

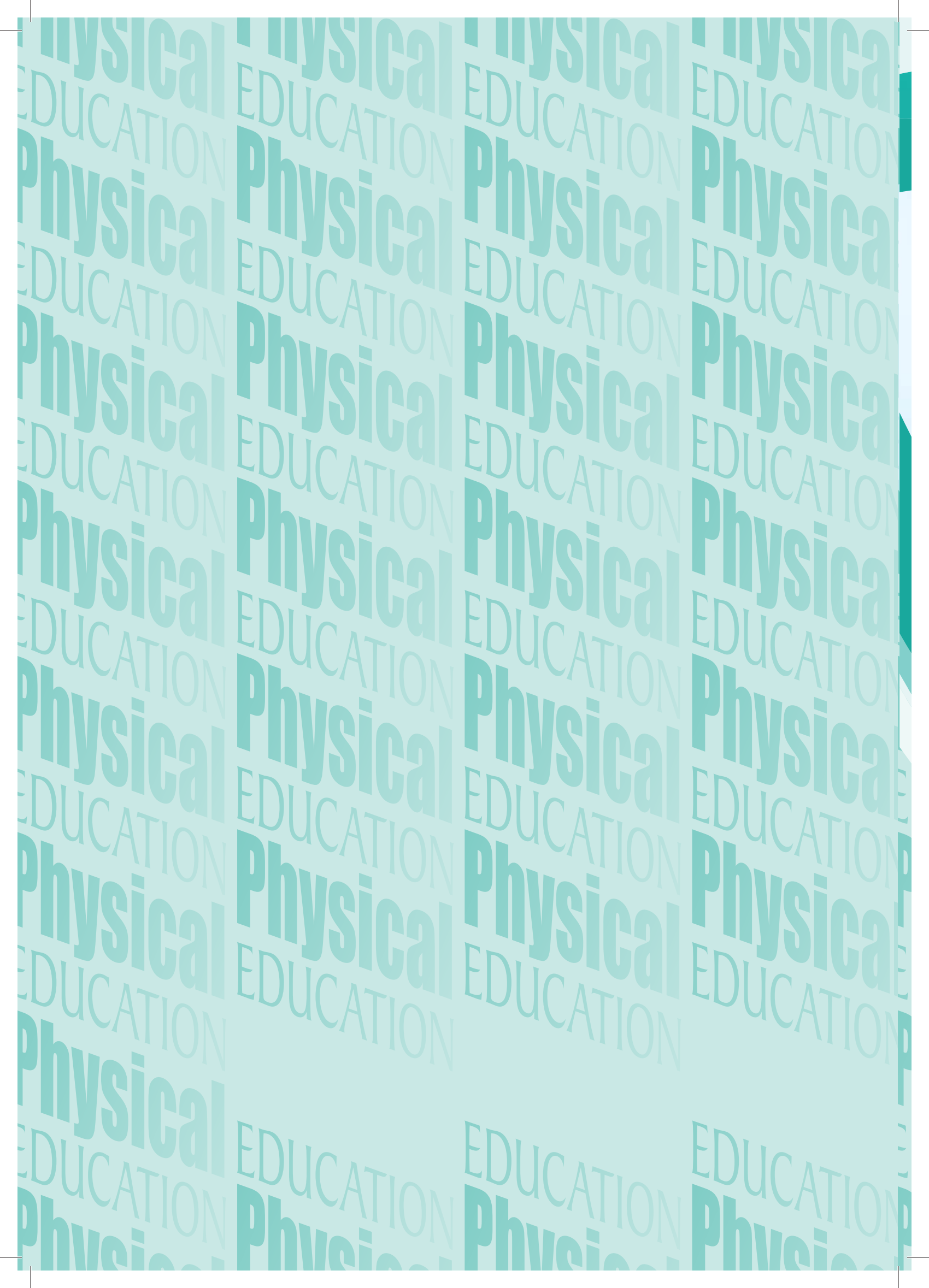
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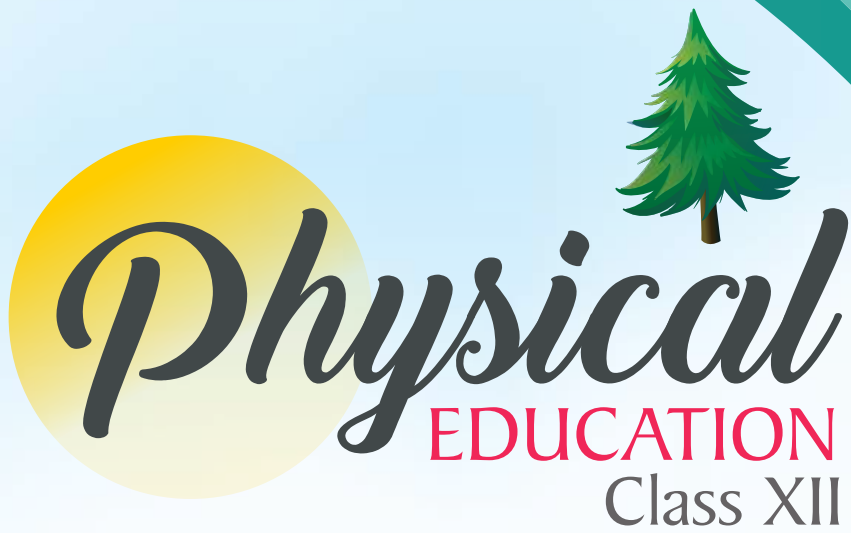
# Physical EDUCATION



**CENTRAL BOARD OF SECONDARY EDUCATION**

Academic Unit, Shiksha Sadan, 17, Rouse Avenue, New Delhi-110 002



A stylized illustration featuring a bright yellow sun on the left and a green coniferous tree on the right, positioned above the word 'Physical'. The background is a light blue gradient with large, flowing teal and white curved bands.

*Physical*  
EDUCATION  
Class XII



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**Physical Education**

Class-XII

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# THE CONSTITUTION OF INDIA

## PREAMBLE

WE, THE PEOPLE OF INDIA, having solemnly resolved to constitute India into a <sup>1</sup>[SOVEREIGN SOCIALIST SECULAR DEMOCRATIC REPUBLIC] and to secure to all its citizens :

JUSTICE, social, economic and political;

LIBERTY of thought, expression, belief, faith and worship;

EQUALITY of status and of opportunity; and to promote among them all

FRATERNITY assuring the dignity of the individual and the<sup>2</sup> [unity and integrity of the Nation];

IN OUR CONSTITUENT ASSEMBLY this twenty-sixth day of November, 1949, do HEREBY ADOPT, ENACT AND GIVE TO OURSELVES THIS CONSTITUTION.

1. Subs. by the Constitution (Forty-Second Amendment) Act, 1976, sec. 2, for "Sovereign Democratic Republic" (w.e.f. 3.1.1977)

2. Subs. by the Constitution (Forty-Second Amendment) Act, 1976, sec. 2, for "unity of the Nation" (w.e.f. 3.1.1977)

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# THE CONSTITUTION OF INDIA

## Chapter IV A

### FUNDAMENTAL DUTIES

#### ARTICLE 51A

Fundamental Duties - It shall be the duty of every citizen of India-

- (a) to abide by the Constitution and respect its ideals and institutions, the National Flag and the National Anthem;
- (b) to cherish and follow the noble ideals which inspired our national struggle for freedom;
- (c) to uphold and protect the sovereignty, unity and integrity of India;
- (d) to defend the country and render national service when called upon to do so;
- (e) to promote harmony and the spirit of common brotherhood amongst all the people of India transcending religious, linguistic and regional or sectional diversities; to renounce practices derogatory to the dignity of women;
- (f) to value and preserve the rich heritage of our composite culture;
- (g) to protect and improve the natural environment including forests, lakes, rivers, wild life and to have compassion for living creatures;
- (h) to develop the scientific temper, humanism and the spirit of inquiry and reform;
- (i) to safeguard public property and to abjure violence;
- (j) to strive towards excellence in all spheres of individual and collective activity so that the nation constantly rises to higher levels of endeavour and achievement;
- <sup>1</sup>(k) who is a parent or guardian to provide opportunities for education to his/her child or, as the case may be, ward between age of six and fourteen years.

1. Ins. by the constitution (Eighty - Sixth Amendment) Act, 2002 S.4 (w.e.f. 12.12.2002)

# भारत का संविधान

## उद्देशिका

हम, भारत के लोग, भारत को एक सम्पूर्ण<sup>1</sup> प्रभुत्व-संपन्न समाजवादी पंथनिरपेक्ष लोकतंत्रात्मक गणराज्य बनाने के लिए, तथा उसके समस्त नागरिकों को:

सामाजिक, आर्थिक और राजनैतिक न्याय,  
विचार, अभिव्यक्ति, विश्वास, धर्म

और उपासना की स्वतंत्रता,  
प्रतिष्ठा और अवसर की समता

प्राप्त कराने के लिए

तथा उन सब में व्यक्ति की गरिमा

<sup>2</sup>और राष्ट्र की एकता और अखंडता

सुनिश्चित करने वाली बंधुता बढ़ाने के लिए

दृढ़संकल्प होकर अपनी इस संविधान सभा में आज तारीख 26 नवम्बर, 1949 ई० को एतद्वारा इस संविधान को अंगीकृत, अधिनियमित और आत्मार्पित करते हैं।

1. संविधान ( बयालीसवां संशोधन ) अधिनियम, 1976 की धारा 2 द्वारा ( 3.1.1977 ) से “प्रभुत्व-संपन्न लोकतंत्रात्मक गणराज्य” के स्थान पर प्रतिस्थापित।
2. संविधान ( बयालीसवां संशोधन ) अधिनियम, 1976 की धारा 2 द्वारा ( 3.1.1977 ) से “राष्ट्र की एकता” के स्थान पर प्रतिस्थापित।

## भाग 4 क

### मूल कर्तव्य

**51 क. मूल कर्तव्य** - भारत के प्रत्येक नागरिक का यह कर्तव्य होगा कि वह -

- (क) संविधान का पालन करे और उसके आदर्शों, संस्थाओं, राष्ट्रध्वज और राष्ट्रगान का आदर करे;
  - (ख) स्वतंत्रता के लिए हमारे राष्ट्रीय आंदोलन को प्रेरित करने वाले उच्च आदर्शों को हृदय में संजोए रखे और उनका पालन करे;
  - (ग) भारत की प्रभुता, एकता और अखंडता की रक्षा करे और उसे अक्षुण्ण रखे;
  - (घ) देश की रक्षा करे और आह्वान किए जाने पर राष्ट्र की सेवा करे;
  - (ङ) भारत के सभी लोगों में समरसता और समान भ्रातृत्व की भावना का निर्माण करे जो धर्म, भाषा और प्रदेश या वर्ग पर आधारित सभी भेदभाव से परे हों, ऐसी प्रथाओं का त्याग करे जो स्त्रियों के सम्मान के विरुद्ध हैं;
  - (च) हमारी सामासिक संस्कृति की गौरवशाली परंपरा का महत्त्व समझे और उसका परिरक्षण करे;
  - (छ) प्राकृतिक पर्यावरण की जिसके अंतर्गत वन, झील, नदी, और वन्य जीव हैं, रक्षा करे और उसका संवर्धन करे तथा प्राणी मात्र के प्रति दयाभाव रखे;
  - (ज) वैज्ञानिक दृष्टिकोण, मानववाद और ज्ञानार्जन तथा सुधार की भावना का विकास करे;
  - (झ) सार्वजनिक संपत्ति को सुरक्षित रखे और हिंसा से दूर रहे;
  - (ञ) व्यक्तिगत और सामूहिक गतिविधियों के सभी क्षेत्रों में उत्कर्ष की ओर बढ़ने का सतत प्रयास करे जिससे राष्ट्र निरंतर बढ़ते हुए प्रयत्न और उपलब्धि की नई उंचाइयों को छू ले;
- <sup>1</sup>(ट) यदि माता-पिता या संरक्षक है, छह वर्ष से चौदह वर्ष तक की आयु वाले अपने, यथास्थिति, बालक या प्रतिपाल्य के लिये शिक्षा के अवसर प्रदान करे।

1. संविधान ( छयासीवां संशोधन ) अधिनियम, 2002 की धारा 4 द्वारा प्रतिस्थापित।





## PREFACE

Physical education refers to Education through physical activities “to achieve all round development of an individual”. And for achieving this aim, the objectives must include -

- physical development
- cognitive development
- social development
- emotional development and
- development of motor skills of the learner.

Physical Education has moved from being an extra-curricular part of school syllabus to being an integral part of the curriculum since UN convention on the rights of the child on May 1st 1989, brought in through article 31 “The child’s right to play”. In India, too, with the focus on “Swasth Bharat”, the primary thrust is on wellness, preventive health care and awareness. This makes it essential that physical fitness issues are addressed at different levels of schooling. With this objective, CBSE has made Physical Education compulsory in its schools to train children for a healthier lifestyle.

A sound Sports Policy must regulate the implementation of school sport consistently for all learners, irrespective of ability, across all schools in an age appropriate way based on the principle of equity. This policy applies to all the schools affiliated to CBSE. Keeping in mind the need for inclusion and the right for each child to good health, there is a chapter on Physical Education and Sports for Children with Special Needs that deals with the meaning and importance of adapted physical education and the role of special educators for Children with Special Needs (CWSN).

As an essential part of education, Physical Education helps the learners acquire skills that improve their performance, sharpen knowledge of strategy and tactics, and helps them to transfer knowledge from one context to another, including sport and recreational and outdoor activities. Participation in Sports and Games builds confidence, teaches the necessary knowledge and skills for working with and relating to others, and provides the learning opportunities to develop skills like qualities of leadership and teamwork skills. This learning is transferred to other learning





areas, when, for example, students cooperate and work together in groups in other subjects in the school setting and in their lives outside of school. As students learn 'in, through, and about' movement, they gain an understanding that movement is integral to human expression and can enhance their lives. By demonstrating the benefits of an active life style, they encourage others to participate in sports, dance, exercise, recreation, and adventure pursuits.

Physical Education provides a solid foundation for preparing our citizens to live healthy life by involving in active lifestyle and also helps to prepare a base of a pyramid where excellence is at the top. It provides a pathway into the many careers that involve working with people, such as education, health, justice, and the social services.

As a subject of study, this textbook of Physical Education highlights a holistic understanding of health, focussing on the importance of exercise, games and sports, nutrition and the environment. This book also discusses the psycho-social and mental health related issues of not just sportspersons, but also children at large and collective responsibilities for healthy community living.

### About the Book

The Handbook of Physical Education has a **goal-oriented, activity-based and investigative approach**. Learning Outcomes are laid out before each chapter listing the desired goals the learner must imbibe in each lesson. Learning Outcomes are assessment standards indicating the expected levels of learning that children should achieve for that Lesson. These outcomes can be used as check points to assess learning and would help teachers to understand the learning levels of children in their respective classes individually as well as collectively.

Holistic Learning refers not only to an all-round development of the learner, but also to a cross-curricular approach. It also means learning must be related to life. The **Discussion section** that precedes each chapter encourages the learner to examine existing knowledge and to relate what he is learning to his/her life. The learning thereby becomes more meaningful to the child.

Physical education engages and energises students. It provides authentic contexts in which to learn. Given the **multidisciplinary nature of this subject**, cross references have also been integrated into the curriculum. There is a chapter on Anatomy and Physiology and on Psychology. Students challenge themselves to develop their physical and interpersonal skills.



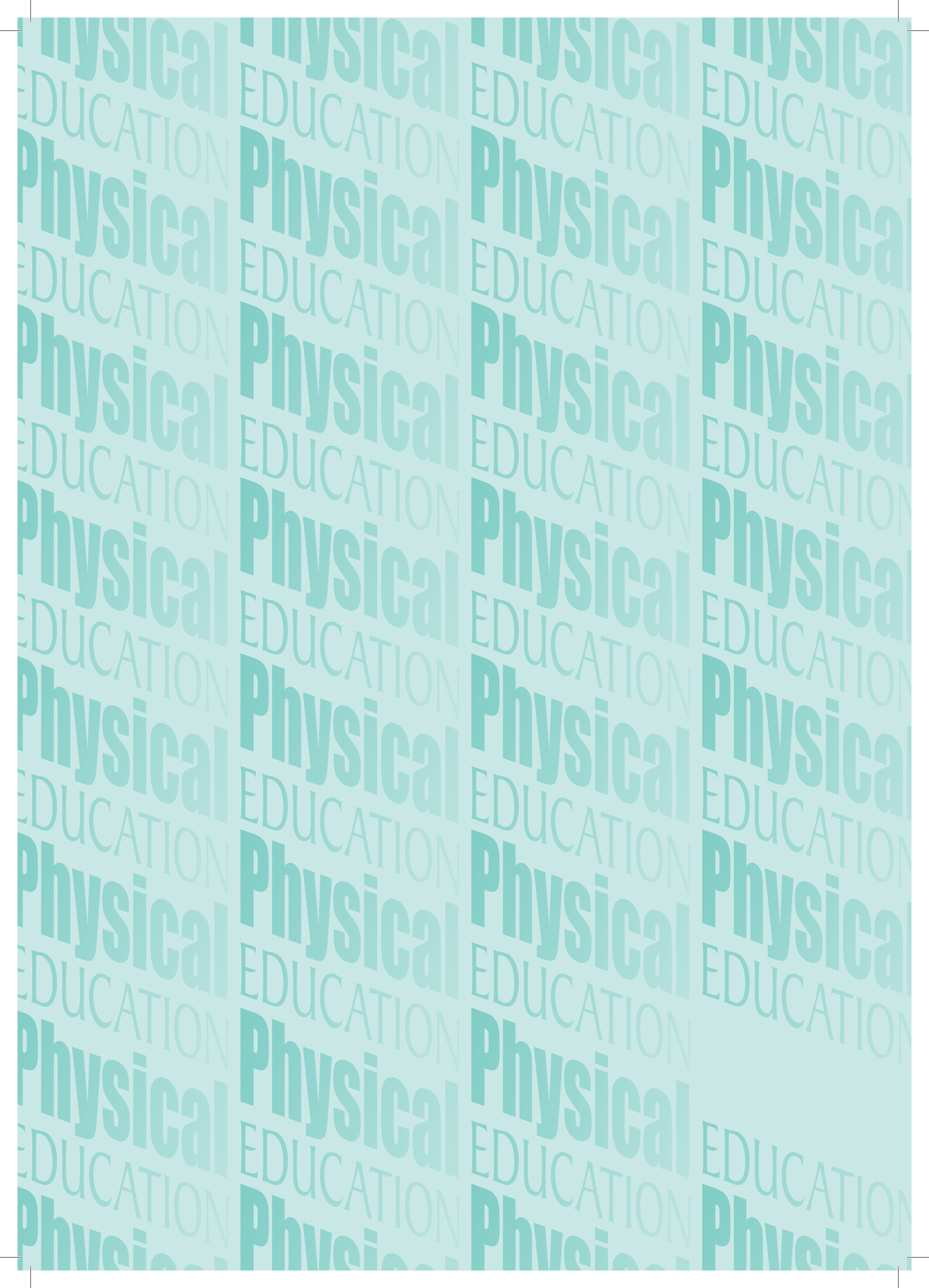


The approach towards learning is **Experiential or learning through experience**. This is distinct from rote or didactic learning, in which the learner plays a comparatively passive role. Experiential learning entails a hands-on approach to learning that moves away from just the teacher at the front of the room imparting and transferring their knowledge to students. It makes learning an experience that moves beyond the classroom and strives to bring a more involved way of learning. **Extension Activities** are an integral part of the Book and students learn as they research, conduct surveys, debate, discuss, write and draw cartoons and design posters. They experience movement and understand the role that it plays in their lives. Additional information has been given in a box in the **Do You Know** Section which provides some input, thereby encouraging students to research and acquire additional information.



## CONTENT

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# UNIT I

## MANAGEMENT OF SPORTING EVENTS

### Overview

- ◆ Functions of Sports Events Management (Planning, Organising, Staffing, Directing Controlling)
- ◆ Various Committees and their Responsibilities (pre; during and post)
- ◆ Fixtures and its procedures - Knock-Out (Bye and Seeding) and League (Staircase and Cyclic)
- ◆ Intramural and Extramural - Meaning, Objectives and its Significance
- ◆ Community Sports - Purpose and benefits

### LEARNING OUTCOMES

*After completing the study of the unit, you will be able to:*

- ◆ describe the functions of Sports Event Management
- ◆ classify the committees and its responsibilities in sports event
- ◆ differentiate the different type of tournament
- ◆ prepare fixtures of knock out and league
- ◆ distinguish between intramural and extramural sports events
- ◆ design community sports program

#### Discussion

Discuss with your group





- Q. Have you heard about fixtures in sports? Discuss in your group and share your views with the class.

## 1.1 Functions of Sports Events Management



### Planning

Planning is the foremost function in sports as it gives a view of future course of action. To be effective, a plan should be specific, logical, flexible and complete in all aspects and should assist in controlling future events. A plan must comprehend all the other functions of management like organising, staffing, directing and controlling in order to achieve the predetermined goals.

In sports and sports events, planning plays important role to make the event run smoothly, effectively and remain free from conflict. Effective planning must clearly define aims, goals and objectives of the event. It should also explain the procedure or method to achieve the target in simple and easy to understand language. A sports plan should be prepared in a professional manner incorporating the elements of commitment, enjoyment and voluntary effort.



## Organising

Organising is a next step after planning. It is a process of execution of the plan. This includes distributing resources and organising personnel in order to achieve the goals established in the planning stage. Organising stage determines the type of jobs and responsibility to achieve planning objectives. Preparation of organisation chart with various positions and reporting should be illustrated in this stage.

## Staffing

This refers to identifying key staff positions, and ensuring that proper talent is serving that specific job duty in order to achieve the aims and objectives of an organization. In this process recruitment and selection of qualified employees take place. After hiring personnel, orientation, training and professional development are also parts of this stage. In orientation new persons are introduced to the nature, goals and policies of events to keep them tuned in to the goals of the organisation. Various training programmes are conducted to provide professional training to the staff at this stage.

In sports events, recruitment of staff as per organisation's needs should be done. Example, the apex post may be for Director of the event, in second line Deputy Director and then Assistant Director of Sports event may be created.

## Directing

Directing personnel is a leadership quality, and includes letting staff know what needs to be done, by whom and also by when. It includes supervision of personnel while simultaneously motivating them. Without directing, planning or organising has no meaning. It is a function of guiding, inspiring and instructing people to accomplish organizational goals.

## Controlling

Controlling refers to all the processes that leaders create to monitor success. It involves establishing performance standards, measuring actual performance and comparing them for irregularities. It is a important function of management as controlling involves imparting instructions to employees and also ensuring that those instructions are followed. To organise any sports event, instructions given to members of the organising committee towards achieving common goal i.e., organising a sports event in this case, must be carried out sincerely for an event to be successful. Higher order management people control lower order people to ensure efficient and effective use to resources.







**I. Tick the correct option.**

1. The basic function of management is:
  - a. controlling
  - b. budgeting
  - c. **planning**
  - d. organising
  
2. In which of the following functions of sports event management “recruitment process” take place?
  - a. Planning
  - b. **Staffing**
  - c. Controlling
  - d. Directing

**II. Answer the following questions briefly.**

1. Explain the role of planning in organizing Sports Event.
2. Why controlling function is important in sports event management.

**III. Answer the following in 150-200 words**

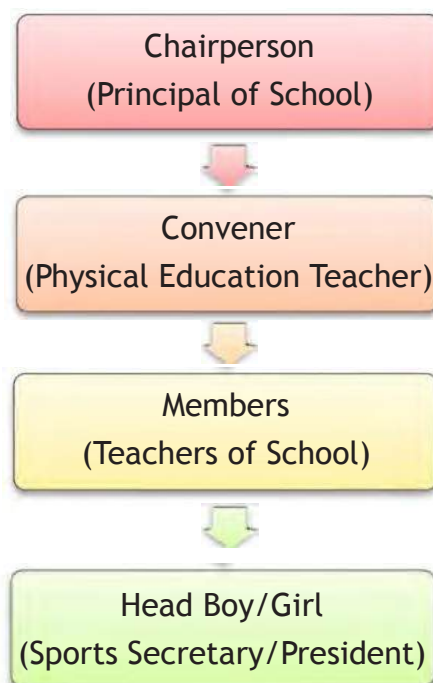
1. Elaborate the functions of sports event management.

## 1.2 Formation of Committees

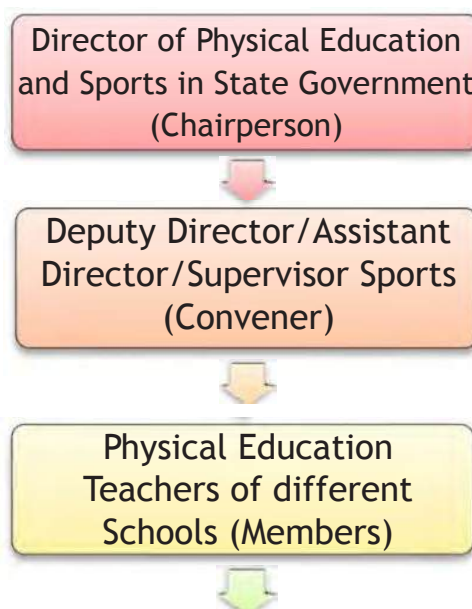
To organise any sports event, various committees are formed for its systematic and smooth conduct. As we have discussed earlier, to conduct sports events lots of professional planning and preparation is required. Formation of committees should be based on three levels of management - top, middle and lower levels. Depending upon the level or area of the sports event, suitable people are chosen for staffing various committees. Example, for an intramural event, members of the governing body or the Principal will remain the top level of management, whereas in an extramural event, the Director/Deputy Director/Supervisor of the state/ zone may be at the top level of management. They prepare policies or aims and objectives of the sports event. Middle level of Management consists of department heads, physical education teachers etc, to execute policies and achieve aims and objectives. The Lower level of management consists of teachers, administrators, finance officers etc. They implement the orders and directives of the top level.



### Hierarchy of Organising Committee to conduct Intramural Event in School/ institution

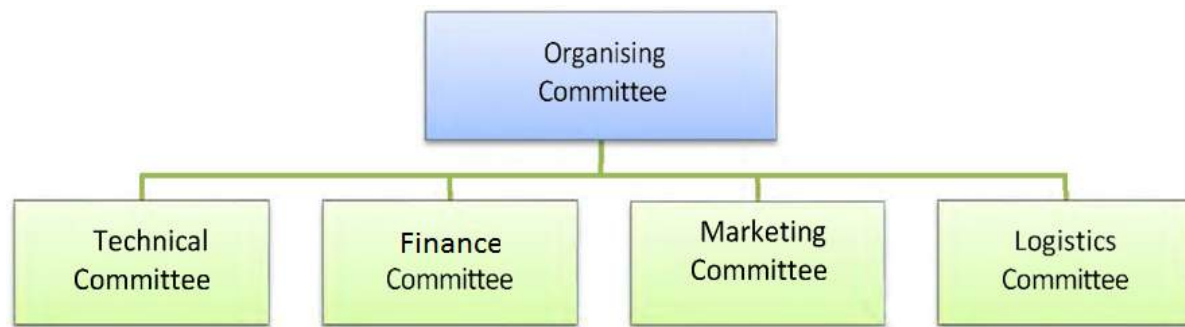


### Hierarchy of Organising Committee to conduct Extramural Event in Schools/ institutions



There is no fixed number of committees to be constituted to organise a sports event; it depends on the number of participants, level of event, area of specialization, dedication of volunteers etc. By and large we can formulate 4 committees under an organising committee. Look at the following chart to study their details of work and their responsibilities.





### 1.2.1 Technical Committee

This committee covers the technical aspect of the events like requisitions to procure sports equipment, conducting matches on time through selected officials (referees, umpires, judges, timekeepers etc.) for their respective games/sports.

**Pre-sports event/ tournament:** Before the event, it is the job of the Technical Committee to put forward a requisition to purchase equipment, invitation and confirmation from officials to conduct sports event, cleaning and layout of the fields, arrangement of equipment and stationery, preparation of fixtures, rules and regulation of the sports event.

**During sports event/ tournament:** While the tournament is in progress, the Technical Committee is responsible for conducting matches, presence of the jury, cleaning and layout of the fields, collection of score sheets and other related papers from officials, preparation of merit list, etc.

**Post sports event/ tournament:** After the event is over, the Technical Committee arranges for the cleaning and layout of the fields, maintenance of the field, and placing of all equipment back to store.

### 1.2.2 Logistics Committee

This committee has a wider scope of work ranging from transportation, boarding and lodging to refreshment, decoration and conducting ceremonies that form a part of the event. This committee may have various sub-committees as per requirement. The Logistics Committee looks after the Opening Ceremony, hires photographer/ videographer, makes arrangements for the Victory Ceremony and the Closing Ceremony including arrangement of refreshment, decoration, reception, entertainment, light and sound, medical aspect etc.

**Pre sports event/ tournament:** It is the duty of the Logistics Committee to look after Placement/Arrangement/Requisition of purchase of stationery, chairs, tables,



souvenirs, light and sound equipment, bouquets, sending invitations to stakeholders including other schools/ institutions and VIP guests, requisition of purchase of medals and certificates, arrangement of refreshments, arrangement of boarding and lodging, selection of volunteers, preparation of first aid kit and arrangement of medical facilities.

**During sports event/ tournament:** While the event is in progress, the Logistics Committee is responsible for the conduct of the Opening and Closing Ceremonies, checking registration, distribution of refreshment, management of spectators, handing over of medals and certificates, transportation of players/participants from place of stay to the field and back.

**Post sports event/ tournament:** After the event, the Logistics Committee supervises cleaning of the venue, and placing of the items back in their appointed places.

### 1.2.3 Finance Committee

The role of the Finance Committee is primarily to provide financial oversight for the event. It is involved in all aspects related to the finances of the sports event like planning, accounting, decision-making etc. Finalization of sponsorship, keeping an eye on inflow and outflow of finances, purchase of equipment and other items required for conducting the event, settling payments of officials are key areas of focus of the committee. It is the backbone of the sports tournament. It pitches to different companies and attracts them for sponsorships for the event.

**Pre sports event/ tournament:** Before the event, It is the responsibility of Finance Committee to prepare the budget, to purchase sports equipment, stationery, medals, certificates, and other requirements as desired by the other committees, as well as preparing and finalizing the MoU with sponsors.

**During sports event/ tournament:** During the course of the event, the Finance Committee keeps a check on the outflow and inflow of finances including payment and remuneration to officials.

**Post sports event/ tournament:** Once the event is over, the Finance Committee examines all records related to settlement of the bills and accounts, and prepares the financial report.

### 1.2.4 Marketing Committee

The Marketing Committee develops plans and strategies to place the event in the market with the purpose of generating publicity and sponsorships. Publicity can





be done through various modes like social media, print media, TV, e-mail etc. and sponsorship can be generated in terms of cash or kind by making media partners, food partners, drink partners etc. through calling on, meeting various companies etc. Marketing Committee also organises campaigns related to the event.

**Pre sports event/ tournament:** The Marketing Committee prepares a strategy for arranging for sponsorships, publicity of the event, arranging meetings or calling on sponsors, preparation of MoUs for sponsorships etc.

**During sports event/ tournament:** The Marketing Committee issues press release(s), works with media, manages methods of communication, fulfils the requirements of sponsors as per MoUs, arrangement for telecast of event etc.

**Post sports event/ tournament:** Once the event is over, the Committee issues a press release, and may arrange for a re-telecast of the event.

### Do You Know?

Check list to organising a sports event

1. Formation of Organising Committees
2. Establishment of Objectives
3. Theme of the event
4. Date of the event
5. Place of the event
6. Budget
7. Sponsorship
8. Marketing (Campaign)
9. Invitations to teams and guests
10. Conformation of teams
11. Logistics (Accommodations, Refreshments, Transportation, Medical Staff, Water, table, chairs, flags, notice board)
12. Checking on the sponsors
13. Drawing Fixtures and layout of field
14. Rules and Regulations
15. Arrangement of Equipment and score sheets
16. Arrangement of Referees and Prizes
17. Direction to the stadium (Sign posts)
18. Briefing of Volunteers and staff
19. Decorations





20. Practice and warm up Area
21. Security
22. Photographers
23. Approvals License and NOCs

### Extension Activity

Working in groups, write a Press Release to be issued by your school regarding the District Badminton Championship hosted by your school.

#### I. Tick the correct option

1. The Committee responsible for liaison with Print media is the \_\_\_\_\_ Committee.
  - a. Technical
  - b. Logistics
  - c. **Marketing**
  - d. Finance
2. Purchase of sports equipment is a work of the \_\_\_\_\_ Committee.
  - a. Technical
  - b. Logistics
  - c. Marketing
  - d. **Finance**
3. Publication of rules and regulations should be done \_\_\_\_\_.
  - a. **Pre event**
  - b. During event
  - c. Post event
  - d. Any time during the event

#### II. Answer the following questions briefly:

1. What should be the role of technical committee while organizing the event.
2. Explain the role of marketing committee during the event.





## 1.3 Fixtures & its procedures

In sports, an individual generally supports a particular team or player to win the game. Winning helps that team or player reach the next round, and after a specified number of matches, a player or a team wins the Championship. While watching a tournament, you would have seen sometimes a player or team lose a game, and get eliminated from the tournament. However, in some tournaments they remain in the game despite losing. Why is this so? Basically, there are different types of fixtures in different tournaments based on duration, cost, manpower, level, interest etc. that you will study here.

### 1.3.1 Tournaments

Tournament is a series of games or matches played among players or teams to determine the winner. It provides an opportunity to demonstrate skills, evaluate one's performance and motivate players to perform well, attract people towards sports to make sports popular and provide healthy entertainment.

There are various types of tournament formats based on advancement or elimination criteria of players or teams. Study the three tournament formats listed below.

**Knock - Out Tournament:** In a Knock-Out Tournament a player or team continues to play matches until it is defeated. In this type of format, players or teams have to consistently give their best performance to avoid elimination. Such a tournament saves cost and time and makes each match intensive because of fear of elimination. Since fixtures are drawn on the basis of lots, there is the possibility of a match between two good teams or players even in the early stages. In this system a good team can be eliminated even at the earliest stage due to getting defeated by chance or by accident.

**League or Round Robin:** In League or Round Robin Tournament, a player or team will play the matches that are allotted before the start of the tournament. Fixed number of matches are given to players and teams. Players or teams will get equal chance to play with each other. Thus, the true winner emerges from this format and ranking can be prepared for all participating players or teams. However, this format involves more money, time and facilities as compared to the Knock-Out Tournament and there is no provision of seeding for extraordinary teams and players.

**Combination:** They are the combination of Knock-Out and League format. Depending upon the need and importance of the tournament, Combination Tournaments can





be Knockout- League, League-Knockout, Knockout-League-Knockout etc. These tournaments are conducted when there are (a) a large number of participants, (b) participants are spread in different areas, (c) venues are in different zones/places etc. In this format some of the demerits of Knockout and League Tournaments can be eliminated.



### 1.3.2 Fixtures, Byes and Seeding

We have learned about three types of tournaments, Now we will study how we can draw the fixtures. In sports, the term *fixtures* refers to the programme listing which team (Team A) will play whom (Team B), where (venue), and when (time).

#### Definitions:

A fixture is “a sports event or its date.”

“A sports match that has been arranged for a particular time and place”

‘Fixture is a process of arrangement of the teams in systematic order in various groups for competitive fights for physical activity’.

Thus, **tie** or **fixture** or **heat** include multiple and progressive matches. In athletics and swimming the term **Heats** is used, in Tennis, badminton and other games we frequently use the terms **Ties** or **Fixtures**. For any tournament, unbiased draws of fixtures is a road towards the success. First, let us understand the words “bye” and “seed”.

**Bye** - means a team is not required to participate in the primary round due to allotment of draws. It should be given to any participating team through random lottery system. In a tournament, bye is generally assigned to teams by the organizing committee not to play a round due to one of the several reasons:

- Uneven distribution of teams in tournament (In knock out tournament, number of teams equals to power of two [e.g., 8, 16, 32, 64, ....] and in League tournament, if there is an odd number of teams.





- Separate pooling of previous winners in same group to create even competition,
- to avoid one team from playing more matches on a single day than the other, so creating disadvantage for some.

### Definitions

The position of a participant in a tournament who is not paired with an opponent, usually in the first round, and advanced to the next round without playing.

Something aside from the main course or consideration.

A sportsman in a tournament who is without an opponent.

The right to proceed to the next round of a competition without contesting the present round, often through non-appearance of an opponent.

**Seeding** - is a process in which teams will be placed in such a manner that good teams that have a ranking or previous year's position etc. do not meet another team at an early stage of the tournament. This procedure is generally implemented to reduce the chance of elimination of good teams at an early stage. Procedure of allotting seeding is the same as given for byes.

### Definitions

The process or result of seeding players for competition.

To arrange or schedule, as competitive teams or players, so that the most skilled are matched in the later rounds of play.

To scatter or distribute (the names of players) so that the best players do not meet in the early part of a tournament.

To rank a player according to the perceived likelihood of his or her winning a specific tournament

### 1.3.3 Procedure for Drawing Knock - Out Fixture

#### Step 1

To determine the total number of teams that will participate in the Knockout tournament.



If the number of teams is: 2, 4, 8, 16, 32, 64, 128, .... (Number being a multiple of Two) then there is no need of byes. You may see the procedure in Illustration : 1 and 2. If the number of teams is other than the given numbers, then byes will be given as per draw of lot.

### Step 2

To determine the total number of matches to be played in the tournament, following formula will be used:

Total Number of Matches= Number of teams - 1 In case of 8 teams then  $8-1= 7$  matches (not including third place match)

If number of teams are 12 then

$12-1= 11$  matches (not including third place match) In case of 15 teams then  $15-1=14$  (not including third place match)

### Step 3

The total number of teams are to be divided into two halves, namely Upper Half and Lower Half.

If the total number of participating teams are even in numbers the Formula will be:

$$\frac{\text{Number of teams}}{2} = \text{Teams in Upper Half or Lower Half}$$

If total number of teams is 12 then,  $\frac{12}{2} = 6$ , i.e., 6 teams will be placed in Upper Half and the remaining 6 will be placed in Lower Half.

If total number of participating teams are **odd in numbers** then Formula will be

$$\frac{\text{Number of teams} + 1}{2} = \text{Teams in Upper Half}$$

$$\frac{\text{Number of teams} - 1}{2} = \text{Teams in Lower Half}$$

If number of teams is 15 then

$$\frac{15 + 1}{2} = 8 \text{ Teams in Upper Half}$$





$$\frac{15 - 1}{2} = 7 \text{ Teams in Lower Half}$$

Thus, 8 teams will be placed in Upper Half and remaining 7 will be placed in Lower Half.

#### Step 4

After determining Upper and Lower Half Teams, byes will be given. We can determine the byes by finding the difference between the number of teams participating in the Tournament and next power of 2 of participating Teams in the Tournament. For example, if total number of Teams is 12, then next power of 2 will be 16.

$16 - 12 = 4$  Byes. For **even numbers** byes will be placed in Upper and Lower Half.

$$\frac{4}{2} = 2$$

If total number of Teams is 19, then next power will be 32.  $32 - 19 = 13$  byes

For **odd numbers** byes will be placed in Upper Half =  $\frac{13 - 1}{1} = 6$  and Lower Half =

$$\frac{13 + 1}{2} = 7$$

#### Step 5

Allotment of byes in the fixture should be given in following order. First bye will be given to last team of Lower Half, Second bye will be given to first team of Upper Half, Third bye will be given to last team of Upper Half, Fourth bye will be given to first team of Lower Half, Same pattern will be followed after fourth bye till the remaining byes have been given.

OR

First bye will be given to last team of Lower Half, Second by will be given to first team of Upper Half, Third bye will be given to first team of Lower Half, Fourth bye will be given to last team of Upper Half

Same pattern will be followed after fourth bye till the remaining byes have been given.





## Step 6

Write the serial number (number of participants) in vertical order. Divide into two halves as per Step 3.

Then place byes as per step 5.

Now place remaining teams through random lottery system from top to bottom or same pattern used to allot byes.

Teams having byes will not play their first-round matches. Put Date, Time, Venue in front of the matches in fixture. Illustration - 1

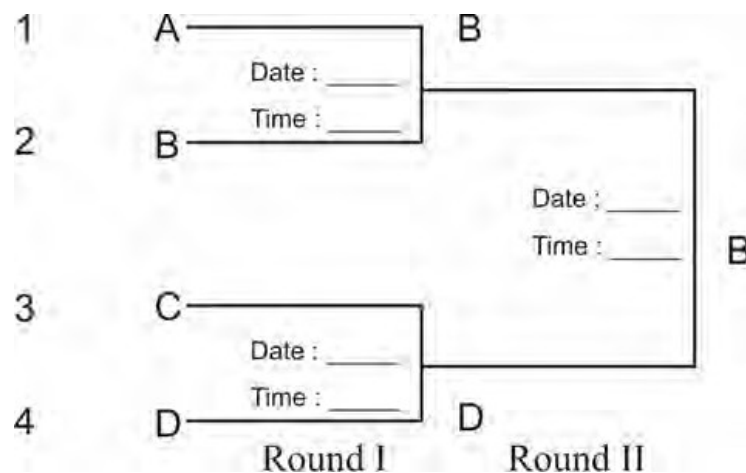
Total Number of Teams = 4

Total Number of Matches =  $4-1 = 3$

Total Number of Byes= since Number having power of Two, no need of bye Number of team in

$$\text{Upper Half} = \frac{4}{2} = 2$$

$$\text{Number of team in Lower Half} = \frac{4}{2} = 2$$



### Round I Matches

First match between A Vs B and won by B

Second Match between C Vs D won by D





### Round II match or Finals

Third match Finals between B Vs D won by B

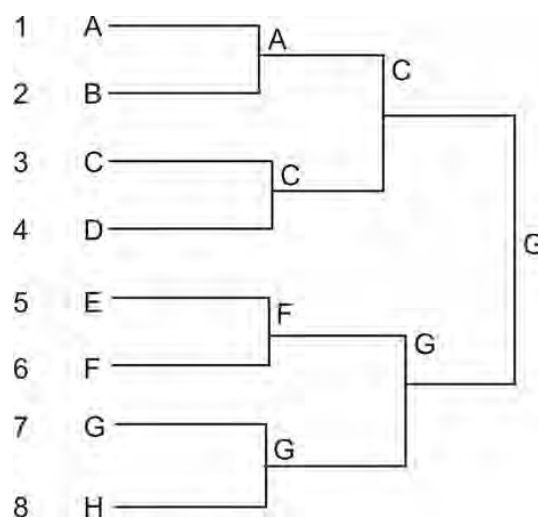
### Illustration - 2

Total Number of Teams = 8

Total Number of Matches =  $8-1=7$

Total Number of Byes= since Number having power of Two, no need of bye Number of team in Upper Half =  $\frac{8}{2} = 4$

Number of team in Lower Half =  $\frac{8}{2} = 4$



### Round I Matches

First match between A Vs B won by A

Second match between C Vs D won by C

Third match between E Vs F won by F

Fourth match between G Vs H won by G

### Round II Matches

Fifth match between A Vs C won by C

Sixth match between F Vs G won by G





### Round III or Finals

Seventh match Final between C Vs G won by G

### Illustration - 3

Total Number of Teams = 11

Total Number of Matches =  $11-1=10$

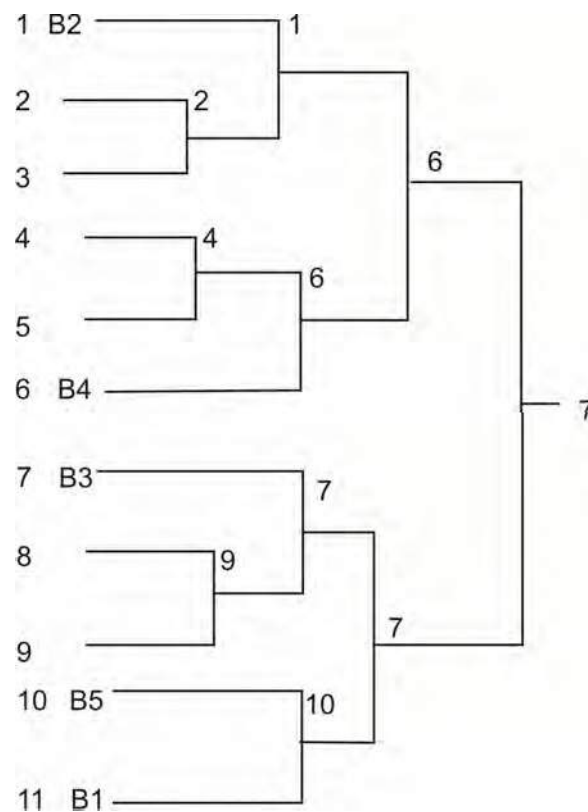
Total Number of Byes =  $16-11=5$

Total Number of Byes in Upper half =  $\frac{5-1}{2} = 2$

Total Number of Byes in Lower half =  $\frac{5+1}{2} = 3$

Number of team in Upper half =  $\frac{11+1}{2} = 6$

Number of team in Lower half =  $\frac{11-1}{2} = 5$







### Round I Matches

First match between 2 Vs 3 won by 2

Second match between 4 Vs 5 won by 4

Third match between 8 Vs 9 won by 9

### Round II Matches

Fourth match between 1 Vs 2 won by 1

Fifth match between 4 Vs 6 won by 6

Sixth match between 7 Vs 9 won by 7

Seventh match between 10 Vs 11 won by 10

### Round III Matches (semi-finals)

Eighth match between 1Vs 6 won by 6 Ninth match between 7 Vs 10 won by 7

### Round IV or Final

Tenth match between 6 Vs 7 won by 7

#### 1.3.4 Procedure to Draw League or Round Robin Fixture

In League or Round Robin Tournament each team has to play once with all the remaining teams of the tournament.

#### Step 1

Determine the number of matches by applying following formula:

Number of teams = n

$$\text{Total number of matches} = \frac{n(n-1)}{2}$$

$$\text{If teams are 6 then } \frac{6(6-1)}{2} = \frac{36-6}{2} = \frac{30}{2} = 15$$

This means, 15 numbers of matches will be played in league tournament. If teams are 7 then 21 numbers of matches will be played in league tournament





## Step 2

Here, we will study two types of methods to fix the team in league tournament namely Cyclic Method and Stair Case Method:

### Cyclic Method

In Cyclic Method, one team will be fixed in position and the other will be placed in rotation to complete the cycle. In this method, two situations may arise, first if teams are even numbered, second situation if teams are odd numbered. Let's see how to set fixtures in these two situations.

Even number of teams in tournament does not require giving of any bye to any team and to find out number of rounds, formula will be number of teams - 1.

Total number of teams= 6 Total number of rounds = 6-1 = 5

I Round	II Round	III Round	IV Round	V Round
6 → 1	5 1	4 1	3 1	2 1
5 → 2	4 6	3 5	2 4	6 3
4 → 3	3 2	2 6	6 5	5 4

In order to draw fixture for odd number of teams one bye will be given to one team in one round and in next round another team will get a bye. Rounds in the tournament will remain the same.

Total number of teams = 7 Total number of rounds = 7

I Round	II Round	III Round	IV Round	V Round	VI Round	VII Round
7 Bye	6 Bye	5 Bye	4 Bye	3 Bye	2 Bye	1 Bye
6 → 1	5 7	4 6	3 5	2 4	1 3	7 2
5 2	4 1	3 7	2 6	1 5	7 4	6 3
4 3	3 2	2 1	1 7	7 6	6 5	5 4

### Staircase Method

In Staircase Method, one team will be fixed on the highest step, and that team will play with all the teams of the tournament and in next step down, the next team will be fixed to play with other remaining teams and so on.





Total number of Teams= 7

A Vs B						
A Vs C	B Vs C					
A Vs D	B Vs D	C Vs D				
A Vs E	B Vs E	C Vs E	D Vs E			
A Vs F	B Vs F	C Vs F	D Vs F	E Vs F		
A Vs G	B Vs G	C Vs G	D Vs G	E Vs G	F Vs G	

### Details of Matches

Match No	Team A	Vs Team B	Date	Time	Venue	Result

### Step 3

Determining the winner/merit in League Tournament.

In League or Round Robin Tournament winner/merit will be decided on the basis of points awarded to the teams. Example Winner = 5, Draw =3, Loser = 0. Points tally may be as follows:

S. No.	Teams	Match Played	Match Win	Match Loss	Match Draw	Total Points	Ranking
1	A	5	4	0	1	23	I
2	B	5	3	1	1	18	II
3	C	5	1	2	2	11	IV
4	D	5	0	4	1	3	V
5	E	5	1	2	2	11	IV
6	F	5	0	0	5	15	III



Tournament organisers frame the rules in regards to tie before the start of the tournament.

### 1.3.5 Procedure to Draw Combination Fixture

These fixtures are the combination of Knockout and League Tournaments. Same steps will be followed as are followed in Knockout and League fixtures. To draw League-Knockout fixtures, the following process will be executed:

League-Knockout

Team = 8

$$\text{Matches} = \frac{8(8-1)}{2} = \frac{64-8}{2} = \frac{56}{2} = 28$$

Rounds in league = 7

League

Round 1	Round 2	Round 3	Round 4	Round 5	Round 6	Round 7
1-8	7-8	6-8	5-8	4-8	3-8	2-8
2-7	1-6	7-5	6-4	5-3	4-2	3-1
3-6	2-5	1-4	7-3	6-2	5-1	4-7
4-5	3-4	2-3	1-2	7-1	6-7	5-6

S. No.	Teams	Match Played	Matches Won	Matches Lost	Matches Drawn	Total Points	Ranking
1	1	7	5	2	0	25	I(Q)
2	2	7	2	3	2	16	V
3	3	7	2	2	3	16	V
4	4	7	2	4	1	13	VI
5	5	7	3	2	2	21	II(Q)
6	6	7	4	2	1	23	III(Q)
7	7	7	1	4	2	11	VII
8	8	7	3	3	1	18	IV(Q)

Winner = 5, Draw =3, Loser = 0

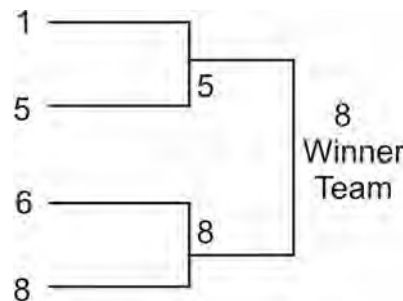
Top four teams namely 1, 5, 6 and 8 qualify for knockout rounds





Tournament committee should form rules regarding placement of teams at semi-finals before the tournament. Here we placed teams as per their ranking. Other patterns are

1. first team may play with third and second may play with fourth ranked team or
2. first ranked team may play with fourth ranked team and second ranked team may play with third ranked team or
3. draw of lots may be another choice.



First semi-final match played between 1 vs 5 and won by 5

Second semi-final match played between 6 vs 8 and won by 8

Final match played between 5 vs 8 and won by 8

Third place match may be played between 1 vs 6

Team 8 winner of the League-Knockout tournament

Team 5 is runner up of the tournament.

### Do You Know?

FIFA World cup is world largest event in term of viewership in the world. In Football World Cup League-Knockout combination fixtures are drawn. Starting rounds are based on League system, there are eight groups from A to H, each group consists of four teams. Every team in the group has to play with the other three teams in the group. Top two teams from each group qualify for pre-quarterfinals based on the points table and then the knockout round starts till the finals.

#### I. Tick the correct option

1. After losing a match, a team will be eliminated from the .
  - a. Knockout tournament





- b. League tournament
  - c. Round Robin tournament
  - d. None of above
2. Which of the following tournament helps save time?
- a. Knockout tournament
  - b. League tournament
  - c. Combination tournament
  - d. Round Robin tournament

**II. Answer the following questions briefly:**

1. Differentiate between knockout and league tournament.
2. Write merits of league tournament.
3. What do you mean by league cum knockout fixture?

**III. Answer the following questions in 150-200 words.**

1. Draw a knockout fixture of 13 teams.

## 1.4 Intramural

The meaning of the word 'intramural' is "within the walls". In context of sports, it refers to a tournament conducted within the walls of a single institution/ school/ community. Intramural competitions/tournament are conducted within players of one institution. The tournament may be an event/ game /more than one games and sports conducted in one day or more or in a month or a year, eg., Sports Day, Sports Festival, Athletics Meet, Swimming Meet, Badminton Tournament conducted among Houses, Classes, Hostels, Residents etc. of a school/institution.

### 1.4.1 Objectives of Intramural Tournaments

Intramurals are common and an integral part of educational organisation and communities, where teams are constituted among classes, houses or groups and competitions are conducted for engaging children and youth and for deriving various types of benefits for the participants. Let us understand few important objectives of intramural tournaments.





1. To encourage mass participation in sports in an institution.
2. To focus on all-round development of children.
3. To develop values like fair play, respect, friendship through sports.
4. To provide first opportunity to compete in a controlled environment.
5. To focus on fitness, wellness and health aspects of children.
6. To promote curricular integration through sports.
7. To help children to develop personality (first stage of leadership, control of emotions, corporation etc.)

### Extension Activity

As the Sports Captain of your school, you are involved in the selection of students for participating in District/Region/Zone matches subsequently.

List out the criteria you will employ for selection of

Individual Games/Sports

Team Games/Sports

### 1.4.2 Significance of Intramural Tournaments

With all the above discussed objectives of intramural tournaments being implemented successfully, it surely brings lots of benefit to the participants. Such competitions conducted in a controlled environment with enough scope of all round development deliver enough significance to the event. Let us discuss few essential significance of intramural tournaments.

**Selection for extramural:** Intramural Tournaments provide an opportunity to select a player or team to participate in Extramural Tournaments. Players demonstrate skill and fitness in events which becomes the base for selection of a player or team.

**Group cohesion:** This is an opportunity where students from different Classes or Houses come together in a team, share their experiences, display cooperation and coordination and lead the team to win the game. Students from different backgrounds, and communities come together as a group and gain self-confidence, develop social relations, tolerance in culture etc.

**Professional experience:** As per the interest of students and need of institution, students become a helping hand in conducting the tournament which gives them



good experience of officiating, in event management etc. In future, this experience helps them in professional and personal aspects.

**Health:** It helps in developing healthy and active lifestyle. Children enjoy the sports events because it is another medium to display their desired skills. It helps them to stay fit and healthy. Intramurals help in contributing to the physical, mental, social and spiritual well-being of children.

**Recreation:** Joy and entertainment are the outcome of Intramural physical activities. The elements of happiness and enjoyment are always there because activities are not so competitive, which makes intramural events successful.

**Mass participation:** Such activities are meant for all the students of the institution not only for sportspersons or players.

### 1.4.3 Extramural Tournaments

The word 'extramural' means "outside the boundary or walls". In Sports Extramural Tournaments are the tournaments conducted outside or beyond the walls of the organising unit that may be a school/college/institution. Such tournaments are conducted between two or more players/teams of different schools/colleges/institutions. For example, Zonal, Inter- District, State, National or International Tournaments.

### 1.4.4 Objectives of Extramural Tournaments

Extramural tournaments are very popular and an essential part of educational organisation, and communities, where a common team represents a school, colleges or group and promote participating or organising various inter-institution competitions for engaging children and youth into various types of benefits. Let us understand few important objective of intramural tournaments.

1. To achieve high performance at highest level of the tournament.
2. To develop the feeling of integration with other institutions
3. To provide opportunities for choosing a career in sports
4. To promote social, cultural, economic development through sports.

### 1.4.5 Significance of Extramural Tournaments

With all the above discussed objectives of extramural tournaments being implemented successfully, it surely brings lots of benefit to the participants. Participation and







organisation of such inter competitions focusing to showcase talent and explore potentials among talented athletes delivers enough significance to the event. Lets discuss few essential significance of intramural tournaments.

### **Progression in performance**

Extramural Tournament helps to lift the level of performance through the athletes and sportspersons gaining experience, learning to prepare tactics and strategies, developing fitness, psychological preparation etc.

### **Psychological factors**

Extramural events help to balance psychological factors like stress, confidence, self-esteem, emotions, and promote qualities like leadership, team building, in students.

### **Level of fitness**

As the level of tournament increases, gradually the level of fitness improves, that make an individual physically as well as mentally strong to compete at higher levels.

### **Socialization**

Such tournaments held among different communities, regions, countries etc. increase cross-cultural exchange, inter-community association etc. in which individuals get a chance to know and understand different places, cultures, etc. which leads to closer ties.

## **1.5 Community Sports - Purpose and Benefits**

Community sports is a society-based practice of connecting and engaging people with opportunities to participate in sports, exercise and fitness activities. Community sports can serve as a backbone for developing health promotion initiatives within community members ranging from school children, adults, elders and various other socially vulnerable populations. Community Sports are conducted for wide variety of purposes, by involving citizens and public residing in a society. Community sports provide opportunities for conducting sporting events frequently depending on the purpose like the community awareness programs, social campaigns, talent search, recreational opportunities and may more. Community sports are also many times referred to as low-threshold sport activities, which make them a powerful tool to involve a wide range of population into sports, exercise and fitness behaviours. Community sports may not be always competitive and even if they are organised they may not be officiated with rule-book style. Example, instead of professional



officials, parents, experienced players or other community volunteers may be engaged in conduct of sporting events.

### 1.5.1 Benefits of Community Sports

**Community Sports** can be a great opportunity for meeting people who share the same interests. Example, in a group environment, there is always at least one thing that just about everyone has in common, so you can use that to strike up a conversation with the people around you. Regular community sports activities like cricket, volleyball, football, or basketball or various other team sports and mass activity programs like yoga, aerobics, morning walk, jogging can provide opportunities to know and understand your neighbours and community members and bond with them over the course of many training sessions, practices, victories, and defeats. Community members working together towards a common goal creates a certain camaraderie and trust within the society members.

Let us discuss few of the major benefits of community sports.

#### Health

Community sports programmes have huge impact on physical and mental health of an individual. Regular physical activities not only improve cardiovascular and muscular health but also lower the risk of various lifestyle related disease.

#### Social

Community sports programmes provide a platform for make friends, connecting people and getting them to work together towards common objectives, thereby developing a sense of belongingness in the group. Developing a network for sharing knowledge and experiences about health, wellbeing and sports for the people of all ages helps to develop group cohesion, proactive social environment, good citizen etc.

#### Psychological

Community sports programmes, through continuous and group engagement in physical activity, can be associated with improved psycho-social health. They help in improving self-esteem, personal development and stress management and provide various other psycho-social benefits.





## Economic

Regular community sports programmes will help to reduce the burden on health budget and also promote optimum usage of resources. Healthy people in any community not help to reduce medical bills but also enhance the production for the nation by providing appropriate time and labour. Economical weaker sections can also take advantage of participating in such sports community programmes.

### 1.5.2 Community Sports

Community sports events should be held at residential societies, villages, cities, schools where the purpose is not only to demonstrate the skills and abilities of children, but create harmony among people of all age groups including of senior citizens, women and differently-abled population.

Let us discuss few of the events which could be organised as part of community sports.

## Sports Day

is one of the important programs that feature in the annual calendar of most residential areas, community schools. It is an event not only to showcase abilities and prowess of children and youth on the sports field but also a great opportunity for community members to meet, greet and interact with each other. It also reflects the organizational strength of the society members and various other organizing institutions. To celebrate Sports Day the focus should not only be participation of talented athletes, but displaying a wide variety of skills among its members. Major focus should be maximum engagement and involvement of community members and other stakeholders.

In recent times, Government of India is celebrating National Sports Day on 29th August on the occasion of birth anniversary of Major Dhyan Chand, a hockey legend.

### Do you Know?

Fit India Movement was launch on 29th August 2019 on the occasion of birth anniversary of Major Dhyan Chand by Shri Narendra Modi, the Prime Minister of India. The purpose of the movement is to promote physical activities and sports in masses so that they stay fit and healthy and keep away from lifestyles diseases. He said "Swasth vyakti, swasth parivar aur swasth samaj, yahi naye Bharat ko shresth Bharat banane ka raasta hai."



## Health Run

Such kind of run is generally conducted for the purpose of improving the health standards in society and creating awareness about the importance of physical activities for maintaining good health or for raising charity. In this run, the purpose of the runners is not to win, but to participate in the events. To get its full impact, a large number of registrations are required. There is no age bar for participants; it is not a professional race so there is no need to run a long distance. Such a run can be conducted by NGOs or health departments to spread awareness about health-related issues.

## Run for Fun

The purpose of this run is to spread the message of staying fit and healthy among the masses. Sometimes such races may be conducted to raise funds for a specific purpose. In schools such races attract children and their parents. These are friendly races and may be conducted for any age group. However, the physical education teacher must be careful and plan meticulously to avoid any kind of accident or mishap. Age, mobility, types of movement involved should be taken care of. Examples of such races are lemon and spoon race, sack race, three-legged race, parent and child race, teacher and child race, banana race, road running etc.

## Run for Specific Cause

This event is generally conducted to spread awareness about social issues like cleanliness, promoting green environment etc. The purpose of such events is to spread awareness among the masses for a definite cause or to generate charity. Example, the specific cause may be cancer, AIDS, gender inequality etc.

## Run for Unity

In such a type of run the purpose is to promote the feeling of integrity and brotherhood in community, state, nation or among different religions. Such events help to develop bonding and a sense of togetherness among people.

## Games and Sports

Different games and sports events can be organised keeping in mind the wholesome development of community. Indigenous game like kho-kho, kabaddi, marbles, *Gilli danda* etc. may be introduced to keep people familiar with the cultural heritage of the nation.





**I. Tick the correct option**

1. National Sports Day is celebrated on
  - a. 9th August
  - b. 19th August
  - c. 28th August
  - d. 29th August
  
2. Which of the races is run "to promote brotherhood"?
  - a. Run for Fun
  - b. Run for specific cause
  - c. Run for Unity
  - d. Health Run

**II. Answer the following questions briefly.**

1. Write briefly about any two types of Run.
2. Write about the objectives of Intramural tournaments.
3. What is the significance of Extramural Tournaments.

**III. Answer the following questions in 150-200 words.**

1. How would you plan for an Intramural Tournament? Highlight any two problems you may encounter. How will you deal with them?
2. Discuss a method you would choose to spread health awareness and harmony in your area. Support your answer with reasons.

**IV. Complete the following table about Intramural and Extramural Tournaments.**

	Intramural Tournaments	Extramural Tournaments
What they mean		





What are their objectives		
What is their significance		

### V. Case Study Question

1.

Clubs	Matches	Won	Drawn	Lost	GF	GA	GD	Points
ATK Mohun Bagan	20	10	7	3	37	26	11	37
Bengaluru FC	20	8	5	7	32	27	5	29
Chennaiyin FC	20	5	5	10	17	35	-18	20
FC Goa	20	4	7	9	29	35	-6	19
Hyderabad FC	20	11	5	4	43	23	20	38
Jamshedpur FC	20	13	4	3	42	21	21	43
Kerala Blasters FC	20	9	7	4	34	24	10	34
Mumbai City FC	20	9	4	7	36	31	5	31
NorthEast United FC	20	3	5	12	25	43	-18	14
Odisha FC	20	6	5	9	31	43	-12	23
SC East Bengal	20	1	8	11	18	36	-18	11

- a. Based on the table given above place the teams according to their ranking
  - b. List down two advantages of this kind of tournament
  - c. Write down the formula for calculating points
2. XYZ School is conducting an invitation tournament in which 25 teams have sent their entries. Matches have to be conducted on a knockout basis.
- a. How many total matches will be played?
  - b. How many matches will be played in the first round of the tournament?





- c. How many rounds will be played?
- d. Which team will get 4th bye of the tournament?

#### VI. Art Integration

1. Prepare a report on the Annual Sports Day of your school for publishing in a National daily.
2. Your School is hosting CBSE Regional Sports Meet. Plan and present a Folk Dance for the Opening Ceremony.

#### Suggested Reading:

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# UNIT II

## CHILDREN AND WOMEN IN SPORTS

### Overview

- ◆ Exercise guidelines of WHO for different age groups
- ◆ Common postural deformities-knock knees, flat foot, round shoulders, Lordosis, Kyphosis, Scoliosis and bow legs and their respective corrective measures.
- ◆ Women participation in Sports - Physical, Psychological and Social benefits
- ◆ Special consideration (menarche and menstrual dysfunction)
- ◆ Female athlete triad (osteoporosis, amenorrhea, eating disorders)

### LEARNING OUTCOMES

*At the end of the chapter, children will be able to:*

- ◆ discuss exercise guidelines for different stages of growth and development.
- ◆ classify common postural deformities and identify corrective measures.
- ◆ recognize the role and importance of sports participation of women in India.
- ◆ identify special consideration relate to menarche and menstrual dysfunction.
- ◆ express female athlete triad according to eating disorders.

### Discussion

Given below is a list of some common postural deformities children may suffer from. What do you know about them? Complete the first two columns of the KWL (Know-Want-Learned) Chart given below. Fill in the last column after completing your research by reading more about them.

Word	What I Know	What I Want to Know	What I Learned







Knock knees			
Flat foot			
Round shoulders			
Lordosis			
Kyphosis			
Scoliosis			
Bow legs			

### Do You Know?

A UNICEF South Asia blog “How sports help girls overcome barriers and bias” had a big message sent by our legendry player of Indian cricket *Sachin Tendulkar*, *UNICEF Regional Goodwill Ambassador for South Asia* “Let every child, girl and boy, play a sport”. The legendary cricketer mentioned that every child must have the right to play, it is the best medium to help them channel their energy and teach them some of life’s most valuable lessons—on strength and determination, humility and mutual respect, on resilience and sportsmanship. Opportunity to play with an open mind encourages children to push their limits, and in the process, discover their own potential. Sports participation provides a common platform to perform and learn to win with dignity and accept defeat with humility. Sport does not differentiate between gender, it respects hard work and values of an athlete. Sport and play is not confined to children nor does it creates impact only on children, rather sports is a big wagon wheel for the upliftment of the status of women in our society. Sports field provides an opportunity for women to showcase their talent and help them grow as an individuals, living a life of dignity and self-respect.

The Indian Women’s Hockey team played brilliantly in the Tokyo 2020 Olympics and produced many such examples. The captain, Rani Rampal’s father could not afford to buy her a hockey stick when she was growing up, so she would play with a broken one; Salima Tete from Jharkhand would play with wooden sticks for the same reason. Deep Grace Ekka’s family was criticized because she was ‘allowed’ to play the game despite being a girl.

## 2.1 Exercise Guidelines of WHO for Different Age Groups

World Health Organisation (WHO) has identified lack of physical activity, or physical inactivity, as the fourth leading risk factor for global mortality (6% of deaths globally). Regular participation in physical activities and sports provides ample opportunities to maintain physical, mental and social health. Participation in sports and physical



activity results in benefits like an increase in self-confidence and self-esteem, a better control over emotions, reduction in levels of stress, anxiety and depression, maintenance of healthy weight, social interaction and achieving high performance in academics. Regular physical activities help in not just physical, but also social, emotional and mental growth and development of infants, children, adolescents and adults. Physical activities should be encouraged among children to ensure strong muscles and bones. Children and young people should not be allowed to sit for long hours watching TV, playing computer games and travelling by car.

WHO has developed certain guidelines - Global Recommendations on Physical Activity for Health - with the overall aim of providing national and regional level policy makers with guidance on the frequency, duration, intensity, type and total amount of physical activity needed for the prevention of Non-Communicable Diseases or Lifestyle Diseases.

### 2.1.1 Recommendations for Children Under 5 Years of Age

“Achieving health for all means doing what is best for health right from the beginning of people’s lives,” says WHO Director-General Dr Tedros Adhanom Ghebreyesus. “Early childhood is a period of rapid development and a time when family lifestyle patterns can be adapted to boost health gains.” If they are to grow up healthy, children under five must spend less time sitting watching screens, or restrained in prams and seats, so that they get better quality sleep and have more time for active play.



The following guidelines are recommended for healthy children aged Under 5 years, irrespective of gender, race, ethnicity, cultural background, and the socio-economic status of the family.

These are also relevant for children with different abilities. Children with a medical





condition or disability should consult with health professionals before undertaking these activities. The goals of these guidelines are to recommend time spent on physical activities, and on sleep and sedentary activities to get health benefits. The age group is further divided in to three groups namely Less than 1 year, 1 to 2 years, 3 to 4 years.

Age	Sedentary Behaviour	Physical Activity	Sleep
Less than 1 year	Not be restrained for more than 1 hour at a time. Encourage reading and storytelling when sedentary. Screen time is not recommended.	Physically active several times a day through interactive floor-based play including 30 minutes of tummy time.	14-17 hours (0-3 months of age), 12-16h (4-11 months of age) of good quality sleep, including naps.
1-2 years	Not restrained for more than 1 hour at a time or sit for extended periods of time. No screen time for 1-year-olds. For 2 years, sedentary screen time should be no more than 1 hour. Encourage reading and storytelling.	At least 180 minutes in a variety of types of physical activities including moderate- to vigorous- intensity physical activity, spreadthroughout the day.	11-14 hours of good quality sleep, including naps, with regular sleep and wake-up times.
3-4 years	Not restrained for more than 1 hour at a time or sit for extended periods of time. Sedentary screen time should be no more than 1 hour; less is better. Encourage reading and storytelling.	At least 180 minutes in a variety of types of physical activities at any intensity, of which at least 60 minutes is moderate- to vigorous intensity physical ctivity, spread throughout the day.	10-13h of good quality sleep, which may include a nap, with regular sleep and wake-up times.



### **Infants (Less than 1 year)**

Infants should be provided enough space and open environment to promote movement and minimize restrictive or sedentary behaviour so that they may explore their surroundings. Babies should be encouraged to be active throughout the day, every day. Before your baby begins to crawl, encourage her/him to be physically active by reaching and grasping, pulling and pushing, moving her/his head, body and limbs during daily routines, and during supervised floor play. This includes giving the baby 30 minutes in prone position (tummy time). Playing equipment should be carefully chosen and must not be so small that it can be swallowed or have sharp edges or be prepared with toxic material. Activities like crawling and rolling should be performed on mat or sheet that is at least 7 feet by 4 feet in size. Once babies can move around, encourage them to be as active as possible in a safe, supervised and nurturing play environment. During sedentary timing, the child must be engaged in reading and storytelling for encouragement. For 0-3 months of age 14-17 hours and for 4-11 months of age baby should have 12-16 hours of good quality sleep that includes naps.

### **Toddlers (1-2 years of age)**

During this period, the child should not be involved in any sedentary activity which is more than one-hour long including being restrained in prams/strollers, high chairs, or strapped on a caregiver's back, or sitting for extended periods of time. Once they learn to sit and stand, toddlers should be encouraged to undertake fundamental physical activity like walking, running, jumping, catching, throwing, leaping etc. In this group sedentary screen time like involvement with computer games, watching TV or video is not recommended. Engagement in reading and storytelling should not be for more than one hour. It is recommended toddlers get 11-14 hours of good quality sleep, including naps, with regular sleep and wake-up times.

### **Children 3-4 years**

Children should spend at least 180 minutes in a variety of types of physical activities at any intensity, of which at least one hour is spent in moderate to vigorous intensity physical activity. This should be spread throughout the day, indoors or outside. In the 180 minutes of physical activity, we can include light activity such as standing up, moving around, rolling and playing, as well as more energetic activities like skipping, hopping, running and jumping. Active play, such as using a climbing frame, riding a bike, playing in water, chasing games and ball games, is the best way for





this age group to get moving. Sedentary time should not be more than one hour, and during this period engagement in reading and storytelling should be encouraged. Quality sleep between 10-13 hours is recommended which includes a nap, with regular sleep and wake-up times.

All these recommendations are divided into three components Physical activity, sedentary behaviour and sleep. Lesser sedentary time and more moderate to vigorous intensity physical activity with sufficient sleep can provide additional health benefits.

### 2.1.2 Children and Youth 5-17 Years

These recommendations are relevant to healthy children and youth between 5 to 17 of age irrespective of gender, race, ethnicity or socio-economic status.

Children and youth with a specific medical condition or disability may follow these recommendations under advice of a medical official or with the help of the school special education teacher. Activities should be done in a progressive manner, for example starting the session with simple exercises to complex, gradually increasing the frequency, duration and intensity of the activities. There are various stages of growth in this age group, wherein at every stage the type of activities changes. The chief aim of activities during this age group is to improve cardiorespiratory and muscular fitness, bone health, cardiovascular and metabolic health biomarkers and to reduce symptoms of anxiety and depression.





<b>Intensity</b>	Moderate to Vigorous.
<b>Volume/ Duration</b>	At least one hour in a day; more than 60 minutes will provide additional health benefits.
<b>Frequency</b>	One session of 1 hour or two sessions of 30 minutes each.
<b>Types of Activities</b>	Aerobic, basic exercises for strengthening of muscles, Fundamental activities (Jumping, running, throwing, turning twisting etc.)
<b>Benefits</b>	Regular exercise helps to develop Musculo-skeletal system (Bones, muscles and joints), cardiovascular system (heart and lungs), neuromuscular system (coordination, movement control, motor learning) and maintain healthy body composition. Physical activities also help to develop psychological (control over emotions, anxiety, depression, and manage stress) and sociological aspects (interaction, integration, leadership), result in healthy behaviour (avoidance of tobacco, alcohol, drugs) and promote academic performance.
<b>Activities</b>	Play, Games, Sports, recreation, physical education, unplanned to planned exercises with or within family, school and Community.

### 2.1.3 Adults 18-64 Years

These recommendations are relevant to healthy adults aged between 18 to 64 irrespective of gender, race, ethnicity or socio-economic status. Adults/youth with disabilities may follow these recommendations with adjustment as per capacity or limitations. An adult having any medical condition should follow the advice of medical official. Activities should be done in a progressive manner, for example, start the session with simple exercises and move to complex, gradually increasing frequency, duration and intensity of the activities.







<b>Intensity</b>	Moderate to Vigorous.
<b>Types of Activities</b>	Muscular strengthening (strength) and Aerobic physical activities
<b>Aerobic activities</b>	150 to 300 minutes per week with moderate intensity or 75 to 150 minutes per week with vigorous intensity; One aerobic activity bout should be at least 10 minutes
<b>Muscle strengthening activities</b>	Activities involving major muscles two or more days in a week
<b>Benefits</b>	Regular physical activity helps to lower the risk of all causes of mortality, (For example heart diseases, blood pressure, stroke, Type 2 diabetes, metabolic syndrome, colon and breast cancers and depression) hip or vertebral fractures, and to develop higher level of cardiorespiratory muscular fitness and maintain healthy weight with healthy body composition and bone health. It lowers the risk of Non-Communicable Diseases and depression.
<b>Activities</b>	Physical activities (walking jogging, swimming, weight training, dancing etc.), occupational work, household work (car wash, gardening, etc.) Games, Sports, recreation, transportation (walking, cycling), planned exercises with or within family and community.

#### 2.1.4 Older Adults 65 Years and Above

These recommendations are relevant to healthy older adults aged above 65 years, irrespective of gender, race, ethnicity or socio-economic status. These recommendations are also relevant for individuals suffering from chronic NCD conditions. Adults, youth with disabilities may follow these recommendations with adjustment as per capacity or limitations. Individuals with specific health conditions, such as cardiovascular disease and diabetes, may need to take extra precautions and seek medical advice before trying to achieve the recommended levels of physical activity for older adults. Activities should be done in progressive manner, for example, starting the session with simple exercises and moving to complex, gradually increasing frequency, duration and intensity of the activities as per their ability and as conditions allow.





<b>Intensity</b>	Moderate to Vigorous.
<b>Types of Activities</b>	Muscular strengthening (strength) and Aerobic physical activities and Balance-enhancing exercises.
<b>Aerobic activities</b>	150 to 300 minutes per week with moderate intensity or 75 to 150 minutes per week with vigorous intensity; One aerobic activity bout should be at least 10 minutes.
<b>Muscle strengthening activities</b>	Activities involving major muscles involved activity, two or more days in a week
<b>Balance-enhancing Activities</b>	Older adults, with poor mobility, should perform physical activity to enhance balance and prevent falls on 3 or more days per week.
<b>Benefits</b>	Regular physical activity helps to lower the risk of all causes of mortality, (For example, heart disease, blood pressure, stroke, Type 2 diabetes, metabolic syndrome, colon and breast cancers and depression) hip or vertebral fractures, and to develop higher level of cardiorespiratory muscular fitness and maintain healthy weight with healthy body composition and bone health. It lowers the risk of Non-Communicable Diseases, depression and cognitive decline.
<b>Activities</b>	Physical activities (walking jogging, swimming, weight training, dancing etc.), occupational work, household work (car wash, gardening, etc.) Games, Sports, recreation, transportation (walking, cycling), planned exercises with or within family and community.







### Do you Know?

**Type of physical activity:** includes aerobic, strength, flexibility, balance.

**Duration:** is the length of time in which an activity or exercise is performed. Duration is generally expressed in minutes.

**Frequency:** is the number of times an exercise or activity is performed. Frequency is generally expressed in sessions, episodes, or bouts per week.

**Intensity:** refers to the rate at which the activity is being performed or the magnitude of the effort required to perform an activity or exercise.

**Volume:** Aerobic exercise exposures can be characterized by an interaction between bout intensity, frequency, duration, and longevity of the programme. The product of these characteristics can be thought of as volume.

**Moderate-intensity physical activity:** On an absolute scale, moderate intensity refers to activity that is performed at 3.0-5.9 times the intensity of rest. On a scale relative to an individual's personal capacity, moderate-intensity physical activity is usually a 5 or 6 on a scale of 0-10.

**Vigorous-intensity physical activity:** On an absolute scale, vigorous intensity refers to activity that is performed at 6.0 or more times the intensity of rest for adults and typically 7.0 or more times for children and youth. On a scale relative to an individual's personal capacity, vigorous intensity physical activity is usually a 7 or 8 on a scale of 0-10.

**Aerobic activity:** also called endurance activity, improves cardiorespiratory fitness. Examples of aerobic activity include: brisk walking, running, bicycling, jumping rope, and swimming.

**Sedentary behaviour:** is characterized by a very low energy expenditure, such as sitting, reclining or lying down

**Sleep behaviour:** Duration and timing of sleep. For children under 5 years of age includes both at night and daytime naps.

**Toddler:** Child aged 1 to under 3 years (12.0-35.9 months).

**Tummy time:** Time an infant spends lying on her/his stomach (in prone position) while awake with unrestricted movement of limbs.

**Nap:** Period of sleep, usually during the daytime in addition to usual night time sleep.

Reference: [www.who.int](http://www.who.int)



**I. Tick the correct options**

1. Minimum duration of activity should be \_\_\_\_\_ per week at vigorous intensity in adults above 65 years of age.
  - a. 75 minutes
  - b. 150 minutes
  - c. 300 minutes
  - d. 450 minutes
2. Rate at which the activity is being performed is known as \_
  - a. Volume
  - b. Intensity
  - c. Type of Activity
  - d. Frequency

**II. Answer the following questions briefly**

1. Write down Physical activities exercise guideline for under 5 of age.
2. Briefly write about physical activities/exercises guidelines for adults above 65 of age.

**III. Answer the following questions in 150-200 words**

1. Describe Physical activities/exercise guidelines for all groups.

## 2.2 Posture

Posture is defined as the attitude assumed by the body either with support during the course of muscular activity, or as a result of the coordinated action performed by a group of muscles working to maintain the stability. Posture is classified into two categories.

1. Dynamic posture is how one holds oneself when moving, for example, walking, running, or bending over to pick up something. It is usually required to form an efficient basis for movement. Muscles and non-contractile structures have to work to adapt to changing circumstances.
2. Static posture is how one holds oneself when stationary or not moving, For example, sitting, standing, or sleeping. Body segments are aligned and maintained in fixed positions. This is usually achieved by co-ordination and





interaction of various muscle groups which are working statically to counteract gravity and other forces.

### Extension Activity

#### Working in groups

- ◆ Distinguish between poor posture and good posture.
- ◆ Describe good posture while sitting, studying, writing, standing, walking.
- ◆ Discuss the significance of having a good posture.

Design a poster to be put up on the school Notice Board urging students to maintain good posture. Highlight the ill effects of poor posture.

It is important to ensure maintaining of a good posture. This is possible where all body parts are aligned in such a way that least stress is put on joints and muscles and, thus, it helps to prevent fatigue. A good posture helps to give good productivity in work, and leads to a physically and mentally stress-free condition. Postural deformity may be caused by heredity, disease, injury, poor habits, improper clothing, unhygienic living conditions, improper diet, improper exercise, lack of exercise, obesity, socio-economic status, etc.

#### 2.2.1 Common Postural Deformities

There are a number of postural deformities, some of which are given below along with corrective measures. Corrective exercises should be done under advice and supervision of a physician or a physiotherapist.

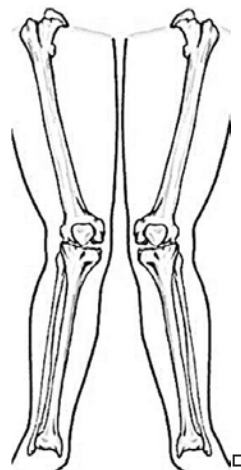




### 2.2.2 Knock Knees

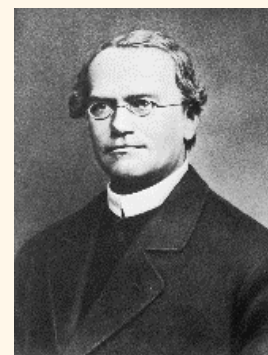
Knock Knees, also known as **Genu valgum**, is a knee misalignment that turns the knees inward. As a result, both knees touch or knock against each other in a normal standing posture but there is a gap of 3-4 inches between the ankles. It is generally first noticed in early childhood, but in most cases, it usually corrects itself naturally by the time children are 7-8 years old. However, in some cases it continues till adolescence. In some cases Genu valgum can also develop due to an injury or infection in the knee or leg, rickets, severe lack of vitamin D and calcium, obesity, or arthritis in the knee.

It negatively effects walking and running and impedes other legs movement which hinder performance. In case Genu valgum persists beyond childhood, it may have other symptoms besides misaligned knees. They include stiff joints, knee pain and walking with a limp. Stressed ligaments and muscles can also cause pain in the hips, ankles, or feet. If only one knee is out of line, the stance may be unbalanced.



#### Do you know?

The man who discovered genes was an Austrian Gregor Mendel. Mendel was a scientist, Augustinian friar and abbot of St. Thomas' Abbey in Brno, Margraviate of Moravia. Though farmers had known for millennia that crossbreeding of animals and plants could favor certain desirable traits, Mendel's pea plant experiments conducted between 1856 and 1863 established many of the rules of heredity, now referred to as the laws of Mendelian inheritance.





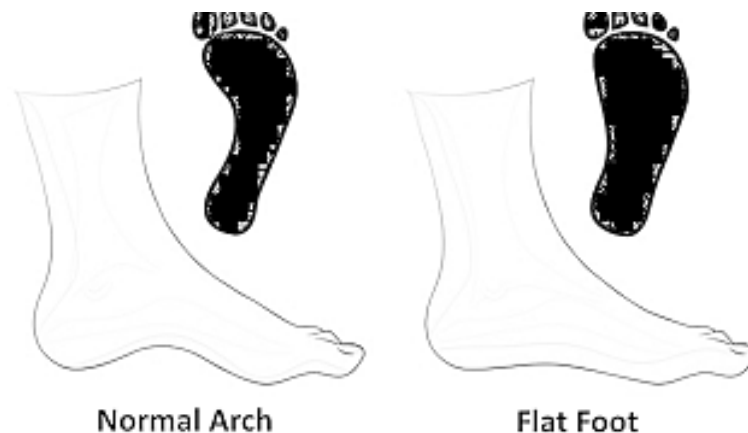
## Corrective Measures

Treatment for Genu valgum largely depends on the cause and severity of the problem. Exercises like horse-riding and keeping the pillow between the knees and standing erect for some time are the best. For most people with Genu valgum, Yoga and exercise can help realign and stabilize the knees. Performing padmasana and gomukhasana regularly can help strengthen muscles of the legs and realign the knees. Strengthening exercises can be simple, such as leg raises while seated or lying down. Using of walking callipers is also a big help at pre-puberty stage.

Excessive body weight can be a contributing factor to Genu valgum as extra weight puts additional strain on the legs and knees, and this can cause knock-knees to worsen. A person who is overweight should lose weight through a combination of diet and exercise.

### 2.2.3 Flat Foot

Flat foot is also known as pes planus or fallen arches. It is a condition that may be diagnosed by looking at the arch of the foot or by taking the water print test. As the name flat foot suggests, people suffering from this deformity have either no arch in their feet, or one that is very low, allowing the entire soles of the feet to touch the floor in standing position.



This problem may be genetic or environmental. At times a foot or ankle injury, obesity, wearing improper shoes (tight shoes, high heels etc.), carrying heavy weight for long time, arthritis or rheumatoid may cause flat feet. It may be caused by a baby being forced to walk in an early stage, or it may be age related. Another condition that might cause flat feet is tarsal coalition. This condition causes the bones of the foot to fuse together unusually, resulting in stiff and flat feet. Tightness in calf muscles may lead to temporary flat feet.





Arches provide a spring to the step and help to distribute body weight across the feet and legs. The structure of the arches determines how a person walks. Arches need to be both sturdy and flexible to adapt to stress and a variety of surfaces. When people have flat feet, it affects their posture while standing, their walking, running, and other related performances. Flat feet can sometimes contribute to problems in the ankles and knees. Majority of babies are born with flat feet but as they grow or get involved in physical activities the arch in the foot develops.

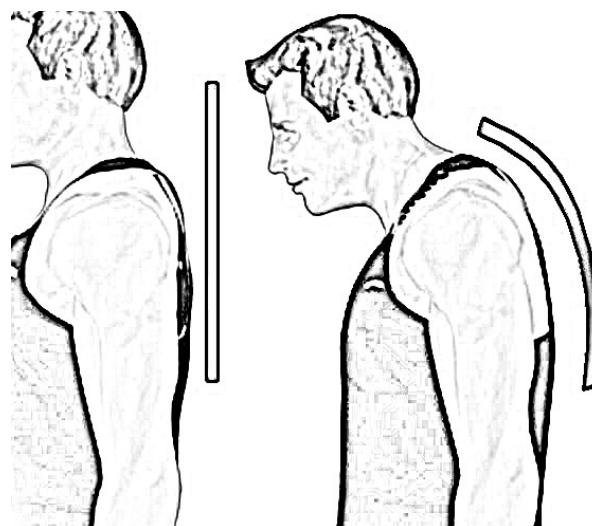
### Corrective Measures

Exercises like walking, standing or jumping on toes and heels in all four directions, skipping rope, strengthens the muscles of foot which help to develop the arch in the foot. Activities like picking up marbles with toes, writing numbers in the sand with the toes will also help in developing the arch. Yoga asanas like Adhomukhsavasana performed in Surya Namaskar, Vajrasana and other therapeutic massages are also helpful in developing the arch.

#### 2.2.4 Round Shoulders

Round shoulders is a postural deformity in which shoulders are bent forward from the ideal alignment, thereby giving a narrow curve to upper back. It leads to postural deviations such as hyperkyphosis, or hunch back and anterior head carriage, or forward head posture. Over time, these postural conditions can progress and lead to other conditions such as chronic neck pain, thoracic outlet syndrome and lack of shoulder mobility.

It may occur at any age due to poor posture habits, heredity, muscle imbalance, tight fitting clothes, injury, disease etc. Poor posture habits include using smartphone, tablet, computer, driving, carrying heavy weights and sitting for long periods.





## Corrective Measures

Most important measure to correct rounded shoulders is strengthening and stretching of muscles and trying to correct the imbalance of muscles by doing chest stretches, T stretch, wall stretch, Handclasp stretch and planks, pull ups, reverse shoulder stretch, etc. Developing the habit of keeping the spine straight is also helpful in correcting rounded shoulders. Yoga asanas like *Chakrasana*, *Dhanurasana*, can be useful in correcting rounded shoulders.

### 2.2.5 Kyphosis

Kyphosis is also known as Hunch Back or round upper back. The word **Kyphosis** comes from the Greek term kyph and means ***bent or bowed***. It is a condition of the spine where the curvature of the upper back gets exaggerated or increases. It is an exaggerated, forward rounding of the back. Kyphosis can occur due to heredity, aging, disease (arthritis, osteoporosis), malnutrition, pulling of heavy weight over a period, unstable furniture, poor postural habit, weakness in muscles etc. Though it can occur at any age, but kyphosis is most common in older women. Age-related kyphosis is often due to weakness in the spinal bones that causes them to compress or crack. Kyphosis can appear in infants or teens due to malformation of the spine or wedging of the spinal bones over time.



While mild Kyphosis causes few problems, severe Kyphosis can cause pain and be disfiguring. This posture creates instability while walking, running etc. that may lead to fall or injury.







## Corrective Measures

Exercises which help to strengthen back muscles, provide stability and make muscles more flexible should be performed. Physical therapy, swimming, exercise/ gym ball exercises, exercises with bands, and Yoga asanas like Dhanurasana, Chakrasana and Bhujangasana should be performed to get optimum benefits. Using a flat bed with a thin pillow while sleeping is also helpful .

### 2.2.6 Lordosis

The term Lordosis comes from the Greek lordos which means bent backward. The spine curves a little in the neck, upper back, and lower back. These curves, which create the spine's S shape, are called the kyphotic (upper back) and lordotic (neck and lower back). Lordosis is a spinal deformity in which the angle of arc of the lower back is reduced. This leads to an increase and exaggeration of normal concavity of the lumbar region of the spine. It is also known as sway back. Chronic Lordosis may lead to pain and discomfort and become more serious if left untreated.



Lordosis is often caused by obesity, improper development of muscles, muscular or skeletal disease or accident, poor posture while standing, sitting and walking, malnutrition, etc. There are few cases where the cause was unknown. It is generally







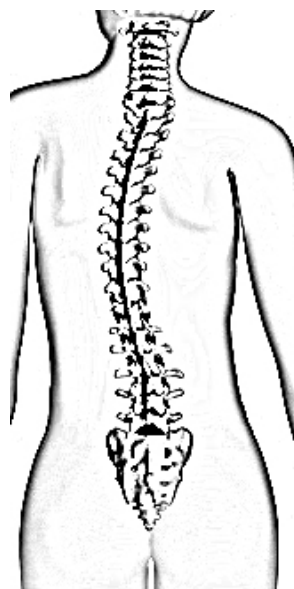
found in children because of weakening or tightening of muscles of the hip area, but they easily recover as they grow and muscles get strengthened.

### Corrective Measures

Most people with Lordosis don't require medical treatment unless it's a severe case. In severe cases of Lordosis in children and teens, the individual may require use of braces, or even surgery. Largely, weight loss to help posture, and daily physical therapy to strengthen muscles and range of motion prove quite helpful. Exercises to develop strength in the pelvic region like sit-ups, sitting against the wall and pushing the trunk backward and lying on the back and raising upper extremities and legs together will give significant benefits. Yoga asanas including Dhanurasana and Halasana will be helpful. Use of braces, weight reduction, maintaining a good posture and taking a balanced diet are helpful in reducing the problem.

### 2.2.7 Scoliosis

The word Scoliosis comes from the Greek skolios which means bent. Scoliosis is a position in which the spine is tilted to either side of the body. It is a position of exaggerated lateral curvature or sideways curvature of the spine. In this disorder, the spine bends, twists or rotates in a way that it makes a C or an S shape. Scoliosis is found more commonly in girls than in boys and, though it can occur at any age, but it is more common during the growth spurt just before puberty. Most cases of scoliosis are mild, but some spinal deformities continue to get more severe as children grow. Severe scoliosis can be disabling. An especially severe spinal curve can reduce the amount of space within the chest, making it difficult for the lungs to function properly.





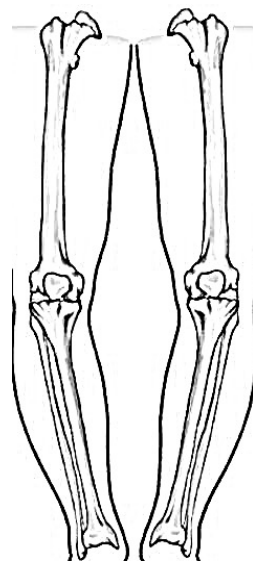
Scoliosis can be caused by conditions such as cerebral palsy and muscular dystrophy, or diseases like arthritis, paralysis, or rickets. It may result from lifting heavy weights, living in an unhealthy environment, and standing and sitting in a wrong posture. However, the cause of most scoliosis is unknown.

### Corrective Measures

In cases of mild Scoliosis, no treatment is necessary. Some children may need to wear a brace to stop the curve from worsening. Others may need surgery to keep the problem from worsening and to straighten the spine. Exercises like hanging on the horizontal bars and swinging should be done on opposite side of the C-shaped curve. Aerobic activities with slow pace and breaststroke in swimming are helpful and also give good results. In yoga *Trikonasana* and *Adhomukhasana* should be performed to straighten the spine.

### 2.2.8 Bow Legs

Bow Legs, also known as Genu varum, is a position of knees in which legs look like a bow, when the legs curve outward at the knees while the feet and ankles touch. Infants and toddlers often have bow legs. It may be caused due to lack of Vitamin D, Phosphorus and Calcium and can be easily cured at an early stage. The condition doesn't cause pain or discomfort and is rarely serious. It does not affect running, standing, crawling etc. Bow legs is a condition that usually goes away without treatment, often by the time a child is 3-4 years old and does not affect a child's ability to crawl, walk, or run. However, parents might worry about the appearance of their child's legs, or an awkward walking pattern.





Sometimes, kids with bow legs may walk with the toes pointed inward, called pigeon-toes, or they may trip a lot and appear clumsy. Although in most cases the problem generally gets resolved on its own as the child grows, sometimes, it may lead to arthritis in the knees and hips. At times Bowlegs can be a sign of an underlying disease, such as Blount's disease, rickets, or arthritis.

### Corrective Measures

Use of braces and modified shoes can be along with sufficient intake of balanced diet can prove to be of help. Walking on the inner edge of the feet may also help.

#### I. Tick the correct options

1. Deformity of the legs is known as
  - a. Scoliosis
  - b. Lordosis
  - c. Knock knees
  - d. Kyphosis
2. Lordosis is a problem of the
  - a. Lower Back
  - b. Middle Back
  - c. Upper Back
  - d. Shoulders
3. Scoliosis is a postural deformity related to
  - a. Muscles
  - b. Shoulders
  - c. Legs
  - d. Spine
4. Kyphosis is a deformity found in
  - a. Shoulders
  - b. Lumber region
  - c. Hips
  - d. Thoracic region



**II. Answer the following questions briefly**

1. What is meant by Round Shoulders? Mention a few exercises to correct it.
2. What is the Lordosis? Write in brief.
3. Write in brief the causes and symptoms of Knock Knees.
4. Explain corrective measures for Flatfoot.

**III. Answer the following questions in 150-200 words**

1. Explain any five postural deformities with their corrective measures.
2. Describe corrective measures of some common spinal postural deformities.

### 2.3 Women participation in Sports - Physical, Psychological and Social benefits

Women's sports, both amateur and professional, have existed throughout the world for centuries in all varieties of sports. There is a rich record of participation of women in sports in India. In the days of Mahabharata, Shakuntala, Madhuri, Kunti all chose physical activities as recreation. As time passed, Indian women, despite having potential and talent, were deprived of participation in sports for a number of reasons. They were put in the back seat and were not allowed to participate in sports. However, female participation and popularity in sports increased dramatically in the last quarter of the 20th century, reflecting changes that emphasize gender parity. Although the level of participation and performance can still be improved, women's participation in sports is generally accepted and promoted today.

Despite the fact that women have shown a dramatic rise in sports participation, there is still a large disparity in participation rates between women and men. But to deal with this disparity many countries like India run programmes such as Khelo India scheme and National Sports Talent Search Scheme (NSTSS) to mainstream women's participation in sports in India. While in the past there were certain psychological constraints like low self-confidence and self-esteem, higher levels of stress and anxiety, and social causes like lack of support or positive reinforcement from family and a male-dominated social structure that affect women's participation in sports, or even, certain economic factors that played a negative role that affected women's participation in sports, these are all a thing of the past.

This trend of lower participation of women in sports exists not just in India but is a global phenomenon. Participation of women at all levels from regional to





international is limited. It affects all domains like participation in sports activities, administration of associations and federations, and participation in national and international level committees. Women who play sports continue to face many obstacles, such as lower pay, less media coverage, and different injuries compared to their male counterparts. Many female athletes have engaged in peaceful protests, such as playing strikes, social media campaigns, and even lawsuits to address these inequalities. The International Olympic Committee (IOC) encourages participation not only in playing sports but in National Olympic Committees and International Federations and conducting regional seminars for female administrators, coaches, technical officials and journalists. In a recent announcement by IOC, 49% women will take part in next Olympic games. The Constitution of India also provides gender equality and ensures elimination of any type of gender bias or hindrance. Sports is a medium to get gender equity and empowerment.



As more women athletes are participating in sports, there is more positive attitude that is being inculcated. Sports is an important tool for social empowerment and helps to develop skills like communication, teamwork, leadership, respect, social interaction, sportsmanship etc. and can significantly contribute to develop society and community. Sports participation not only provides health benefits but also promotes overall development. Sport does not discriminate based on colour, caste, creed, sex, race etc.



### 2.3.1 Women participation in Sports - Physical, Psychological and Social benefits

Women participation in sports helps them to stay fit and reduces chances of diseases. These are some physical benefits for women participating in sports. These benefits are as true for women as for their male counterparts.

#### I. Physical Benefits

##### Lifestyle Diseases

Sports participation helps women to stay active which, in turn, reduces chances of lifestyle diseases such as Diabetes, high blood pressure, obesity etc. and enables them to live a healthy life.

##### Bone Density

There is a higher chance of osteoporosis in female than males. Sports help them to increase their bone density and have stronger bones.

##### Toned Muscles

Regular exercise and participation in sports increases the muscle tone of women which helps them to stay strong.

##### Cardiovascular System

Regular exercise helps increase the number of capillaries, helping them in the intake of oxygen. This enables women to participate in sports for a longer period without getting fatigued.

##### Obesity

Obesity is one lifestyle disease which is found in every part of the world. Most of the India's population is also suffering from this disease. Women has more chances of being obese than men, regular participation in sports helps them to stay in shape and stay fit.

#### II. Psychological Benefits

Participation in sports has a great impact on women psychologically as it gives them confidence and enhances their self-esteem. It gives them that sense of achievement





which empowers them to achieve and overcome any obstacles that they may have faced. Some of the psychological benefits of participation in sports are:

### **Stress Management**

Any physical activity releases lot of hormones in our body which helps us to stay happy and reduces stress levels. Sportspersons, men and women, who participate in sports can manage their stress better than those who don't participate in the sports.

### **Control Emotions**

Women, like their male counterparts, who participate in sports are well equipped to manage their emotions as they face difficult situations in the game which take a toll on them, and regular participation makes them emotionally stronger.

### **Confidence**

Every small win increases the confidence of the winner. Thus, when a woman participates in sports and wins, it gives not just her, but other women sportspersons a sense of achievement and really boosts their confidence. This renewed confidence in themselves they bring to all areas of their life.

### **Self - Esteem**

Sports helps women to realise their self-worth and when they achieve or even participate in sports, they get a boost in their self-image and that helps them to realise their own worth, which is very important for an individual.

### **Leadership**

one of the best quality about sports is that it inculcates or bring out the leadership skills or qualities of an individual. Those women, or men, who participate in sports better are able to lead people even outside the sports as well.

### **III. Social Benefits**

Women participation in sports helps them to be more open towards society as it helps them to communicate with others and helps them to bond with their teammates and other officials. Some of the social benefits of sports are as follows:





## Coordination

Sport helps in increasing and improving the coordination between team players and women who participate in sports learn the skill of working in coordination with others.

## Communication

Communication is an integral part of sports as players must communicate with each other while playing. It helps women participants to be more vocal and expressive.

## Inter-relationships

A sport is not played in isolation, it's a team effort, whether it is inside the team or as supporting staff, the player must maintain her relationship with everyone in the team. Women participants learn to maintain their relationships and respect each other whether it is on the field or off the field.

## Cooperation

Women learn to cooperate with each other when they are playing on the field. This becomes a part of their life also as they learn to work and cooperate with others in total harmony and peace.

Because of the above discussed benefits women should participate in sports. Women's participation in sports should be encouraged in schools, colleges and in universities. Awareness programmes for women's participation in sports should be conducted on a regular basis and they should be encouraged to participate in competitive sports. Families should also be encouraged to support their girls to participate in sports. Media coverage and sponsorship can enhance sports participation of women in India. Sports equipment must be developed focusing on physiological aspects of women. Appointment of women coaches, providing opportunities for competitions, eliminating cultural and social negativity and proper facilities can ensure larger participation. States where social or other factors are a constraint should come up with some incentives so that their women can also participate in sports and live a better and healthy life.

Now times are changing, and society is accepting, and even encouraging, women's participation in sports at National and International levels. In recent years, it has been raining gold on Indian women athletes in the international arena proving women are no less of a powerhouse when it comes to winning medals and championships for the country. Women are coming out and participating in sports and physical activities in







large numbers. Karnam Malleswari was the first women who won a medal in Olympic Games in Sydney in 2000. In 2012, London Olympics, five times world champion Mary Kom won a medal in boxing and Saina Nehwal in Badminton. In 2016 Rio Olympics Sakshi Malik won medal in wrestling and P.V. Sindhu won the first ever women's silver medal in badminton. P.T Usha and Anju Bobby George were athletes who earned a name in Athletics at international level. Saina Nehwal has won 24 international titles, which includes ten Superseries titles. In 2015 that she was able to attain the world no. 1 ranking, thereby becoming the only female player from India to achieve this feat. Saikhom Mirabai Chanu, an Indian weightlifter, lifted a total of 201 kg to win the Gold Medal at the CWG 2022. Lovlina Borgohain is an Indian boxer who won a bronze medal at the 2020 Olympic Games in the women's welterweight event and the silver medal at the 2020 Tokyo Olympics in Women's 49 kg category. Our Indian women cricket team, wrestling, badminton, boxing are bringing glory to the country as they achieve new heights.

### Do you know?

**Some Indian women sportspersons who won medals in international events in 2019.**

1. **Dutee Chand** - First Indian to win a 100m gold in a global event at the 30th Summer University Games in Napoli, Italy.
2. **Hima Das** - **Won 5 gold medals in 20 days**
  - July 2, Poznan: 200m gold (23.65 seconds)
  - July 7, Kunto: 200m gold (23.97 seconds)
  - July 13, Kladno: 200m gold (23.43 seconds)
  - July 17, Tabor: 200m gold (23.25 seconds)
  - July 20, Prague: 400m gold (52.09 seconds)
3. **PV Sindhu** - **First Indian to win World Championships**
  - 2013 - Bronze
  - 2014 - Bronze
  - 2017 - Silver
  - 2018 - Silver
  - 2019 - Gold
4. **Manasi Joshi** - **Won BWF Para-Badminton World Championship**  
Para-badminton player Manasi Joshi created history by securing gold at the BWF Para- Badminton World Championships, just a day before Sindhu.
5. **PU Chitra** - **Clinched gold in women's 1500m race**  
Won the Gold at the Asian Athletics Championship 2019 in Doha.





The International Olympic Committee (IOC) encourages participation not only in playing sports but in National Olympic Committees and International Federations and conducting regional seminars for female administrators, coaches, technical officials and journalists. In a recent announcement by IOC, 49% women will take part in next Olympic games. The Constitution of India also provides gender equality and ensures elimination of any type of gender bias or hindrance. Sports is a medium to get gender equity and empowerment.

### Extension Activity

In recent years Indian women athletes have done India proud in International Sports events. Identify the following and match the pictures to their names. Mention their games in the blank.

Make a PPT about any one of them.

	P.V. SINDHU	
	MARY KOM	
	HIMA DAS	
	SAIKHOM MIRABAI CHANU	
	SAINA NEHWAL	





	SAKSHI MALIK	
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**I. Tick the correct options**

1. Sports is an important tool for social empowerment for women as it develops the following:
  - a. Aggression
  - b. Isolation
  - c. Stress
  - d. **Leadership**
2. Psychological benefits of women participation in sports include:
  - a. Cooperation
  - b. **Emotion Control**
  - c. Physical Fitness
  - d. Communication

**II. Answer the following questions briefly**

1. Write a short note on benefits of participation in sports.
2. Explain Physical benefits of Women participation in sports.

**III. Answer the following questions in 150-200 words**

1. Explain the various benefits of Women participation in Sports?

## 2.4 Special Consideration (Menarche & Menstrual Dysfunction)

### 2.4.1 Menarche

The period of adolescence is marked by certain universal physical and biological changes in the body which lead to the attainment of sexual maturity. The time when sexual maturity is reached is called puberty. Menarche (first menstruation) is usually considered the point of sexual maturity for girls. It is the process in which the female reproductive system matures and the body prepares itself for potential pregnancy. It is associated with the development of secondary sexual characteristics. Menarche



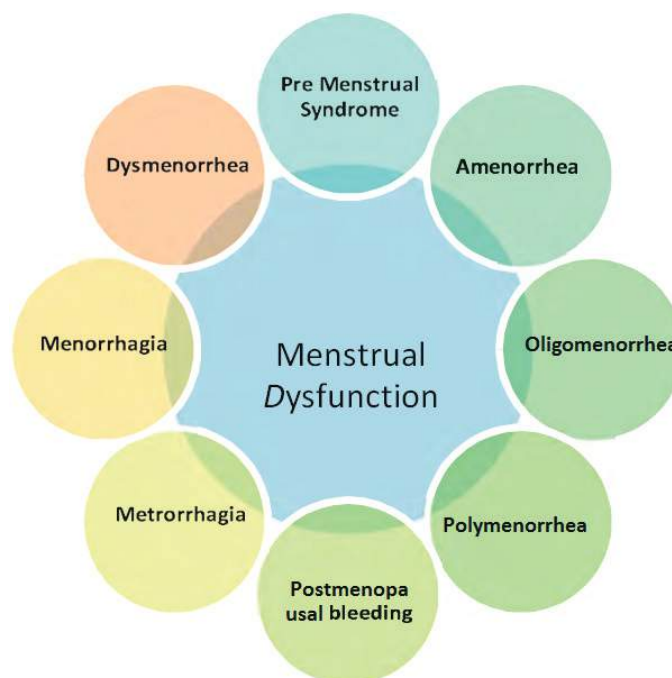


is one of the most significant milestones in a woman's life. The average age for a girl to get her first period ranges from 8 to 15 years old. Although the precise determinants of menarcheal age remain to be understood, genetic influences, socio-economic conditions, general health and well-being, nutritional status, certain types of exercise, seasonality, and family size possibly play a role. Over the past century the age at menarche has fallen due to reasons still unknown.

Menstruation (also termed as period or bleeding) is the process in a woman of discharging (through the vagina) blood and other materials from the lining of the uterus at about a monthly interval from puberty until menopause, except during pregnancy. This discharging process lasts about 3-5 days. Women usually have periods until about ages 45 to 55 and have menopause usually around age of 50. Menopause means that a woman is no longer ovulating and can no longer get pregnant. Like menstruation, age of menopause can vary from woman to woman and these changes may occur over several years.

### 2.4.2 Menstrual Dysfunction

Menstrual dysfunction is an abnormal condition in a woman's menstrual cycle. Normal range of the menstruation cycle is 21 to 35 days. If it happens earlier than 21 days or after more than 35 days, then it's a problem. Other menstrual problems include missing three or more periods, menstrual flow heavier or lighter in comparison with usual, cycle happening longer than seven days, any pain, cramping or vomiting during period, bleeding after menopause etc.





Causes of abnormal menstrual cycles or menstrual order are: overweight, stress, dietary disorder, disease, sudden change in exercise schedule, travel, other medical complications etc.

There are different types of menstrual disorders which are given below:

1. **Pre-menstrual Syndrome:** Pre-menstrual Syndrome includes unpleasant or uncomfortable symptoms during the cycle. These may include depression, anxiety, irritation, headache, fainting, vertigo, infection etc. and may last from a few hours to few days. Such symptoms may be reduced through moderate exercise, taking a balanced diet, having a good sleep and rest.
2. **Amenorrhea:** Amenorrhea is known as missed periods or absence of a normal monthly period or menstrual cycle. There are two types of amenorrhea.
  - (a) Primary amenorrhea: Menstruation cycle does not begin at puberty.
  - (b) Secondary amenorrhea: It happens when menstruation is missed for three months or more. This is the most common type of amenorrhea.
3. **Dysmenorrhea:** When menstruation happens with severe pain or frequent menstrual cramps, the condition is called Dysmenorrhea. Symptoms associated with dysmenorrhea may be cramping in lower abdomen, low back pain, pain in legs, nausea, fatigue, weakness etc.
4. **Menorrhagia:** Menorrhagia is characterized by heavy and long term or continuous menstrual bleeding.
5. **Polymenorrhea:** Polymenorrhea is a term used to describe a menstrual cycle that is shorter than 21 days.
6. **Oligomenorrhea:** Oligomenorrhea is infrequent menstruation. More strictly, it is menstrual periods occurring at intervals of greater than 35 days.
7. **Metrorrhagia:** Metrorrhagia refers to missed, delayed or erratic periods or abnormal bleeding patterns.
8. **Postmenopausal bleeding:** Postmenopausal bleeding is bleeding that occurs after one year of menopause or after a woman has stopped having menstrual cycles due to menopause.

The female hormones oestrogen and progesterone are important for overall body health. These hormones also regulate a woman's periods. Intense exercise and extreme thinness can reduce the levels of these hormones to prevent or stop monthly menstrual cycles.





### Extension Activity

Visit a nearby stadium and talk to women athletes. Collect a data of 5 such athletes in their teens. Are they facing any problem related to their health, diet etc? Discuss about it in the class.

#### I. Tick the correct options

1. Frequent menstruation is known as:
  - a. Metrorrhagia
  - b. Oligomenorrhea
  - c. Polymenorrhea
  - d. Menorrhagia
2. If the menstruation cycle does not begin at puberty, the condition is called
  - a. Primary amenorrhea
  - b. Secondary amenorrhea
  - c. Oligomenorrhea
  - d. Dysmenorrhea

#### II. Answer the following questions briefly

1. What is menstrual dysfunction? Write in brief.
2. Explain the term Menarche.
3. Write short note on Amenorrhea.

#### III. Answer the following questions in 150-200 words

1. Explain menstrual dysfunction.

## 2.5 Female Athlete Triad

Participation in sports and physical activities provides a lot of physical and social benefits like developing leadership qualities, competition, teamwork etc. Regular participation in such activities is associated with a longer and better quality of life, reduced risks of a variety of diseases and many psychological and emotional benefits. Evidence suggests a positive relationship between physical activity and a host of factors affecting girls' physical health, including diabetes, blood pressure

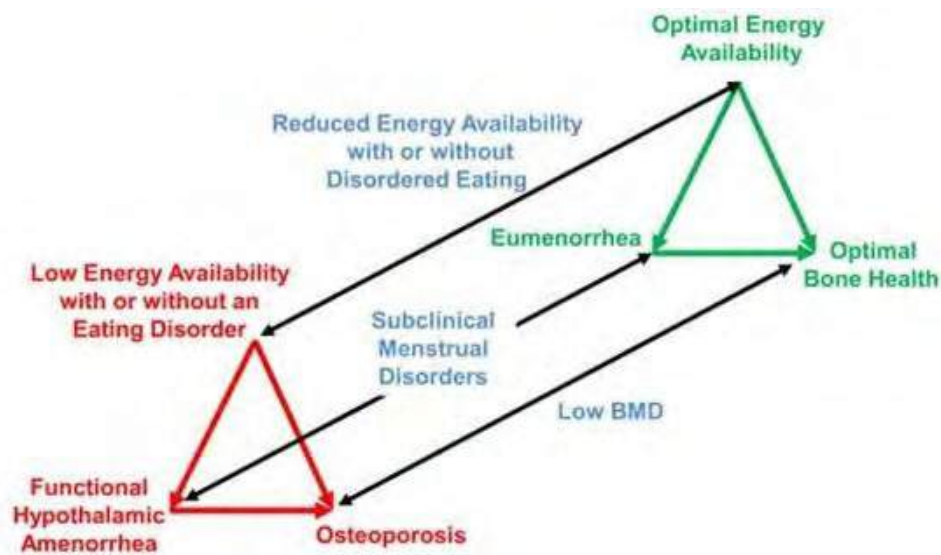




and the ability to use fat for energy, thus preventing obesity. Physical activity could reduce the risk of chronic diseases in later life. Conditions, such as cancer, diabetes and coronary heart disease, have their origins in childhood, and can be aided, in part, by regular physical activity in the early years. Also, regular activity beginning in childhood helps to improve bone health, thus preventing osteoporosis, which predominantly affects females.

However, participation in sports is not without certain health risks. Sports like Judo, boxing, wrestling, taekwondo etc. exert a lot of pressure on athletes to maintain their shape and weight. For participation in sports like distance running, cycling, cross country etc. athletes have to take a balanced diet since these demand high levels of energy and a good quantity of dietary intake. Such pressures put the athlete's health at risk and leads to *Female Athlete Triad*. The term 'triad' was first described by American college of sports medicine in 1992, and the three components to describe the triad were

- (a) disordered eating,
- (b) amenorrhoea and
- (c) osteoporosis



The illustration above depicts the female athlete triad spectrum. The black lines represent the spectrums of each of the 3 components and the red and green triangles show both of the extremes. The top green triangle represents a healthy athlete who has a good balance between energy intake and expenditure. Because of this, they have a normal menstruation cycle and a bone mineral density that is above average for the athlete's age. The bottom left, red triangle represents an athlete who does not have an appropriate balance between energy intake and expenditure, which may be the result of restrictive dieting and/or clinical eating disorders.

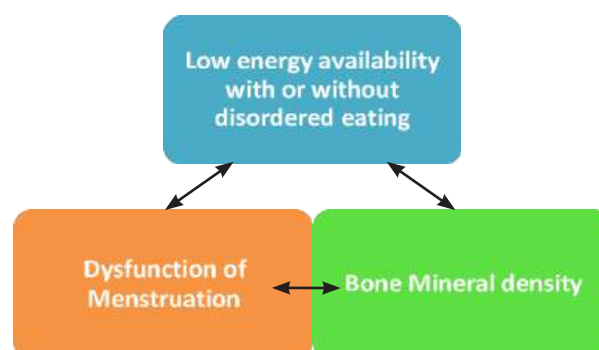




The terms to describe Female Athlete Triad have now been revised. The new terms to indicate problems are

- (a) low energy availability with or without eating disorder,
- (b) dysfunction of menstruation and
- (c) low bone density.

This change was relevant because all these three revised components can be easily resolved by proper energy intake and expenditure and same may be used as effective strategy. Thus, if an individual takes optimum calories as required by body, including energy required for physical activity and energy required for body functions, the result is promotion of healthy bones and normal menstrual function. All three components are very much interlinked.



### 2.5.1 Low Energy Availability with or Without Disordered Eating

Disbalance of energy may occur due to eating disorder. The problem of female athlete triad originated from not balancing energy intake and energy expenditure. Consequently, an athlete must have knowledge of how to balance the energy intake.

Eating disorder is known as gross disturbance in eating behaviour. Disordered eating has wide range of harmful and often ineffective eating behaviours in the process of weight reduction.

These includes calorie restriction to clinical disorders of Anorexia nervosa and bulimia nervosa. Sportspersons participating in activities in which leanness or specific weight is required for performance are at higher risk of developing eating disorders. Coaches, team physicians, parents, and other supporting staff should know the symptom so that the problem can be treated on time, other-wise it leads to long term physiological, psychological effects or, in extreme cases, fatal results. **Anorexia nervosa** is an eating disorder where an individual tries to reduce body







weight abnormally, having an intense fear of gaining weight or misconception over his/her weight. Individuals with anorexia place a high value on controlling their weight and shape, using extreme efforts that tend to significantly interfere with their lives. To prevent weight gain or to continue losing weight, people with anorexia usually severely restrict the amount of food they eat. They may control calorie-intake by vomiting after eating or by misusing laxatives, diet aids, or diuretics. They may also try to lose weight by exercising excessively. No matter how much weight is lost, the person continues to fear weight gain. Symptoms may include menstrual dysfunction, constipation, diarrhoea, bloating, unexpected weight loss, muscle weakness, stress fracture, bone weakness, overuse injuries, anxiety etc.

**Bulimia nervosa** is an eating disorder in which an individual eats large amount of food with loss of control over eating and then adopts unhealthy ways to cut down calories like vomiting, taking laxatives, weight loss supplements, diuretics, excessive exercises etc. Symptoms of bulimia are dehydration, dental problems, oedema, electrolyte abnormalities, extreme weight fluctuation, menstrual irregularity, weakness, cramps, depression etc.

## 2.6 Menstrual Dysfunction

Menstrual irregularities is one of the components of Female Athlete Triad and it is a marker of quality health in female athletes. Menstrual dysfunction is common in sportswomen and is often ignored. It is important that young female athletes should be informed enough to understand the problem and must know the management of the menstruation disorder. If the problem is managed in time, then it may positively affect athletic performance. Ignored or untreated menstrual irregularities may have a prolonged effect on bone mineralization and the treatment may last months and years. Generally female sportspersons suffering from menstrual irregularities, self-select different sports in comparison with normal menstruating peers because in delayed puberty females develop strong bones and taller height than others. However, such dysfunction may affect sports performance in the long run and lead to complications. Recent research says weight training has lots of benefits including strengthening of the bones and may not affect adolescent menstrual irregularities. Studies show that more than 15% females participating in Olympics may be suffering from amenorrhea. Sometimes the skeletal health of a female athlete suffering from amenorrhea is much lower than that of a sedentary woman.

### 2.6.1 Low Bone Mineral Density

Low bone mineral density, previously termed osteoporosis, may be defined as a disease



marked by increased bone fragility, disturbance in bone structure including low bone mineral density (BMD) that may result in fractures, pain, deformity, disability etc. Low BMD is generally caused by improper diet and amenorrhoea. Due to low level of oestrogen and progesterone in female athletes, their bones become weaker and lose minerals. Effects of low bone mineral density include increased occurrence of injury, stress fractures, and risk of early osteoporosis after menopause. Deposition of bone increases during childhood and adolescence and peaks during the 20s and 30s. A large genetic component to BMD also exists, with heritability of BMD suggested to be 50-85%. Knowledge of family history or other medical conditions linked with BMD will help keep female athletes safe from risk of injury and fractures. Intensity, volume, frequency, type of activity should be determined by knowledge of genetic characteristics.

The female athlete triad is a result of energy imbalance; thus, adjusting the energy expenditure and energy availability is the main intervention. For this the main treatment is restoration of regular menstrual cycle for reestablishment of energy balance and enhancement of bone mineral density. The strongest predictor of recovery to normal menstrual function in young athletes is weight gain. Family-based therapy and cognitive behavioural therapy, also have been known to be effective interventions for disordered eating. A sports nutritionist can help the athlete and her family determine the quantity and quality of food consumption and dietary supplements required to meet her bodily functions, replace energy output due to athletic training, and enhance bone health. Additionally, weight gain may be necessary to increase BMD.

**I. Tick the correct options.**

1. Weakening of bones due to loss of bone density and improper bone formation is
  - a. Amenorrhoea
  - b. Anorexia Nervosa
  - c. Osteoporosis
  - d. Lordosis
  
2. What is the cause of Osteoporosis in women?
  - a. High blood pressure
  - b. Menarche
  - c. Excessive exercise
  - d. Lack of calcium and vitamin D





3. Female athlete triad is a syndrome characterized by
  - a. (a) Osteoporosis
  - b. (b) Amenorrhea
  - c. (c) Eating disorder
  - d. (d) All of the above
4. In which type of Anorexia does an individual lose weight by taking laxatives or diuretics
  - a. Bulimia Nervosa
  - b. Purging type
  - c. Restricting type
  - d. Anorexia Nervosa

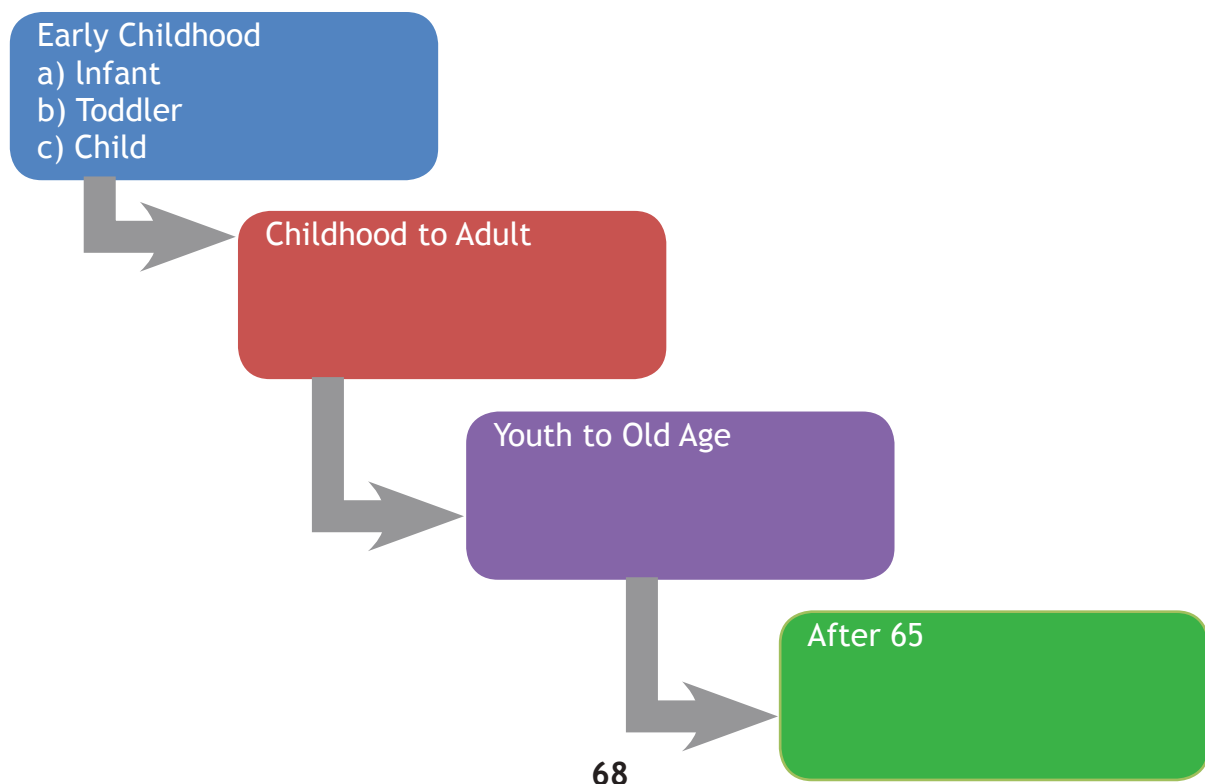
**II. Answer the following questions briefly.**

1. Explain eating disorder.
2. Write a short note on Bone Mineral density.

**III. Answer the following questions in 150-200 words**

1. What is Female Athlete Triad? Explain.

**IV. Complete the given diagram listing suitable at exercises various stages of life.**



## V. Art Integration

There's no easier way to make someone smile, or let them know you admire them than giving them a heartfelt compliment. It's amazing how much saying these kind words can lift someone up and really turn a person's day around. There are many ways to deliver a compliment. However, nothing can be as beautiful as saying it in a song.

Write and dedicate a song to the Female Sportsperson you admire most.

### V. Case study Questions

1. Anjali, a student of class IX was diagnosed with 'knock knees' which is becoming quite common in children due to lifestyle choices. She has sought help from her physical education teacher. The teacher has advised her to practice certain exercises on a daily basis.
  - a. What are common causes for this postural deformity.
  - b. Suggest any two exercises for curing knock knees.
  - c. What other leg related postural deformities are there?
2. Priya, a student of class XI has very low BMI due to which her class teacher has asked the school counselor to help priya because it seems priya is not taking proper meals.



- a. List down the different types of eating disorders.
- b. What is the range for underweight students in BMI?
- c. What could be the possible causes of eating disorders?





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**UNIT****YOGA AS PREVENTIVE MEASURE FOR LIFESTYLE DISEASE****Overview**

Asanas as preventive measures for lifestyle disease :

- ◆ Obesity: Procedure, Benefits & contraindications for Tadasana, Katichakrasana, Pavanmuktasana, Matsayasana, Halasana, Paschimottasana, Ardh Matsyendrasana, Dhanurasana, Ushtrasana, Suryabedhan pranayama.
- ◆ Diabetes: Procedure, Benefits & contraindications for Ktichakrasana, Pavanmuktasana, Bhujangasana, Shalabhasana, Dhanurasana, Supta-vajarasana, Paschimottasana, Ardh Matsyendrasana, Mandukasana, Yogmudra, Gomukhasana, Ushtrasana, Kapalbhathi
- ◆ Asthma: Procedure, Benefits & contraindications for Tadasana, Urdhwahastottasana, Uttan Mandukasana, Bhujangasana, Dhanurasana, Ushtrasana, Vakrasana, Kapalbhathi, Gomukhasana, Mtsyaasana, Anulom-Vilom.
- ◆ Hypertension: Tadasana, Katichakrasana, Uttanpadasana, Ardha Halasana, Sarla Matyasana, Gomukhasana, Uttan Mandukasana, Vakrasana, Bhujangasana, Makarasana, Shavasana, Nadi-Shodhanapranayam, Sitlipranayam.
- ◆ Back Pain and Arthritis: Procedure, Benefits & Contraindications of Tadasan, Urdhawahastootansana, Ardh-Chakrasana, Ushtrasana, Vakrasana, Sarala Maysyendrsana, Bhujandgasana, Gomukhasana, Bhadrasana, Makarasana, Nadi-Shodhana pranayama.





### LEARNING OUTCOMES

*At the end of the chapter, children will be able to:*

- ◆ identify the asanas beneficial for different types of ailments and health problems.
- ◆ recognize importance of various asanas for preventive measures of obesity, diabetes, asthma, hypertension, back pain.
- ◆ describe the procedure for performing variety of asanas for maximal benefits.
- ◆ distinguish the contraindications associated with performing of different asanas.
- ◆ outline the role of yogic management for various health benefits and preventive measures.

### Discuss in a Group

- ◆ What are the factors that have led to an increase in sedentary behaviour in our modern lifestyle?
- ◆ What prompts individuals to develop a particular lifestyle or adopt a particular occupational culture?
- ◆ In what way do their different lifestyles and occupations impact the day to day life or health of individuals?
- ◆ What do you understand by the term lifestyle diseases?
- ◆ List some lifestyle diseases. What do these diseases lead to?
- ◆ What is the meaning of the term “premature mortality”?

### Do you know?

Difference between yoga and exercise?

When Yogasanas are performed, respiration and metabolic rates slow down. As a result, consumption of oxygen and body temperature drop. However, during exercise, breathing and metabolism speed up, oxygen consumption rises, and body gets hot. Yoga postures tend to arrest catabolism whereas exercise promotes it. Asanas are designed to have specific effects on the glands and internal organs, and to alter electrochemical activity in the nervous system. The asanas are classified in to three groups- beginners, intermediate, and advanced. Regular practice of a balanced programme, tailored to individual needs is recommended for maximum benefits.





## 3.1 Asanas to Prevent Obesity

### 3.1.1 TADASANA



This is a traditional posture. The final position of this asana resembles the palm tree. Palm trees are usually erect and straight. Therefore, one should be straight and erect in this asana

#### Technique

1. Stand with feet together or about 10 cm apart (for beginners), hands by the side of the thighs.
2. Distribute weight equally on both the feet to keep the body steady.
3. Raise arms over the head. Interlock the fingers and turn the palms upward.
4. Place hands on top of the head.
5. Fix eyes at a point on the wall slightly above the level of the head. The eyes should remain fixed on this point throughout the asana.
6. Inhale and stretch the arms, shoulders and chest upward.
7. Raise heels, coming up onto the toes.
8. Stretch whole body without losing balance or moving the feet.
9. Hold the breath and the position for a few seconds.
10. Lower the heels while breathing out and bring hands to the top of the head. This is one round.







## Breathing awareness

Breathing should be synchronized with the raising and lowering of the arms and balance should be maintained while stretching the whole body.

### Things to remember while performing this Asana:

1. Do not move eyes from the point, it makes you lose balance.
2. While returning to starting position, first bring the heels on the floor slowly. Do not jerk as it can make you lose balance.

## Benefits

- Strengthens the legs, knees, ankles, arms, and chest.
- Stretches and opens the hips, groins, hamstrings, and calves; shoulders, chest, and spine
- Increases mental and physical equilibrium.
- Helps improve digestion.
- Reduce anxiety, stress, back pain and sciatica.

## Contraindications

Avoid doing this asana if you are suffering from

1. Migraine
2. Diarrhoea
3. low or high blood pressure
4. neck and back injuries

### 3.1.2 KATICHAKRASANA

The name of this yoga asana comes from *Kati* meaning waist and *chakra* meaning circle. Katichakrasana, literally means rotation of the waist. It gives a nice stretch to the waist and helps in making it more flexible and supple.





### Technique

1. Keep the legs 2-3 feet apart.
2. Raise both the arms up to shoulder level with palm facing each other and keep them parallel.
3. While exhaling, twist the body towards the left side so that the right palm touches the left shoulder, come back with inhalation.
4. While exhaling, twist the body towards the right side so that the left palm touches the right shoulder, come back with inhalation.
5. This is one round: repeat it two more times.
6. Relax in Samasthiti

### Breathing awareness

1. Inhale, come back to the centre.
2. Exhale, turn to your left and repeat the yoga posture on your left side.
3. Do the same on either side.

### Benefits

- Good for relieving constipation
- Strengthens and improves the flexibility of the spine and waist
- Good for arm and leg muscles





- Opens up the neck and shoulders and strengthens the abdominal muscles and lower back
- Beneficial for those with sedentary or deskbound jobs

### Contraindications

1. Avoid practicing Katichakrasana during pregnancy, or if you have hernia, slip disc, or have had an abdominal surgery recently.
2. Consult your doctor before practicing this yoga posture if you have chronic spinal disorders.

### 3.1.3 PAVANMUKTASANA

The name comes from the Sanskrit word pawan meaning wind and mukta meaning “free”. Thus, Pawanmuktasana is also known as the wind removing asana.



### Technique

1. Lie on back, stretching your legs straight.
2. Now bend your right knee and hold it with your hands, pressing it towards your abdomen. Breathe out, while lifting up your head and try to touch your knee with your chin.
3. Breathe in and stretch your legs straight.
4. After that press your abdomen with your left leg.
5. Then press your abdomen with both legs, placing your chin between your knees. From this position, swing your body back and forth 5 to 10 times, then swing your body left to right and vice versa 5 to 10 times.

### Breathing awareness

Breathe normally throughout the asana. Be aware of the coordination of the movement.



## Benefits

- Stretches the neck and back.
- The abdominal muscles are stretched and the internal organs are compressed which increases the blood circulation and stimulates the nerves, increasing the efficiency of the internal organs.
- The pressure on the abdomen releases any trapped gases in the large intestine.
- Digestive system is improved.
- Relieves constipation.
- Strengthens the lower back muscles and loosens the spinal vertebrae.
- It is beneficial for women too. Massages the pelvic muscles and reproductive organs and is beneficial for menstrual disorders.
- Reduces fats in the abdominal area, thighs and buttocks.

## Contraindications

1. Must be avoided if there is recent abdominal surgery as there is a lot of pressure on the abdomen.
2. Anyone suffering from hernia or piles should avoid this asana.
3. Pregnant women should not practice this asana.

### 3.1.4 MATSYASANA

The Sanskrit word Matsya means fish. Hence, Matsyasana refers to the fish pose. According to the ancient Yogic texts, Matsyasana can restore spinal strength and overall body balance, consequently leading to a better physical and emotional outlook.



## Technique

1. Begin Matsyasana by lying down in Savasana (Corpse Pose). Stretch arms and legs out, relax the body and take a few deep breaths.





2. Place your palms under your hips in a way that the palms are facing the ground. Now, bring the elbows closer to each other, placing them close to your waist.
3. Cross your legs so that your feet cross each other at your middle, and your thighs and knees are placed flat on the floor.
4. Breathe in and lift your chest up in a way that your head is also lifted, and your crown touches the floor.
5. Make sure the weight of your body is on your elbows and not on your head. As your chest is lifted, lightly pressurize your shoulder blades.
6. Hold the position only until you are comfortable. Breathe normally.
7. To release from Matsyasana gently raise the head up, lowering the chest and head to the floor and bring the hands back along the sides of the body.
8. Ensure the head is at complete rest and the lower spine is close to the floor. Relax in Savasana and take few breaths. When ready, go back into the asana again and hold it for longer time and take the asana deeper with every exhalation.

### Breath awareness

1. Begin slow inhalation and exhalation and as you exhale throw the chest out and bring the head deeper down.
2. Slowly inhale and bring the head up and release the head and shoulders.
3. Relax the body as you exhale and stretch the entire back down to the floor or mat and take few breaths.

### Benefits

- Matsyasana opens and stretches the neck muscles and shoulders.
- Helps in opening the chest and corrects round shoulders too.
- Gives relief from respiratory disorders by encouraging deep breathing.
- Strengthens the back muscles with the formation of the arch.
- Helps tone the parathyroid, pituitary and pineal glands.
- This posture helps to regulate emotions and stress.

### Contraindications

Matsyasana should not be practised by someone suffering from

1. high or low blood pressure





2. neck injuries or injury to any part of the lower or middle back.
3. migraine.
4. spondylitis
5. heart ailments
6. Women who are pregnant should not attempt this yoga asana.

### 3.1.5 HALASANA

**Hala** means plough. This posture is known as Halasana because in its final position the shape of the body resembles the Indian plough.



#### Technique

1. Take supine position, hands straight by the side of thighs, palm resting on the ground.
2. Slowly raise your legs together at an angle of 30 degree without bending at the knees by pressing your hands.
3. After a few seconds raise your legs further upto 60 degrees angle and maintain the position for a few seconds.
4. Now slowly bring the legs to a 90 degrees angle.
5. Pressing both hands bring the legs slowly towards the head.
6. Continue bending of legs till toes touch the ground and then stretch your legs backward as far as possible.
7. Now place both the palms on the head making finger lock. Bring the elbows on the ground.
8. While returning back to original position first release the finger lock. Stretch the hands straight and place them on the ground by the side of the body.





9. Lower the waist and raise the legs from the ground Slowly let the waist rest on the ground and stop bringing the legs at 90 degree angle.
10. Slowly come back to the original position.

### Breath Awareness

1. Keep the breath under control and ensure it is not irregular and erratic.
2. With a deep inhalation raise the legs to 90 degrees and exhale completely.
3. Remain in this position for a few breaths and allow the flow of blood to happen.

### Benefits

1. Due to the disturbance of abdominal muscles if there is a complaint of Dyspepsia or constipation, it can be corrected by practice of this asana.
2. The practice of this asana is helpful in certain types of Diabetes.
3. Maximum benefits of Halsana can be derives when Bhujangasana is practised immediately after Halasana.

### Contraindication

Halsana should not be practiced

1. by the ones suffering from cervical spondylitis or stiffness in spine.
2. By a person suffering from abdominal injuries or Hernia.

### 3.1.6 PASCHIMOTTANASANA

The word paschimottasana comes from the Sanskrit words paschima meaning west or back of the body and uttana meaning intense stretch or extended. In this asana one has to sit and intensely stretch the back forward.



### Technique

1. Sit, stretching both the legs together in front, hands by the side, palms resting on the ground. Fingers should remain together pointing forward.



2. Loosen your back muscles and bend the body forward as far as it is possible.
3. Maintain this position and loosen your hands and place them where they are comfortable. It would be better if they are put on the thighs.
4. Practice it daily and keep bending forward a little more. Finally hold the big toes with forefingers of respective hands and place the forehead on the knees.
5. After a few seconds raise the head, release the toes and come to the original position.

### Breathing awareness

- Breathe slowly and deeply during the final position or release breath out if holding for a short duration.
- Inhale while returning to the starting position.

### Benefits

1. It stretches the muscles of the back from head to the ankles. It contracts the muscles of the anterior part of the body.
2. Improves the process of respiration and the functions of the intra-abdominal glands, especially the secretions.
3. Improves flexibility of the lumbar region, the hips and thighs (back side of thighs and calves).
4. Massages and tones the abdominal and pelvic region including all organs such as the liver, pancreas, kidneys, adrenals, spleen and intestines.
5. Improves blood circulation in the back region and tones the spinal nerves.
6. Improves alignment of the vertebral column.

### Contraindications

In case of a painful and enlarged liver or spleen, herniated discs or acute appendicitis you should not do paschimottanasana until you are relieved of the symptoms.

### 3.1.7 ARDHA MATSYENDRASANA

The name comes from the Sanskrit words *ardha* meaning half, *matsya* meaning fish, and *eendra* meaning king. The final position of this asana is just like Half Lord of the Fish that is why it is called "ardhamatsyendrasana". This asana is also known as "Half Spinal Twist Pose".







### Technique

1. Sit extending both the legs together in front, hands by the side, palm resting on the ground. Fingers should remain together pointing forward.
2. Fold the right leg at knee. Slowly set the right heel at the perineum.
3. Now folding the left leg, bringing it from above the right knee, place it by the side on the ground. The knee of the left leg should remain towards sky.
4. Bring the right hand on the left side of the left knee. The left knee should remain at the left side of the right armpit.
5. Now straighten the right hand and hold the toe or ankle of the left leg.
6. Twisting the body to the left side look backwards, place the left hand bringing it from the back on the right thigh. Gaze should be towards back.
7. While returning to the original position first release the hand from the thigh and turn head forward.
8. Now bring the back to normal position after loosening the right hand.
9. Bring the left leg in original position.
10. Now bring the right leg also in original position.
11. Repeat it similarly from the other side by folding the left leg first.

### Breathing awareness

1. Inhale in forward position.
2. Exhale while twisting the trunk. Breathe deeply and slowly without strain in the final position.
3. Inhale while returning to the starting position.





## Benefits

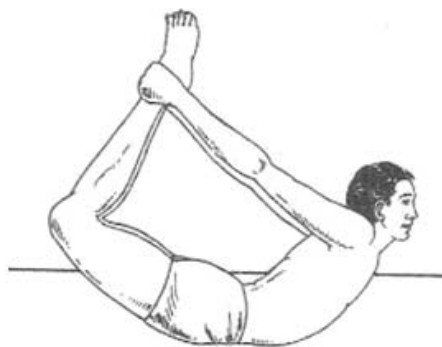
1. It is very useful in constipation and dyspepsia.
2. This asana improves liver efficiency and removes debility of kidney.
3. It is very useful in diabetes.
4. It is very beneficial for the muscles of shoulder and back.

## Contraindications

1. Should be avoided during pregnancy and menstruation due to the strong twist in the abdomen.
2. People who have undergone heart, abdominal or brain surgeries should not practice this asana.
3. Care should be taken by those suffering from peptic ulcers or hernia.
4. Those with severe spinal problems should avoid the asana. While those suffering from mild slipped disc can benefit from this asana but in severe cases it should be avoided.

### 3.1.8 DHANURASANA

The name Dhanurasana comes from the Sanskrit words *Dhanura* meaning bow. The final position of this asana is like a bow that is why this asana is called dhanurasana.



## Technique

1. Take prone position, legs together, and hands straight by the side of the thighs, chin resting on the ground.
2. Fold the legs at the knee and bring them to the thighs. Knees must remain together.





3. Bring your hands backward and hold the toes of respective legs with the thumb and forefinger of the respective hands.
4. Raise your legs up a bit and simultaneously raise your head and chest.
5. Holding the toes, pull the legs towards your ears and bring the toes near the ear. Gaze in front.
6. While returning to the original position loosen your hands, take legs backward, let the thighs touch the ground, leave the toes and ultimately bring the legs and hand to the first position.

### Breathing awareness

Inhale deeply in the starting position. Retain breath inside while coming into the final position; Breathe slowly and deeply. Exhale while returning to the starting position.

### Benefits

- It makes the spine and back muscles flexible, removes nervous weakness.
- It cures constipation and removes excess fat.
- It acts as a cure for dyspepsia, rheumatism and gastrointestinal disorders.
- It improves digestion and appetite.

### Contraindications

1. A person suffering from high blood pressure, back pain, hernia, headache, migraine or abdomen surgery should not practice dhanurasana.
2. Ladies should not practice this asana during pregnancy and during periods.

### 3.1.9 USHTRASANA

*Ustra* means Camel. So Ushtrasana refers to the camel pose.

Ushtrasana is an **intermediate level back-bending yoga posture** known to open Anahata (Heart chakra). This yoga posture adds flexibility and strength to the body and also helps in improving digestion.





### Technique

1. Sit in Vajrasana
2. Stand on the knees, and raise the arms beside the body on the shoulder level.
3. Keep the knees and feet together or can be separated if needed.
4. While exhaling twist to the right side and place the right palm on the right heel.
5. Bending a little bit more to back place the left palm on the left heel.
6. In the final position push the abdomen and hips forward, with the thighs vertical to the floor, and bend the head and spine backward according to the flexibility.
7. Try to relax the whole body, especially the back muscles, in the final position.
8. Weight of the body should be evenly supported by the legs and arms. The arms should anchor the shoulders to maintain the arch of the back.
9. Exhale and bring back the abdomen and the thighs from the vertical position.
10. Return to the standing position by inhaling and slowly raising the left hand from the heels. Bring left arm to the shoulder level and then the right arm in the same way.
11. Exhale lowering the arms and come back to vajrasana.

### Breathing awareness

- Slow inhalation and exhalation while taking position and bringing the body to proper position and alignment.
- With every inhalation raise the chest up and spine in, and relax the body with exhalation.
- Inhale and release the neck first, slowly bring the body back to the initial position and here exhale completely.





## Benefits

- It promotes stretching of anterior muscles and contraction of the posterior muscles.
- Generates favourable influence on ovaries, thyroid and other endocrine glands.
- Develops strength and confidence.
- Beneficial for digestive and reproductive organs.
- It loosens up the vertebra and stimulates the spinal nerves, relieving backache, rounded back and drooping shoulders.
- It is helpful for asthmatic people.

## Contraindication

Avoid this asana in case of

- hernia
- abdominal injuries
- back problems
- severe arthritis
- vertigo
- pregnancy.

### 3.1.10 SURYA BHEDHANA PRANAYAMA

*Surya* is the sun and *bhedhana* means to get through. In Surya bhedhana Pranayama all inhalations are done through the right nostril and all exhalations through the left.





## Technique

1. Sit in any meditation posture e.g. Padasana, Sukhasana etc. Close your eyes.
2. Keep the left nostril closed with the middle and ring finger of the right hand.
3. Slowly inhale without making any sound through the right nostril as long as you can do it comfortably.
4. Then bring your hand down and place it on the knees and retain the breath by firmly pressing the chin against the chest. Simultaneously contract your rectum muscles.
5. This point cannot be reached at the very outset. You will have to increase the period of retaining breath gradually. This is the limit of the sphere of practice of Surya Bhedhana Pranayama.
6. Exhale very slowly, without making any sound through the left nostril by closing the right nostril followed by releasing the rectum muscles (anal lock), chest from the chin lock.
7. Relax and come back to original position. Do this 3 to 5 times.

## Benefits

- This Pranayama should be performed again and again, as it purifies the brain and destroys the intestinal worms and diseases arising from excess of wind (Vayu).
- It helps to manage rhinitis and various sorts of neuralgia.
- The worms that are found in the frontal sinuses are removed.
- It is good for persons suffering from low blood pressure.

## Contraindications

1. In case of any shoulder, wrist , fingers and hand injuries and surgery avoid this asana.
2. If there is acidity, stomach and mouth , avoid this practice due to the heat created by it.

### I. Tick the correct option

1. What causes Obesity?
  - a. Non-Activity
  - b. Smoking





- c. Over indulgence in food
  - d. All of the above
2. Ushtrasana pose refers to :
  - a. Camel pose
  - b. Cow pose
  - c. Fish pose
  - d. Cobra pose
3. Which asana is of side twist pose ?
  - a. Shavasana
  - b. Chakrasana
  - c. Ardha Mastendrasana
  - d. Parvatasana

**II. Answer the following questions**

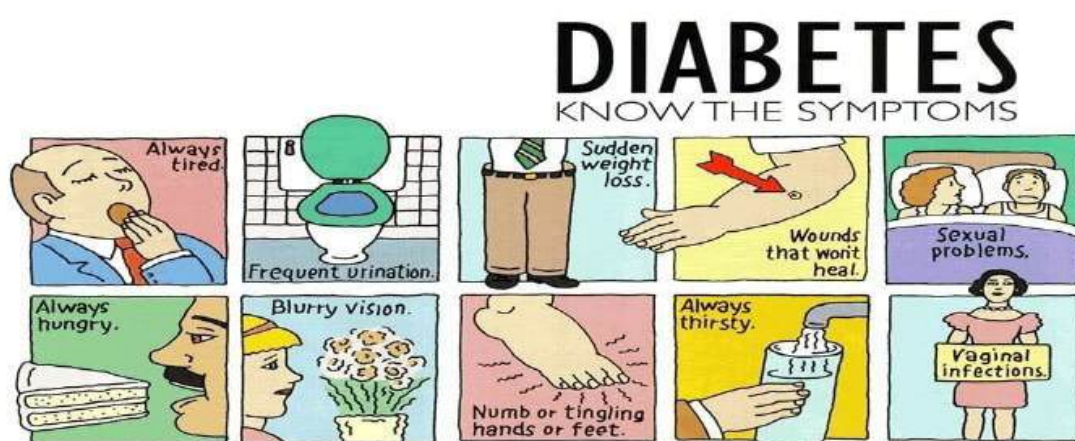
1. Draw and label the diagram of Dhanurasana correctly and discuss the technique for the asana,
2. Explain the correct breathing pattern while performing Suryabhedan pranayama.
3. Write in detail the benefits of Paschimottanasana.

**III. Answer the following questions in 150-200 words.**

1. Discuss the asanas helpful for prevention of obesity.
2. Write down the procedure and contraindications of Pavanmuktasana in detail.
3. Explain Katichakrasana and its benefits



### 3.2 Asanas to Prevent Diabetes Mellitus



#### 3.2.1 KATICHAKRASANA

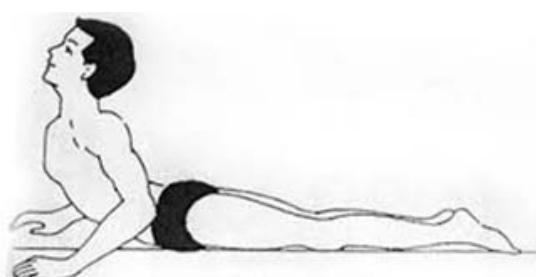
See 3.1.2

#### 3.2.2 Pavanmuktasana

See 3.1.3

#### 3.2.3 BHUJANGASANA

In Sanskrit the word Bhujanga means Cobra. Since the final position of this asana resembles the 'Hooded Snake' therefore it is called Bhujangasana.



#### Techniques

1. Take prone lying position, legs together, toes together, pointing outwards, hands by the side of the body, fingers together, palm facing upward and forehead resting on the ground.
2. Fold hands at the elbows, place palms on the ground near each side of the shoulders, thumb should be under the armpit.
3. Bring chin forward and place it on the ground. Gaze in front.







4. Raise chin and turn head backward as much as possible. Raise the thorax turning the spine backwards up to the navel. Do not raise navel.
5. Maintain the posture for some time. Then slowly bring your body back on the ground, starting from the upper part of the navel, thorax shoulder, the chin, and lastly place your forehead on the ground.
6. Now, relax your hands and place them on either side of your thighs.

### Breathing awareness

- Inhale while raising the torso
- Breathe normally in the final position
- Exhale while lowering the torso.
- Breathing and movement should be synchronized and smooth.

### Benefits

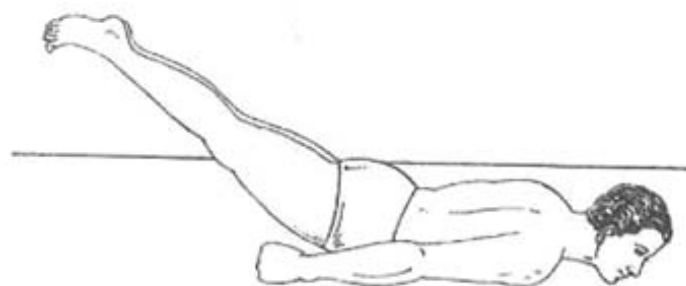
- Strengthens and increases the flexibility of the spine and vertebral column.
- Opens the chest, shoulders, heart and ribcage.
- Tones and strengthens the entire spinal extensor group of back muscles.
- Stimulates the endocrine system and digestive organs.
- Good for kyphosis

### Contraindications

1. Women during pregnancy should avoid this asana.
2. Avoid the asana if suffering from Spondylitis.
3. People with spinal injuries and/or weak back muscles should avoid this asana.

### 3.2.4 SHALBHASANA

The name Shalabhasana comes from the Sanskrit shalabh which means grasshopper or locust.



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## Techniques

1. Take prone lying position, legs together, toes backward, sole towards the sky. Hands by the side, palms upward, fingers together, forehead touching the ground.
2. Folding both hands at the elbow, bring them under the shoulder like Bhujangasana, fingers together pointing forward.
3. Now slowly bring both the legs upwards, without bending them at knees, and maintain the position.
4. Then bring the legs down slowly.
5. Come back to the original position bringing hands back to their place.

## Breathing awareness

- Inhale deeply in the starting position.
- Retain breath inside while raising both legs and hold the position.
- Exhale while lowering the legs.
- Maintain this synchronization of breath and movement.

## Benefits

1. It helps to reduce the abdominal fat and tones the abdomen.
2. It strengthens back and neck muscles.
3. It helps in repairing your entire spinal cord and replenishes it.
4. It helps to rectify your neck pain, and repair defects in the neck joints.
5. It encourages digestion by improving activity of the intestines by stretching them.
6. It helps in rectifying urinary disorders.
7. It strengthens the uterus and reproductive system.
8. It helps in correcting the menstrual problems.
9. It strengthens the hip bones and reduces any excessive thigh muscles.
10. It helps to decrease constipation.

## Contraindications

1. Those who are suffering with acute back pain or slip disc should avoid this asana.





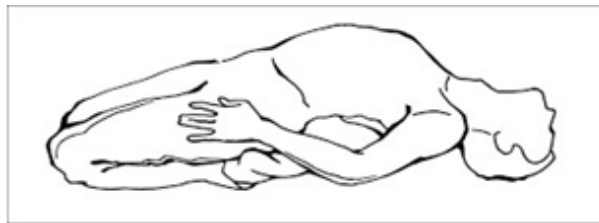
2. Those with severe sciatica should avoid this asana as it tightens the entire body from the hip to the feet.
3. Those who have major problems with menstruation or with a prolapsed uterus should avoid this asana.
4. Women in their pregnancy should avoid this asana.
5. Those who have blood pressure problems should avoid this asana as it may lead to suffocation.

### 3.2.5 Dhanurasana

See 3.2.8

### 3.2.6 SUPTA - VAJRASANA

In Sanskrit, *supta* means reclined, and *Vajra* means thunderbolt. This is mainly useful in improving the digestive system and boosting our stamina.



#### Technique

1. Sit in Vajrasana.
2. Slowly place your elbows on the ground near your hips.
3. Slowly straighten your hands and completely lie on your back
4. Shoulders should rest on the floor and knees should remain together
5. After practicing this position well, making the shape of a scissor with both hands bring them under the shoulders. Right hand should be under the left shoulder and left hand should be under the right shoulder and the head should be in the middle.
6. When returning to the original position, first take out the hands and place them by the side of the body.
7. Now with the help of the elbow sit as in the first position.



### Breathing awareness

- Breathe deeply and slowly in the final position.
- While returning to the starting position, breathe in the reverse order.

### Benefits

1. It massages the abdominal organs improving digestive ailments and constipation.
2. It tones the spinal nerves, makes the back flexible, and realigns rounded shoulders.
3. helps to fill the lungs to its maximum capacity and bringing more oxygen into the system.
4. It is beneficial for those suffering from asthma, bronchitis and other lung ailments.
5. It increases the circulation in the brain.
6. It regulates the functioning of the adrenal glands.
7. It tones the pelvic muscles
8. It helps to improve disorders of both the male and female reproductive organs.

### Contraindications

1. Should not practice in case suffering from very high blood pressure, slipped disc.
2. Those who suffer from vertigo should avoid the asana.
3. Pregnant women or those undergoing irregularities in menstruation cycle or having knee injuries or surgery, should avoid supta vajrasana.

### 3.2.7 PASCHIMOTTANASANA

See 3.2.6

### 3.2.8 ARDHA MATSYENDRASANA

See 3.2.7

### 3.2.9 MANDUKASANA

Mandukasana comes from the Sanskrit manduk which means frog. This yoga asana is aptly named frog pose as your body resembles a frog when you practise it.





This yoga asana is fairly straightforward and can be practised by almost all age groups.



### Technique

1. Sit in Vajrasana and make fists with both hands, the thumbs inside.
2. Place your fists on your belly next to the belly button.
3. Bend forward with exhalation.
4. Keep looking straight.
5. Hold your breath in the yoga posture for a few seconds and come up with inhalation.
6. Repeat this asana 3-4 times.

### Breath awareness

- Inhale deeply.
- Exhale slowly and completely once you touch the floor with the forehead.
- Slowly inhale as you look up to release from the position and expand the neck forward and then backwards along with the entire back.
- Come back completely exhaling and sit in Vajrasana again.

### Benefits

- This asana is beneficial to all organs of the body.
- Mandukasana gives you relief from diabetes, digestive disorders and constipation.
- This asana improves the flexibility and mobility of the knee and ankle joints.
- It helps tone muscles of the shoulder and abdomen.





- Regular practice of this asana increases your lung capacity.
- This yoga asana is beneficial for people suffering from problems of the pancreas and the heart.
- This asana helps reduce fat from thighs, belly and hips.

### Contraindications

1. People suffering from severe back pain must avoid practising this yoga asana.
2. If you have recently undergone abdominal surgery, abstain from attempting to perform Mandukasana.
3. Pregnant women are not advised this yoga technique.
4. If you have injured your ankle, have high blood pressure, suffer from insomnia, or are prone to migraines, you should not practise this yoga asana.

### 3.2.10 GOMUKHASANA

The name Gomukhasana comes from the Sanskrit words Go, meaning cow and Mukha, meaning face or mouth.

This yoga asana gets its name because the thighs and calves of the person performing it resemble a cow's face, wide at one end and tapering towards the other.



### Technique

1. Sit on the floor, with legs extended and spine straight.
2. Place the palms on the floor and bring the left leg bent at the knee and place the left foot below the right hip, raising the body a bit. Sit on the left foot taking the ankle and the toes deep inside.





3. Raise the right leg bent at the knee and place the right thigh over the left thigh by bringing the right foot close to the left hip on the floor.
4. Bring your left arm and stretch it above your shoulder and head. Bending it, take the left palm and place it on your back, close to the shoulder blade.
5. Now raise the right arm and from below take it behind you bending at the elbow and with the right palm try to reach for the left palm. Once comfortable, clasp the left palm and maintain the position feeling the stretch at the shoulders and the elbows.
6. Gradually, pull the palms closer and bring the chest out raising the upper body upwards. Ensure the neck does not bend forward, but remains in line with the shoulders and chest.
7. Feel the stretch at the thighs, knees, chest, abdomen, shoulders, arms, neck and the elbows.
8. Maintain this position for a few breaths and slowly release. Relax by stretching the legs out in front of you and bring the arms down beside you.
9. After taking a few breaths in the relaxed position, bring the right leg bent at the knee and place the right foot close to the left hip and cross the left thigh over the right thigh and bring the left foot close to the right hip on the floor.
10. Raise the right arm and bring the right palm from up and behind your head and place it close to the shoulder blade behind you.
11. Stretch the left arm and take it from down and place the left palm close to the shoulder blade behind you and try to clasp the right palm. Interlock the fingers and pull the chest out and the shoulder blades closer expanding the spine upwards.
12. Remain in this posture for a few breaths, then release the arms and stretch the leg out in front of you and relax.

### Breath Awareness

- In Gomukhasana, inhale and cross the legs taking the feet deep into the asana completely exhale expanding the spine
- Inhale again and bring the arms behind you
- Exhale taking the other arm from below holding on to the palms.
- With every exhalation stretch deeper into the asana and loosen the body with inhalation.





## Benefits

1. The stretch at the hamstrings helps in gaining flexibility
2. Gomukhasana enables greater flexibility of the hip joint.
3. It stretches and tones the muscles of the chest.
4. This asana increases blood supply to the legs and arms.
5. The flexion of the knee joint can be useful to heal certain kinds of weakness in the knees (provided there is no ligament tear).
6. Improves the functioning of the abdominal organs and digestion.
7. Stretching the abdominal area also burns the unnecessary fat at the tummy area and tones the entire torso.
8. Biceps and triceps muscles are strengthened and there's increased flexibility of the shoulder and the upper arms.

## Contraindications

1. Gomukhasana should not be practised by those suffering from shoulder pain, back ache, hip or knee pain or stiffness in the shoulders.
2. This asana must be avoided when pregnant.

### 3.2.11 YOGAMUDRA

Yogamudra is not asana rather it is a mudra but it can be performed as a remedy for Diabetes.

Yogamudra recreates the human form in its role of being a part of the Divine. It is the sign of great understanding and wisdom which knows the weakness of human nature and has endless potentiality.



## Technique

1. Sit in padmasana and close the eyes.







2. Hold one wrist behind the back with the other hand.
3. Inhale deeply
4. While exhaling, bend forward, keep the spine straight.
5. Bring the forehead to the floor.
6. Stay in that final position for as long as it is comfortable.
7. Slowly return to the starting position.

### Breathing awareness

- Inhale slowly and deeply in the starting position.
- Exhale while bending forward. Breathe deeply and slowly in the final position.
- Inhale while returning to the starting position.

### Benefits

1. It helps to stretch the posterior muscles of the trunk and the neck.
2. Improves muscle toning and venous circulation of the spinal column.

### Contraindications

1. Should be avoided during pregnancy.
2. People who have undergone heart, abdominal or brain surgeries should not practice this asana.
3. Care should be taken by those suffering from peptic ulcer or hernia.
4. Those with severe spinal problems should avoid asana. While the asana can benefit those with mild slipped disc, but in severe cases it should be avoided.

### 3.2.12 USHTRASANA

See 3.2.9

### 3.2.13 KAPALABHATI

This involves forceful and fast diaphragmatic breathing. In a comfortable sitting position, one exhales forcefully by contracting the abdomen and inhales. The exhalations and inhalations are accompanied with the abdominal movements which take place in quick successions for a number of times depending on one's capacity.





### Benefits

- This is a great cleanser for the respiratory passages including the sinuses.
- It improves respiratory function and promotes circulation.
- Improves balance.
- It removes acidity and gas related problems.
- It cures sinusitis, asthma, and hair loss.

### Precautions

- Pregnant women, slipped disc patients, and asthma patients should avoid it.
- It should not be performed during menstruation

#### I. Tick the correct option

1. Which gland secretes the hormone insulin, the lack of which is associated with Diabetes?
  - a. Endocrine glands
  - b. Pituitary
  - c. Pancreas
  - d. Hypothalamus
2. Katichakrasana is a
  - a. standing asana
  - b. Sitting asana
  - c. Lying asana
  - d. Balancing asana





3. Bhujangasana is also known as
  - a. Dog posture
  - b. Child posture
  - c. Cobra posture
  - d. Reverse Boat posture
4. Which asana can be suggested as preparatory asana for Pawanmuktasana
  - a. Vajarasana
  - b. Bhujangasana
  - c. Matsyendrasana
  - d. Naukasana

**II. Answer the following questions**

1. Draw and label the diagram of Supta Vajarasana correctly.
2. Explain the correct breathing pattern while performing Paschimotasana.
3. Write in detail the benefits of Shalabhasana.

**III. Answer the following questions in 150-200 words.**

1. Discuss the technique and benefits of Bhujangasana.
2. Explain how yoga can prevent Diabetes?

### 3.3. Asanas to Prevent Bronchial Asthma

#### 3.3.1 TADASANA

See 3.1.1

#### 3.3.2 Urdhvahastottansana

The name for this asana comes from the Sanskrit *urdhva*, meaning upward, and *hasta*, meaning hands. Urdhvahastasana is called upward salute or upward hands pose in English.





### Technique

- Stand upright in the overhead-stretch pose with fingers interlocked.
- Breathing in, stretch the hands high, but keep the feet flat on the floor.
- Breathing out, slowly bend to the left/right. Pause for few seconds at the limit of the bend;
- Strengthen up slowly, breathing in.
- Slowly bend to the opposite side (left/right), breath out, hold for few seconds;
- Straighten up slowly, inhaling.

### Breath awareness

Inhale when stretching up.

Exhale out when side stretch and return position.

### Benefits

1. **Back pain:** It gives appropriate stretch to the muscles, especially the finer muscles of the back. The regular practice of this yogasana is helpful in overcoming back pain.
2. **Spinal health:** It is beneficial for spinal health. After focusing on the alignment of the body and spine, it helps to improve the curvature of the spine.
3. **Weight loss:** It is known as yoga for waist slim, yoga to remove fat from hips due to adequate stretch in this region.





4. **Asthma control:** It provides stretch to the chest region, thus, helps to increase the intake capacity of the lungs. All these ensure the betterment of lung health and gives relief from asthma too.
5. **Constipation relief:** It ensures proper movement to the alimentary canal, especially the stomach, intestine, and large intestines, which result in relieving constipation.
6. **Abdominal sides' fat:** This is one of the best yoga poses to burn the fats from abdominal sides because of experiencing extra stretching in these areas.
7. **Nerve health:** Practicing the yoga asana on regular basis will facilitate stretching from toes to fingers. If it is maintained with breathing, it can show its impact upon the efficiency of nerves.
8. **Strengthening of legs:** The asana is good for the health of toes, feet, ankles, knees, buttocks, etc.
9. **Sciatica:** If it is practiced under the supervision of a yoga expert, sciatica pain can be reduced drastically.

### Contraindications

- **Pregnancy:** The asana should be avoided during pregnancy.
- **Varicose vein:** A person suffering from varicose veins should take the help of a yoga expert.
- **Headache:** Don't perform during headache.
- **Insomnia:** During insomnia, a yoga therapist should be consulted before practicing the yoga pose

### 3.3.3 UTTANMANDUKASANA

When in Mandukasaana, hold the head in the elbows. This is Uttanaamandukasana which resembles an upright frog.





## Technique

1. Sit in Vajrasana
2. Spread out both the knees but toes should remain together.
3. Fold your right hand backward from above the right shoulder and place the palm below the left shoulder.
4. Now folding the left hand similarly place the palm on the right shoulder. One elbow should be on the other.
5. While coming back to the original position slowly remove left hand. Bring knees together as in first position.

## Benefits

1. Uttanmandukasana is helpful in
2. Diaphragmatic movements.
3. Improving posture
4. Removes back pain and pain in lumbar region.
5. Increases elasticity of thigh joint and shoulder.

## Contraindications

- Individuals suffering from arthritis, hernia, chronic and severe back problems, elbow pain, shoulder pain, spinal deformities should not perform this asana.

### 3.3.4 BHUJANGASANA

See 3.2.3

### 3.3.5 DHANURASANA

See 3.1.8

### 3.3.6 USHTRASANA

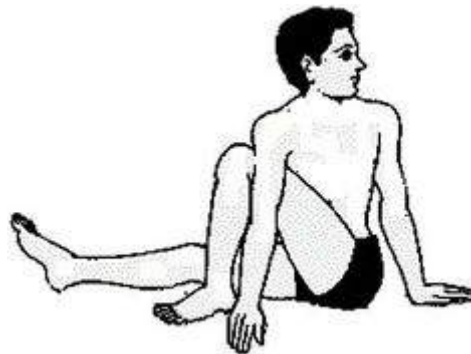
See 3.1.9





### 3.3.7 VAKRASANA

Vakra means twist in Sanskrit. Thus the Sanskrit name of Vakrasana means Twisted Pose because the spine is twisted in practicing this asana. Vakrasana comes under the category of seated asanas. The lower back, middle back, hips, neck are involved in practicing Vakrasana.



#### Technique

1. Seated in Dandasana, take a few breaths and expand the spine upwards. Connect the breath with the movement of the spine and relax the entire body.
2. Bring the left knee close to your chest and take a few breaths, then pick up the left foot and place it outside of the right knee.
3. Twist your upper body towards the left while the right elbow is placed at the outside of the left knee and place the hand on the floor close to your right knee. Remember the body is twisted to the same side as the knee is bent and, in this case, because the left knee is bent, the body is twisted to the left.
4. Take a deep breath and, with the support of the right elbow, twist the upper body to the left as far as possible and face the wall behind you.
5. Place the left hand behind you as close as possible to your lower back. This should help you raise your spine up and also to balance your body.
6. With every exhalation raise the spine and twist as much as possible trying to turn your neck and shoulders to bring it parallel to the wall to your left.
7. Release the asana and take a few breaths and relax in Dandasana.
8. Continue the stretch with the same position of the left knee, but twist your body now to the right by placing both the palms on to the floor on the right close to your lower back and try to look behind you as much as possible.
9. Repeat the same now with the right knee and start with turning to the right and then release. Continue the asana with the upper body twisted to the Left.



## Breath Awareness

- Inhale as you twist the body
- Exhale while coming back to the initial position.
- Repeat on either sides.

## Benefits

1. This asana helps straighten the upper back.
2. It strengthens the neck muscles.
3. This asana tones the internal organs like the digestive system, intestines, uterus and kidneys.
4. As this asana puts neck muscles to work, it activates thyroid gland. This ensures a balanced hormone level in the body.

## Contraindications

1. It may not be a good idea to practice this yoga asana if there is a back injury.
2. Pregnant women should avoid this yoga asana as it will bring discomfort to the uterus and hence this asana is not good for them.
3. Persons suffering from weak neck muscles or upper spine may get sore neck muscles.

### 3.3.8 KAPALBHATI

See 3.2.13

### 3.3.9 GOMUKHASANA

See 3.2.10

### 3.3.10 MATSYAASANA

See 3.1.4

### 3.3.11 ANULOM-VILOM

This is one of the fundamental types of Pranayams. This practice is also known as Anuloma-viloma as Viloma means 'produced in the reverse order'. This practice gets the name from the fact that the order of using the nostrils for inhalation and exhalation is reversed every time.







### Technique

1. Sit in any comfortable meditation asana. Keep the head and spine straight. The eyes should be closed.
2. Place right hand in jnana mudra. Close the right nostril with the right thumb. Inhale through the left nostril for 5 counts.
3. After 5 counts of breath, release the pressure of thumb from the right nostril and close the left nostril with the ring finger.
4. Exhale through the right nostril for 10 counts, keeping the respiration rate slow, deep and silent. Then, inhale through the right nostril for 5 counts.
5. Exhale 5 rounds of practice or for 3 to 5 minutes, making sure that no sound is produced as the air passes through the nostrils.

### Benefits

1. Calms and steadies the mind, improves focus and concentration. Balances left and right hemispheres.
2. Strengthens the immune system.
3. Manages hypertension.
4. Provides sufficient oxygen for the functioning of every cell in our body.
5. Removes waste products such as carbon dioxide and other toxic gases from the body, so that they do not remain in the blood stream.

#### I. Tick the correct option

1. What causes an Asthma Attack?
  - a. Allergy
  - b. Smoke





- c. Exercise
  - d. All of the above
2. Poor exchange of oxygen and carbon dioxide in an individual is the result of
    - a. exercise induced Asthma
    - b. allergy induced Asthma
    - c. Pulmonary Hypertension
    - d. Respiratory Failure
  3. Which asana is base asana for curing Asthma?
    - a. Sukhasana
    - b. Chakrasana
    - c. Matsyasana
    - d. Parvatasana

## II. Answer the following questions

1. Draw and label the diagram of Parvatasana correctly and discuss the technique for the asana,
2. Explain the correct breathing pattern while performing Chakrasana.
3. Write in detail the benefits of Gomukhanasana.

## III. Answer the following questions in 150-200 words.

1. Discuss the asanas helpful for a person suffering from asthma.
2. Write down the procedure and contraindications of Matsyasana in detail.
3. Explain role of yoga in Asthma management

### 3.4 Asanas to Prevent Hypertension

#### 3.4.1 TADASANA

See 3.1.1

#### 3.4.2 KATICHAKRASANA

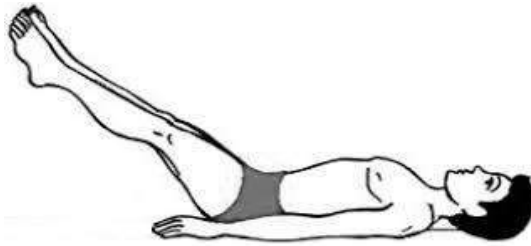
See 3.1.2





### 3.4.3 UTTANPADASAN

The asana gets its name from the Sanskrit terms Uttana meaning raise-upward, and pada meaning feet or legs. Uttanpadasana is one of the most important asanas in yoga with lots of health benefits. It is also known as The Raised Leg Pose as the legs are raised upwards in supine position.



#### Technique

1. Take supine position with legs together, hands together by the side of the body. Palm resting on the ground.
2. Raise both the legs together slowly upto 30 degree angle.
3. Another few seconds, raise further upto 45 degree angle.
4. After few second, raise upto 60 degree angle and maintain it there for few seconds.
5. While returning, stop at 45 degree or 30 degree angle.
6. Finally, bring both the legs on the ground.

#### Benefits

1. This asana is very beneficial for those suffereing from diabetes, constipation, indigestion and nervous weakness.
2. It balances the naval cetre " Nabhimanipurachakra"
3. It builds up the abdominal muscles.
4. Helps to improve breathing and lung capacity.

#### Contraindications

- Avoid this posture in case there is any injury in the neck, back, pelvis, or leg muscles.
- Pregnant women should not perform this asana.
- People suffering from severe spondylitis, cardiac disease or abnormal blood pressure must refrain from uttanapadasana.





- If an individual has undergone hernia-repair surgery, wait at least two weeks before practicing this asana.
- If you have a migraine, then do not practice it.

### 3.4.4 ARDHA -HALASANA

Ardha means half and Hala means plough so this asana is called Ardha-halāsana because in its final position, the body resembles half the shape of an Indian plough.



#### Technique

1. Take supine position, hands straight by the side of thighs and palm resting on the ground.
2. Slowly raise your legs together without bending them at the knees and pressing your hands till you stop at an angle of 30°.
3. After few seconds, raise your legs further towards your head up to an angle of 60° and hold position.
4. Now slowly bring your legs up to an angle of 90° and maintain position for 15-30 seconds.

#### Breathing awareness

- Inhale while in the lying position. Retain breath inside while assuming the final asana.
- Breathe slowly and deeply in the final position. Retain breath inside while returning to the starting position.
- It is the preparatory asana for halāsana.

#### Benefits

1. Improves digestion and appetite.





2. Improves blood circulation.
3. Strengthens the thigh and calf muscles.
4. Helps to reduce abdomen fat and lose weight
5. Stimulates the abdominal organs.

### Contraindications

1. People suffering from any cardiac problems, back pain, high blood pressure should avoid this practice.
2. Not to be practised by women who are pregnant, as the pressure is immense at the lower abdomen causing tightening around the pelvic area.
3. Anyone suffering from acute lower back pain needs to take precaution during this practice.
4. Anyone recovering from any kind of stomach infection or surgery around the abdominal area should take proper precautions and guidance.

### 3.4.5 SARALA MATYASANA

The word Saral means easy and Matsya means fish.



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### Technique

Lie flat on the back.

1. With the support of your hands keep the top of your head on the mat.
2. Neck, upper back and shoulders will be lifted from the ground.
3. Relax your hands at the side of your body.
4. Breathe normally and keep your toes stretched out.
5. Hold the position for 30 seconds, then relax.

### Breath Awareness

1. Inhale as you lift the chest and tuck the head.





2. Exhale while relaxing the body and bring it to the initial position.
3. And get back to normal breathing.

### Benefits

- It improves digestive system.
- Helps to cure irritable bowel syndrome.
- Helps to get rid of abdominal-related issues

### Contraindications

People with cervical spondylitis and frozen shoulder should avoid practicing this asana.

#### 3.4.6 GOMUKHASANA

See 3.2.10

#### 3.4.7 UTTAN MANDUKASANA

See 3.3.3

#### 3.4.8 VAKRASANA

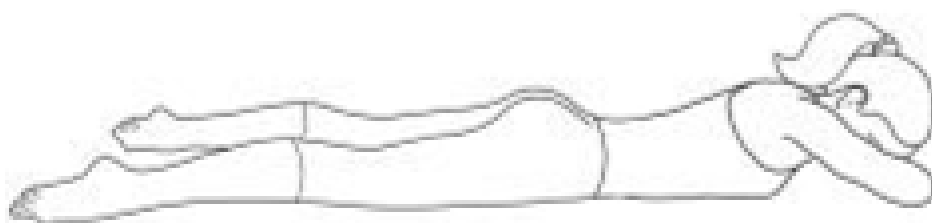
See 3.3.7

#### 3.4.9 BHUJANGASANA

See 3.2.3

#### 3.4.10 MAKARASANA

Makar means crocodile. While doing this asana the body resembles the shape of a crocodile, hence it is known as Makarasana. It is also considered a relaxing asana like Shavasana.





## Technique

1. Take prone lying position, hands by the side of the thighs.
2. Slowly spread out both the legs. The toes should point out and heels inward.
3. Slowly fold the left hand at elbow bringing it from below the armpit. Place it on the right shoulder. Fold the hand at the elbow and place it on the left shoulder.
4. Place your head on the triangle made by both the elbows.

## Breath Awareness

- **Inhale** as you lift the torso up.
- **Exhale while** resting the elbows on the floor.
- **Inhale** by pushing the chest out and taking the shoulders back.
- **Exhale** gently lift the chin up and push the belly into the floor. **Inhale and** feel the expansion of the chest and belly.
- **Inhale and Exhale as you** continue to remain in this posture.

## Benefits

1. This is beneficial in Asthma
2. For those who have acquired wrong process of respiration this asana is quite useful.
3. Abdominal muscles get automatic massage.

## Contraindication

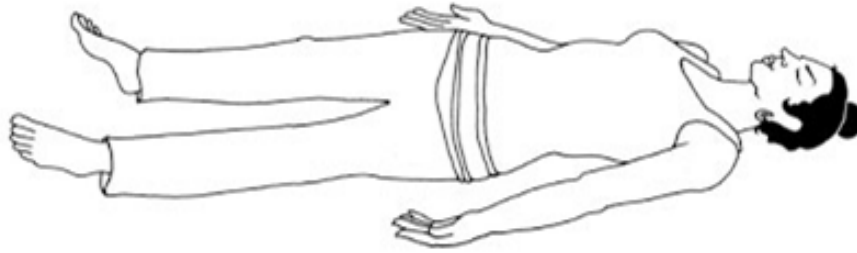
This asana should not be performed by those suffering from

1. Heart problem
2. Obesity
3. Gas or high blood pressure

### 3.4.11 SHAVASANA

Lying supine on the ground like a corpse is Shavasana. Shavasana wards off fatigue and brings mental repose. This asana is supposed to be a relaxing asana. It is very useful in removing fatigue created due to the practice of other asanas.





### Technique

1. Lie straight on your back with ease.
2. Keep distance of about one and half feet between the legs.
3. Place hands straight on the ground at the distance of six inches from your body, palms facing upward, fingers will remain slightly curled and eyes closed.
4. After maintaining it for sometime, return to first position.

### Benefits

1. This asana is practised soon after the practice of other asanas, through this fatigue is removed.
2. This very beneficial in high blood pressure, and cardiac diseases.
3. It is also beneficial for people suffering from neurosis and fear complexes.

### Contraindications

Those who have been forbidden for supine position by doctors due to some reasons, should not practice it.

#### 3.4.12 NADI- SHODHANA PRANAYAM

Nadi means "channel" and Shodhana means "purification", therefore it is known as channel for purification. Nadi Shodhana, also known as Anulom Vilom or Alternate Nostril Breathing.







### Technique

1. Sit in any comfortable meditation asana. Keep the head and spine straight. The eyes should be closed.
2. Place right hand in jnana mudra. Close the right nostril with the right thumb. Inhale through the left nostril for 5 counts.
3. After 5 counts of breath, release the pressure of thumb from the right nostril and close the left nostril with the ring finger.
4. Exhale through the right nostril for 10 counts, keeping the respiration rate slow, deep and silent. Then, inhale through the right nostril for 5 counts.
5. Exhale 5 rounds of practice or for 3 to 5 minutes, making sure that no sound is produced as the air passes through the nostrils.

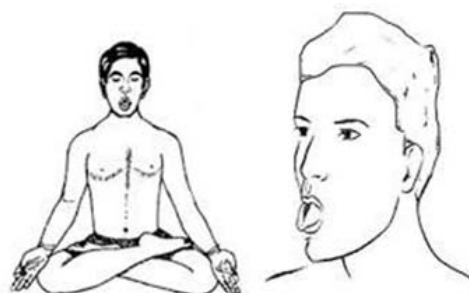
### Benefits

1. Calms and steadies the mind, improves focus and concentration. Balances left and right hemispheres.
2. Strengthens the immune system.
3. Manages hypertension.
4. Provides sufficient oxygen for the functioning of every cell in our body.
5. Removes waste products such as carbon dioxide and other toxic gases from the body, so that they do not remain in the blood stream.

### 3.4.13 SHEETALI PRANAYAMA

As the name indicates, this Pranayama cools the system.

It helps to keep the body's temperature down.



### Technique

1. Sit in Padmasana or in any comfortable position. Place your hands on the knees in jnana mudra. Close your eyes gently.





2. Open your mouth, bring the tongue outside the mouth and form a cylindrical shape by bending the sides of the tongue longitudinally and inhale.
3. While inhaling, the air should pass through the tongue.
4. Close your mouth.
4. Retain breath for as long as you can while pressing the chin against the chest (chin lock), simultaneously pulling your rectum muscles (anal lock).
5. Then release chin lock and anal lock and exhale slowly through the nostrils.

### Benefits

1. Beneficial in diseases pertaining to throat and spleen etc.
2. Cures indigestion.
3. Helps in controlling thirst and hunger. Lowers blood pressure.
4. Beneficial for diseases caused by imbalance of pitta dosha (heat).
5. Purifies blood.

#### Extension Activity Find out

- ◆ Three factors that may increase blood pressure.
- ◆ Relationship between having high blood pressure and the circulatory system.
- ◆ The reason high blood pressure is called the “silent killer”.
- ◆ Five symptoms of high blood pressure?
- ◆ Three factors that could cause a decrease in blood pressure.

#### I. Tick the correct options

1. What causes Hypertension?
  - a. Excessive insulin secretion
  - b. Smoke
  - c. Food
  - d. All of the above
2. In Uttanpadasana which is the correct pose:
  - a. Legs raised in supine position
  - b. Legs raised in prone position
  - c. Head raised in supine position
  - d. Head and led raised in prone position





3. Which asana is base asana for relaxation and mental repose?
  - a. Shavasana
  - b. Chakrasana
  - c. Halasan
  - d. Parvatasana

**II. Answer the following questions**

1. Draw and label the diagram of Saral Matsayasana correctly and discuss the technique for the asana,
2. Explain the correct breathing pattern while performing nadi-shodhan pranayama.
3. Write in detail the benefits of Ardha halasana.

**III. Answer the following questions in 150-200 words.**

1. Discuss the asanas helpful for a person suffering from Hypertension.
2. Write down the procedure and contraindications of Matsyasana in detail.
3. Explain sitli pranayama and its benefits

### 3.5. Asanas to Prevent Back Pain and Arthritis

#### 3.5.1 TADASANA

See 3.1.1

#### 3.5.2 URDHWAHASTOTTANSANA

See 3.3.2

#### 3.5.3 ARDHA-CHAKRASANA

In Sanskrit, *Ardha* means half, *Chakra* means wheel and *Asana* means a pose. Therefore, Ardha-chakrasan means half-wheel postures. It is a simpler version of chakrasana.



## Technique

1. Stand straight and bring your hands together in a clasped position.
2. Raise and rotate your hands above the shoulders.
3. Slowly bend the upper part of your body along with the hands, as far as possible.
4. Remain in this position for some time according to your capacity.
5. To release the pose, bring back slowly to the standing position with hands on your side.
6. There is a variation of Ardha Chakrasana, where the hands are placed behind the hips and then the back bending is attempted

## Benefits

1. Strengthens the back and abdominal muscles.
2. Tones the organs in the abdomen including the digestive, excretory and reproductive organs.
3. Relief from back problems and postural defects.
4. Opens the chest and strengthens the arms and shoulder muscles.
5. Posture prepares beginners for the more difficult full wheel pose or Chakrasana.

## Contraindications

1. Ardha Chakrasana should not be done by those suffering from any neck, hip or spinal injury.
2. Those suffering from high blood pressure should avoid this pose.
3. Pregnant women should avoid all poses that puts any strain on the foetus.

### 3.5.4 USHTRASANA

See 3.2.12

### 3.5.5 VAKRASANA

See 3.4.8

### 3.5.6 SARALA MATSYENDRASANA

See 3.4.5





### 3.5.7 BHUJANGASANA

See 3.2.3

### 3.5.8 GOMUKHASANA

See 3.2.10

### 3.5.9 BHADRASANA

Bhadrasana means Gracious Yoga, it consists of two words -Bhadra and Asana. Bhadra is a Sanskrit word, which means Auspicious or Gracious, while asana indicates Yoga pose.



1. Sit on the mat with legs fully stretched forward.
2. Bring the feet, with the toes pointing outward, close to the generative organ, the heels touching the perineum very closely.
3. If required, clasp the feet to bring the heels as close to the body as possible
4. Once this position is secured, place the hands on the respective knees pressing them down.
5. Keep the neck straight , upper body (chest) forward, stomach held in normal contour, focus eyes at one point straight ahead.

#### Benefits

1. Helps to loosen the joints by flexing and stretching the tendons. The muscles of the pelvis, knees and ankles become more supple.
2. Relieves tension from the spinal region.
3. Provides relief in cases of sciatic, varicose vein and menstrual disorders.
4. Prevents Arthritis
5. Improves posture



- Promotes concentration
- Bhadrasana is a good for those who find it difficult to sit in more classical posture like Padmasana and Vajrasana.

### Contraindications

Although beneficial for prevention from arthritis, practitioners with serious arthritis should consult yoga expert before practising this asana.

### 3.5.10 Makarasana

In Sanskrit “Makar” means “Crocodile, and “Asana” means “posture”. The English name is “Crocodile pose”.



### Technique

- Lie down on the floor on your stomach with your hands folded under the head.
- Place the right palm over the left palm on the ground and place the head over the right palm in a relaxed way and close your eyes.
- Stretch the legs as far as possible. The toes should point outwards.
- Relax the whole body. Breathe normally and slowly. Feel the whole body touching the ground and the deep relaxation in all your muscles.
- Relax in this posture for few minutes.
- While returning from the posture, slowly bring the feet together. Unfold the arms and come to the Prone Position.

### Benefits

- Deep relaxation to the shoulders and the spine.
- Reduce Waist pain.
- Helps in Slipped disc.
- Asthmatic and patients with lung disorders.
- Relief for arthritis patients.





## Contraindications

Practitioners in their second or third trimesters of pregnancy should avoid practice of makarasana in prone posture.

### 3.5.11 NADI-SHODHANA PRANAYAM

See 3.4.12

#### Extension Activity Find out

- ◆ What structures make up the back?
- ◆ What causes lower back pain?
- ◆ What are the risk factors for developing low back pain?
- ◆ How is low back pain diagnosed?
- ◆ How is back pain treated?
- ◆ Can back pain be prevented?

Share your answer in the form of a poster.

#### I. Tick the correct options

1. Which of the asana is for relaxation?
  - a. Makarasana
  - b. Bhadrasana
  - c. Ardh-Chakrasana
  - d. All of the above
2. In Ardh Chakrasana which is the correct pose:
  - a. Back bend in standing position
  - b. Forward bend in standing position
  - c. Leg raised in sitting position
  - d. Head and led raised in lying position
3. Which asana is base asana is not having back bend?
  - a. Tadasasana
  - b. Chakrasana
  - c. Bhujangasana
  - d. Ushtrasana





## II. Answer the following questions

1. Draw and label the diagram of Bhadrasana correctly and discuss the technique for the asana,
2. Explain the correct breathing pattern while performing nadi-shodhan pranayama.
3. Write in detail the benefits of Ardha Chakrasana.

## III. Answer the following questions in 150-200 words.

1. Discuss the asanas helpful for a person suffering from arthritis?
2. Write down the procedure and contraindications of Makarasana in detail.

## IV. Complete the table given below.

Name of disease	Name of asanas	Benefits
Obesity		
Hypertension		
Diabetes		
Asthma		

## V. Case Study Question







1. Yoga as preventive measure for lifestyle diseases
  - a. Based on the picture above, write down the name of lifestyle disease for which these asanas are used as preventive measures?
  - b. Which pranayama can also be used to help with this lifestyle disease?
  - c. What could be the possible cause for this lifestyle disease?
2. Raman, a student of class X has Asthma due to which he is unable to participate in sports activities. He has requested his yoga teacher at school for assistance. The Yoga teacher has advised him to practice certain asanas.
  - a. Write down the name of any four asanas which could be done for asthma?
  - b. Which pranayama is most effective in this disease?
  - c. Draw a stick diagram of any two asanas for preventing asthma.

### Sports Integration Activity

Talk to few people doing yoga at park, ask them the asanas, kriya and pranayama they do in their yoga routine and make a list of it.

Try to find the Sanskrit meaning of poses, asanas, kriya or pranayama they perform and convert them to your local or official language to understand how the names have been derived.

Classify the names as type of nouns (eg. Parvatasana - mountain : Object; Ushtraasana- Camel: animal)



# UNIT IV PHYSICAL EDUCATION AND SPORTS FOR CHILDREN WITH SPECIAL NEEDS

## Overview

- ◆ Organizations promoting Disability Sports (Special Olympics; Paralympics; Deaflympics);
- ◆ Concept of Classification and Divisioning in Sports;
- ◆ Concept of Inclusion in sports, its need, and Implementation;
- ◆ Advantages of Physical Activities for children with special needs;
- ◆ Strategies to make Physical Activities assessable for children with special needs

## LEARNING OUTCOMES

*At the end of the chapter, children will be able to:*

- ◆ Appreciate advantages of physical activities for children with special needs
- ◆ Differentiate between methods of categorization in sports for CWSN
- ◆ Understand concepts and importance of inclusion in sports
- ◆ Create advantages for Children with Special Need through Physical Activities
- ◆ Strategise physical activities accessible for children with special needs

The Commonwealth Games in Manchester, England in 2002, marked an extremely important change in the way disabled competitors were treated in athletics tournaments. For the first time, medals won by disabled competitors were counted towards their countries' final totals. Disabled competitors joined the procession of national teams, they lived together in the athletes' village, and their events were staged in the same stadiums at peak times alongside star names.

Read the following transcript of a radio interview with Desmond Green, a former





athlete on the changes in the Manchester Commonwealth Games.

**Presenter:** Do you think these changes are a welcome step forward?

**Desmond Green:** Much, much more than that. They are a revolution in sport. After yesterday we can't go back, though for certain the traditionalists will complain. No, it's a marvellous turning point. Calling someone a 'disabled athlete' will no longer be considered one of those second best, embarrassing expressions: it will stand for status of a sort that will appeal to the public.

**Presenter:** Surely, what the public want to see is first past the post, the world's fastest - that sort of thing...

**Green:** Ah, that's precisely what traditionalists will say! But it isn't like that. These decisions have turned sport upside down because, from now on, we shall acknowledge what individuals can do. Take Natalie du Toit. Since losing her leg in a road accident, she's trained relentlessly. Now she's in Manchester representing South Africa as a swimmer. What an achievement against the odds! That's the sort of story readers want. They're tired of muscles and speed and running the same old races in the same old ways. They want real competitors, people who are doing their best under very trying circumstances, just like them. The traditionalists can't handle that. They fear change and want athletics competitions to be the same as always.

**Presenter:** So you reckon spectators will like this?

**Green:** Of course. They've seen it in marathon events. You see, they want more than excellence. To see a magnificent performance by someone in a sporting wheelchair is moving and uplifting. You identify strongly with them, which is emotional. You could say that these changes give us a new version of an old sport, something fresh and exciting to talk about. But the real importance is that it inspires the spectators. How many of us who are burdened by unhappiness and depression will see the Games and ask ourselves why we can't overcome our difficulties and go and do something positive ourselves?

**Presenter:** I suppose you're also saying that these changes in the ways disabled athletes are treated mark a change in our attitudes towards them.

**Green:** Absolutely. They're taking a real part. No one can patronise them with second-class events that 'someone let us have because we are cripples', tagged on for the sake of political correctness. No patronising, that's the point. They're there in their own right. You know, 'political correctness' is necessary because it protects people - but it's marvellous when you can throw it out of the window and



start again.

**Presenter:** You feel very strongly about disability, don't you, Desmond?

**Green:** I do. There are many forms, and you and I could easily find ourselves classified in some way. When we talk about a minority, we forget how many real people there are out there and the important part they play in society. These games will help people to turn disability into normality. I've seen blind people skiing, and we both know about the work done by societies for horse-riding for the disabled. We all want to be accepted as normal, and this will help.

**Presenter:** Will the Games change disabled people's attitudes too?

**Green:** Anything that gives them the confidence they deserve is important. They will hear interviews with athletes and they'll say, 'Why can't we do something like that?'

**Presenter:** I can see why you mistrust traditionalists.

**Green:** They live in ivory towers, in the past. They talk about the pursuit of excellence and how athletes must be ruthless. They deride the participation of the disabled because they say that athletics is not suitable for them. But no organisation can protect itself from change. If it does, it withers away. These changes are important because they show that athletics is alive and that will gain public support and interest.

**Presenter:** Some disabled athletes argue that not enough has been done.

**Green:** There's a long way to go, but what has been done is radical. It'll take some time to digest. Then we can all think what we should add. It's not beyond us to invent other ways of celebrating the excellence of personal achievement.

### Discussion

Every individual is different and therefore, has different capabilities and needs.

Discuss in a group

- ◆ In what ways are the students in your class different from each other? (e.g., some may be short or tall, or have different abilities)
- ◆ In what way do their different needs impact their learning capabilities?
- ◆ How important is it to respect individual differences and strengths? Share your views with the class.





## 4.1 Organizations promoting Disability Sports

Disability refers to limitations in individual functioning, including physical impairment, intellectual impairment, cognitive impairment, sensory impairment, mental illness and various types of chronic diseases. A person with disability is not able to participate in sports and physical education due to her/his impairment, attitudinal and environmental barriers.

Sports events for athletes with an impairment have existed for more than 100 years, and the first sport clubs for the deaf were already in existence in 1888 in Berlin. However, competitive games for people with special needs were widely introduced only after World War II. The purpose was to assist the large number of war veterans and those soldiers who had been injured during wartime. In 1948, on the occasion of the opening ceremony of London Olympic Games, Guttman conducted wheel chair competitions for the first time in history. He named these Games "Stoke Mandeville Games". These Games later became Paralympic Games which took place in 1960 at Rome. Sports for Intellectually disabled, which were later promoted as Special Olympics, began when Eunice Kennedy Shriver organised a summer Day Camp in the backyard of her Maryland home in 1960s. In July 1968, the world witnessed the first International Special Olympics Games at Soldier Field in Chicago. Sports for people with hearing impairment were also promoted through International Committee of Sports for the Deaf (ICSD) which is the governing body responsible for Deaflympics since 1924 with their first games known as International Silent Games at Paris in 1924. Since then, the Deaflympics are held every four years, except for a break during World War II. The Deaflympic Winter Games, were started in 1949. Paralympics, and Special Olympics are organisations recognized by International Olympics Committee. Today we have sports for athletes with special needs in the area of visual impairment, cerebral palsy and various other needs. In this chapter, we will read about promotion of sports by Paralympics, Special Olympics and Deaflympics.

### Extension Activity

Find out the history of the following events:

1. Special Olympics Bharat
2. Special Olympics
3. Paralympics
4. Deaflympics



### 4.1.1 PARALYMPICS

Paralympics is a mega sports event involving athletes with a range of disabilities, and is organized by the International Paralympic Committee. The range of disabilities includes impaired muscle power (eg., paraplegia and quadriplegia, muscular dystrophy, post-polio syndrome, spina bifida), impaired passive range of movement, limb deficiency (eg., amputation or dysmelia), leg length difference, short stature, hypertonia, ataxia, athetosis, vision impairment and intellectual impairment. These disabilities are further divided into classifications which vary from sport to sport. The word Paralympics is derived from the Greek word para which means beside or alongside and Olympic. Combined, Paralympics means an international Games competition that is parallel to the Olympics. Thus, the word Paralympics refers to “a series of international contests for athletes with disabilities that are associated with and held following the summer and winter Olympic Games.” There are Winter and Summer Paralympic Games, which since the 1988 Summer Games in Seoul, South Korea, are held almost immediately following the respective Olympic Games. All Paralympic Games are governed by the International Paralympic Committee (IPC).



International Paralympic Committee (IPC) was formed on 22 September 1989 and is situated in Germany. IPC organizes Summer and Winter Paralympic Games and coordinates world championships and other competitions. The vision of IPC is ‘To enable Para athletes to achieve sporting excellence and inspire and excite the world.’

#### Do you know?

List of summer Paralympic sports for Tokyo 2020

1. Archery (since 1960)
2. Athletics (since 1960)
3. Boccia (since 1984)
4. Cycling : Track & Road cycling (since 1984)
5. Equestrian (since 1996)





6. Football5-a-Side (since 2004)-for vision impaired
7. Goalball (since 1980)
8. Judo (since 1988)
9. Para-Badminton (since 2020)
10. Paracanoe (since 2016)
11. Paratriathlon (since 2016)
12. Para-Taekwondo (since 2020)
13. Powerlifting (since 1984)
14. Rowing (since 2008)
15. Shooting (since 1976)
16. Sitting Volleyball (since 1976)
17. Swimming (since 1960)
18. Table tennis (since 1960)
19. Wheelchair Basketball (since 1960)
20. Wheelchair Fencing (since 1960)
21. Wheelchair Rugby (since 2000)
22. Wheelchair Tennis (since 1992)

Although sports clubs for the deaf were already in existence in Berlin since 1888, and some sports competitions for athletes with an impairment had been organised for more than 100 years, it was not until after World War II, however, that they became widely accepted. The purpose at that time was to assist the large number of war veterans and civilians who had been injured during wartime.



Dr Ludwig Guttmann opened a spinal injuries centre at the Stoke Mandeville Hospital in Great Britain in 1944, and in time, rehabilitation sport developed to recreational sport and then to competitive sport.

On 29 July 1948, during the Opening Ceremony of the London 1948 Olympic Games, Dr Guttmann organised the first competition for wheelchair athletes which he named the Stoke Mandeville Games where 16 injured servicemen and women took part in archery. This was a milestone in Paralympics history. In 1952, Dutch ex-





servicemen also joined the Movement and the International Stoke Mandeville Games Federation (ISMGF) was founded which conducted its first Paralympic Games at Italy 1960 featuring athletes from 23 nations. These have now come to be recognised as the first Paralympic Games. There were various different organizations working for different disabilities and, therefore, there was a need to bring all impairments under one umbrella. A major effort in this direction was made in 1982. The ISMGF, along with International Sport Organisation for the Disabled (ISOD), which had been formed in 1964 for those who could not participate in Stoke Mandeville Games, created an international coordination committee along with two other organizations that focused on games for people with disabilities. These were the Cerebral Palsy International Sports and Recreation Association (CPISRA) founded in 1978 and International Blind Sports Federation (IBSA) founded in 1980. They joined together as the International Co-coordinating Committee Sports for the Disabled in the World” (ICC) in 1982. Later in 1986, International Sports Federations for Persons with an Intellectual Disability (INAS-FID) also joined the Internal Coordination Committee (ICC). Thus, a combination of these organizations led to formation of International Paralympics Committee (IPC) on 22nd September 1989 at Dusseldorf, Germany as a global governing body of paralympic movement.

The vision of the IPC is, “To enable Paralympic athletes to achieve sporting excellence and to inspire and excite the world.” The Paralympic anthem is “Hymne de l’Avenir” or “Anthem of the Future”. It was composed by Thierry Darnis and adopted as the official anthem of the IPC in March 1996.

Till 1988, Winter and Summer Paralympic Games were held as per a separate schedule. However, since the Summer Games of Seoul, Korea in 1988 and the Winter Games in Albertville, France in 1992 the Games have also been organised in the same cities and venues as the Olympics due to an agreement between the International Paralympic Committee (IPC) and the International Olympic Committee (IOC). All Paralympic Games are governed by the IPC.

Given the wide variety of disabilities that Paralympics athletes have, there are several categories in which the athletes compete. The allowable disabilities are broken down into ten eligible impairment types which vary from sport to sport.

## Categories

A major challenge facing the organisers of para-sports is that the competition may become one sided and predictable, in which the least impaired athlete will always win. To prevent this, para-athletes are placed in categories for competition based on their impairment, these are called sport classes. Paralympic athletes have an







impairment in body structure and functions that leads to a competitive disadvantage in sports. Consequently, criteria are put in place to ensure that winning is determined by skill, fitness, power, endurance, tactical ability and mental focus. When an athlete starts competing, she/he is allocated a class that may be reviewed throughout the athlete's career.

### The purpose of the criteria

- Defining the impairment group in which an athlete can compete in the various sports.
- Grouping athletes in classes defined by the degree of activity-limitation related to the impairment and/or specific to the task in the sport.

The IPC has established ten disability categories, including physical, visual, and intellectual impairment. Athletes with one of these disabilities can compete in the Paralympics though not every sport can allow for every disability category. These categories apply to both Summer and Winter Paralympics.

1. **Physical Impairment** - There are eight different types of physical impairment:

- **Impaired muscle power** - With impairments in this category, the force generated by muscles, such as the muscles of one limb, one side of the body or the lower half of the body is reduced. eg., spinal cord injury, spina bifida, post-polio syndrome.



- **Impaired passive range of movement** - The range of movement in one or more joints is reduced in a systematic way. Acute conditions such as arthritis are not included in this category.
- **Loss of limb or limb deficiency** - A total or partial absence of bones or joints from partial or total loss due to illness, trauma, or congenital limb deficiency. eg., amputation, dysmelia.
- **Leg-length difference** - Significant bone shortening occurs in one leg due to congenital deficiency or trauma.





- **Short stature** - Standing height is reduced due to shortened legs, arms and trunk, which are due to a Musculo-skeletal deficit of bone or cartilage structures. eg., achondroplasia, growth hormone deficiency, osteogenesis imperfecta.
  - **Hypertonia** - Hypertonia is marked by an abnormal increase in muscle tension and reduced ability of a muscle to stretch. Hypertonia may result from injury, disease, or conditions which involve damage to the central nervous system. eg., cerebral palsy.
  - **Ataxia** - Ataxia is an impairment that consists of a lack of coordination of muscle movements. eg., cerebral palsy, Friedreich's ataxia, multiple sclerosis.
  - **Athetosis** - Athetosis is generally characterized by unbalanced, involuntary movements and a difficulty maintaining a symmetrical posture (eg., cerebral palsy, choreoathetosis).
2. **Visual Impairment** - Athletes with visual impairment ranging from partial vision, sufficient to be judged legally blind, to total blindness. This includes impairment of one or more component of the visual system - eye structure, receptors, optic nerve pathway, and visual cortex. The sighted guides for athletes with a visual impairment are such a close and essential part of the competition that the athlete with visual impairment and the guide are considered a team. Beginning in 2012, these guides, along with sighted goalkeepers in 5-a-side football, became eligible to receive medals of their own.
  3. **Intellectual Disability** - Athletes with a significant impairment in intellectual functioning and associated limitations in adaptive behaviour fall under the category of intellectual disability. The IPC primarily serves athletes with physical disabilities, but the Intellectual Disability group has been added to some Paralympic Games. This includes only athletes with exceptional athletic ability who have intellectual disabilities diagnosed before the age of 18. However, the IOC recognized Special Olympics World Games are open to all people with intellectual disabilities.





### 4.1.2 SPECIAL OLYMPICS

Special Olympics is the world's largest sports organization for children and adults with intellectual and physical disabilities, providing year-round training and competitions to 5 million athletes and Unified Sports partners in 172 countries. The concept was the brainchild of Eunice Kennedy Shriver, who in 1962 initiated a day camp called Camp Shriver for children with intellectual disabilities at her home in Potomac, Maryland. The camp sought to address the concern that children with special needs had very little opportunity to participate in organised athletic events. With Camp Shriver as an example, Kennedy Shriver, head of the Joseph P. Kennedy Jr. Foundation and a member of President John F. Kennedy's Panel on Mental Retardation, promoted the concept of involvement in physical activity and other opportunities for people with intellectual disabilities.



The Logo of Special Olympics is based on the sculpture "Joy and Happiness to All the Children of the World" by Zurab

Tsereteli and was adopted in 1979. It reflects joy, happiness, confidence among children and adults with special needs who are learning coordination, mastering skills, participating in competitions and preparing themselves for richer, more productive lives.

The mission of Special Olympics is to provide year-round sports training and athletic competition in a variety of Olympic-type sports for children and adults with intellectual disabilities, giving them continuing opportunities to develop physical fitness, demonstrate courage, experience joy and participate in events like Athletics (Track and Field), Badminton, Basketball, Bocce, Bowling, Cricket, Cycling, Equestrian sports, Figure Skating, Floorball, Floor Hockey, Football (Soccer), Golf, Gymnastics - Artistic and Rhythmic, Handball, Judo, Kayaking, Netball, Powerlifting, Roller Skating, Sailing, Snowboarding, Snowshoe running, Skiing - Alpine and Cross-Country, Softball, Speed Skating - Short-track, Swimming - Pool and Open-Water, Table Tennis, Tennis, Triathlon and Volleyball.



There are a large number of benefits for people with intellectual disabilities as a result of participating in activities organized by Special Olympics. Apart from physical and health benefits, it provides psychological benefits including higher self-confidence, self-esteem and social competence. The transformative power of sports in instilling confidence, improving health and inspiring a sense of competition lies at the core of Special Olympics.

### Extension Activity

Working in groups, investigate the history of the Indian Paralympic and Special Olympics teams. Who have been the most successful athletes?

Select one and find out more about him/her. Present your findings to the class in the form of a Power Point Presentation.

One of the major events of Special Olympics is World Games, which was first held in July 1968 at Chicago with around 1000 participants from U.S. and Canada. Special Olympic Winter Games were initiated in 1977 at Colorado, US. Special Olympics also conducts Unified Sports Programme for inclusion. Sports Participants who have attained 8 years of age along with condition of intellectual disabilities, cognitive delays identified by the agency or a professional can participate in sports competitions.

The Special Olympics was officially recognized by the International Olympic Committee (IOC) in 1988. It provides year-round training and competitions to 5 million athletes and Unified Sports partners in 172 countries. Special Olympics competitions are held every day, all around the world—including local, national and regional competitions, adding up to more than 100,000 events a year. Like the IPC, the Special Olympics organization is recognized by the IOC; however, unlike the Paralympic Games, Special Olympics World Games are not held in the same year or in conjunction with the Olympic Games.

### History of Special Olympics

In June 1962, Eunice Kennedy Shriver started a day camp called Camp Shriver for children with intellectual and physical disabilities at her home in Potomac, Maryland. The camp sought to address the concern that children with special needs had very little opportunity to participate in organised athletic events. With Camp Shriver as an example, Kennedy Shriver, head of the Joseph P. Kennedy, Jr. Foundation and a member of President John F. Kennedy's Panel on Mental Retardation, promoted the concept of involvement in physical activity and other opportunities for people with





intellectual disabilities. Camp Shriver became an annual event, and the Kennedy Foundation gave grants to universities, recreation departments, and community centres to hold similar camps. The first games were held on July 20, 1968 in Chicago, Illinois, with about 1000 athletes from the U.S. and Canada. International participation expanded in subsequent games. In 2003, the first Special Olympics Summer Games to be held outside the United States, were held in Dublin, Ireland with 7000 athletes from 150 countries. The first World Winter Games were held in 1977 in Steamboat Springs, Colorado. Austria hosted the first Winter Games outside the United States in 1993. The World Games alternate between Summer and Winter Games, in two-year cycles, recurring every fourth year.

**Recognition** Like the International Paralympic Committee, the Special Olympics organization is recognized by the International Olympic Committee; however, unlike the Paralympic Games, the Special Olympics World Games is a major event put on by the Special Olympics.

### Logo and Oath

The Special Olympics logo is based on the sculpture “Joy and Happiness to All the Children of the World” by Zurab Tsereteli. The logo is a symbol of growth, confidence and joy among children and adults with disabilities who are learning coordination, mastering skills, participating in competitions and preparing themselves for richer, more productive lives. The Special Olympics athlete’s oath, which was first introduced by Eunice Kennedy Shriver at the inaugural Special Olympics international games in Chicago in 1968, is “Let me win. But if I cannot win, let me be brave in the attempt.”

### Programmes run by Special Olympics around the world

#### Young Athlete Programme

For young people with and without intellectual disabilities between the ages of 2-7, Special Olympics has a Young Athletes Programme – an inclusive sport and play programme with a focus on activities that are important to mental and physical growth. Children engage in games and activities that develop motor skills and hand-eye co-ordination.

#### Unified Sports Programme

In recent years, Special Olympics has pioneered the concept of Unified Sports, bringing together athletes with and without intellectual disabilities as teammates. The basic concept is that training together and playing together can create a path



to friendship and understanding. The programme has expanded beyond the U.S. and North America: more than 1.4 million people worldwide now take part in Special Olympics Unified Sports. The goal is to break down stereotypes about people with intellectual disabilities and promote unity.

### Healthy Athletes Programme-

This Programme offers health screenings to athletes in need. In 1997, Special Olympics began an initiative called Healthy Athletes that currently offers health screenings in seven areas: Fit Feet (podiatry), FUN fitness (physical therapy), Health Promotion (better health and well-being), Healthy Hearing (audiology), MedFest (sports physical exam), Opening Eyes (vision) and Special Smiles (dentistry). Screenings educate athletes on health issues and also identify problems that may need additional follow-up. For example, the FUNfitness Programme that assesses flexibility, strength, balance, and aerobic fitness of the athlete. Following the screening, the physical therapist provides instructions on how to optimize their physical fitness in the area as screened.

### Special Olympic Sports Rules/Guidelines

- Athletes shall be divided into competition division based upon their ability, age and sex. Competition divisions are structured so that an athlete competes against another athlete of similar ability
- Special Olympics has more than 30 Olympic-type individual and team sports that provide meaningful training and competition opportunities for people with intellectual disabilities.
- At competitions, medals are awarded to the first, second and third-place winners in each event, and ribbons are awarded to athletes who finish in fourth through eighth place.

To participate in Special Olympics, a person must be at least 8 years old and identified by an agency or professional as having one of the following conditions: intellectual disabilities, cognitive delays as measured by formal assessment, or significant learning or vocational problems due to cognitive delay that requires or has required specially designed instruction.

#### 4.1.3 Deaflympics







Sports for hearing impaired were started long back, the first games, known as the International Silent Games, were held in 1924 in Paris with 148 athletes from nine (9) European nations participating. The Silent Games were the first ever for any group of people with disabilities and also the secondly created internally competed games after Olympics. Winter Games were instituted in 1949 at Seefeld, Austria.

The event was organized by Le Comité International des Sports Silencieux (the International Committee of Silent Sports), commonly known as the CISS which was formed in 1924 at France. In 1955, the CISS was admitted into the International Olympic Committee, the IOC, as an International Federation with Olympic standing. The flag of the IOC has flown next to the flag representing CISS/ICSD at the Summer/ Winter Deaflympics since 1985.

CISS was lately changed as Le Comité International des Sports des Sourds (The International Committee of Sports for the Deaf) or referred as ICSD. At present, the International Committee of Sports for the Deaf (ICSD) is the main governing body responsible for the organization of Deaflympics and other World Deaf Championships. ICSD is the organization behind the building, evolving and fortifying the tradition of inviting deaf/hard of hearing elite athletes from all of the world to come together not only to compete in their respective sports, but to also develop comradeship between their countries. The most recent name, the "Deaflympics," was formally adopted in 2001. Deaflympics is being organised and managed by ICSD across the world with its national partners and associate members.

The Deaflympics are distinguished from all other IOC-sanctioned games by the fact that they are organized and run exclusively by members of the community they serve. Only people with hearing impairment are eligible to serve on the ICSD board and executive bodies. Deaflympics are held every four years starting from 1924, Paris, with exceptions of 1943 and 1947 games which were cancelled due to world war-ii.



*24<sup>th</sup> Summer Deaflympics*



### 4.1.3.1 Logo



The logo of Deaflympics, designed in 2003 is a positive and powerful symbol of the international deaf sports community. It ties together strong elements: Sign language, deaf and international cultures, unity and continuity.

The hand shapes, “ok”, “good”, and “great” that overlap each other in a circle, represent the original sign for “deaflympics”. Together, the hand shapes represent the sign for “united”.

The centre of the logo represents the iris of the eye, which defines deaf people as visual people; they must use their eyes to communicate.

The logo incorporates the four colours of the national flags of the world. The red, blue, yellow and green represent the four regional confederations - the Asia Pacific Deaf Sports Confederation, the European Deaf Sports Organization, the Pan American Deaf Sports Organization and the Confederation of African Deaf Sports.

#### I. Tick the correct options

1. The International Paralympics Committee was founded in the year
  - a. 1960
  - b. 1948
  - c. 1900
  - d. 1989
2. The reason Paralympic Games got their name was because
  - a. they were meant for athletes suffering from paraplegia.
  - b. they run alongside or parallel to the Olympic Games.
  - c. the athletes are paragons of their sports.
  - d. they are attended by a large number of paramedics.







3. Paralympic Games was a 1948 sporting competition held at Stoke Mandeville hospital in
  - a. England
  - b. United States of America
  - c. Germany
  - d. Greece
4. The founder of Special Olympics was
  - a. Eunice Kennedy Shriver
  - b. John F. Kennedy
  - c. Lyndon B. Johnson
  - d. Donald Trump
5. The first Deaflympics Games were held in the year
  - a. 1924
  - b. 1948
  - c. 1954
  - d. 1988

**II. Answer the following questions.**

1. When and where did Paralympics start? What was the purpose of these games?
2. What is the vision of the International Paralympic Committee?
3. What is the anthem of the Paralympics? What, according to you, is its relevance?
4. What do you understand by the term hypertonia?
5. Differentiate between Special Olympics, Deaflympics and Paralympics.
6. What do you know about logo of Deaflympics?

**III. Answer the following questions in 150-200 words.**

1. What was the major challenge facing the organisers of para-sports? How did they deal with this challenge?
2. Write a short note on Special Olympics.
3. List the Programmes run by Special Olympics around the world.





## 4.2 Concept of Classification and Divisioning in Sports

The concept of Classification and Divisioning is a process used in disability sports for providing even and fair competition for athletes with disability through grouping of athletes. The purpose is very much similar to grouping system used in mainstream sports according to their age-group, gender, weight etc. The general goal of any classification or divisioning in disability sports is to reduce or minimize the effect of sports performance due to any of the above-mentioned variables like age, gender, weight or even abilities. In this chapter we will understand the two terms -- 'classification' and 'divisioning', wherein 'classification' is a grouping process associated with Paralympics and para-athletes, and 'divisioning' is a process of grouping associated with Special Olympics. Classification process adopted by Paralympics assigns categories to athletes based on different types of disabilities, on the other hand divisioning process of Special Olympics is a performance based system of grouping athletes bases on their skill level.

### 4.2.1 Classification in Paralympics

Paralympic Games, through the international paralympic committee (IPC), has developed classification process which can contribute "to sporting excellence for all Athletes and sports in the Paralympic Movement, and providing equitable competition. Classification is undertaken to ensure that an Athlete's impairment is relevant to sport performance, and to ensure that the Athlete competes equitably with other Athletes" with fair chance to all participant athletes engaging in competitive sports. According to the IPC, the classification process serves two roles. The first is to determine who is eligible and the second is to group sportspeople for the purpose of competition. The eligibility minimum is an impairment that limits the sportsperson's ability to participate in an activity and the disability needs to be permanent in nature.

#### Classification Process

Classification for Paralympics sports generally has three or four steps. The first step is generally a medical assessment. The second is generally a functional assessment which involves two parts: first observing a sportsperson in training and then observing the sportsperson in competition. There are a number of people involved in this process beyond the sportsperson, including individual classifiers, medical classifiers, technical classifiers, a chief classifier, a head of classification, a classification panel and a classification committee.





### 4.2.2 10 Classifications in PARALYMPICS (eligible impairments)

1. **Physical Impairment** - There are eight different types of physical impairment:
  - **Impaired muscle power** - With impairments in this category, the force generated by muscles, such as the muscles of one limb, one side of the body or the lower half of the body is reduced. eg., spinal cord injury, spina bifida, post-polio syndrome.
  - **Impaired passive range of movement** - Range of movement in one or more joints is reduced in a systematic way. Acute conditions such as arthritis are not included in this category.
  - **Loss of limb or limb deficiency** - A total or partial absence of bones or joints from partial or total loss due to illness, trauma, or congenital limb deficiency. eg., amputation, dysmelia.
  - **Leg-length difference** - Significant bone shortening occurs in one leg due to congenital deficiency or trauma.
  - **Short stature** - Standing height is reduced due to shortened legs, arms and trunk, which are due to a musculoskeletal deficit of bone or cartilage structures. eg., achondroplasia, growth hormone deficiency, osteogenesis imperfecta.
  - **Hypertonia** - Hypertonia is marked by an abnormal increase in muscle tension and reduced ability of a muscle to stretch. Hypertonia may result from injury, disease, or conditions which involve damage to the central nervous system. eg., cerebral palsy.
  - **Ataxia** - Ataxia is an impairment that consists of a lack of coordination of muscle movements. eg., cerebral palsy, Friedreich's ataxia, multiple sclerosis.
  - **Athetosis** - Athetosis is generally characterized by unbalanced, involuntary movements and a difficulty maintaining a symmetrical posture. eg., cerebral palsy, choreoathetosis.

### 4.2.3. Divisioning in Sports by Special Olympics

Special Olympics uses a competitive-level matching or grouping referred to as 'divisioning', which is a fundamental rule at Special Olympics. Athletes in competitions are matched with others of the same gender, about the same age and most importantly, of about the same competitive ability.



The fundamental difference between Special Olympics competitions and those of other sports organizations is that athletes of all ability levels are encouraged to participate, and every athlete is recognized for his/her performance. Competitions are structured so that athletes compete with other athletes of similar ability in equitable divisions

#### 4.2.4 Implementation of Divisioning

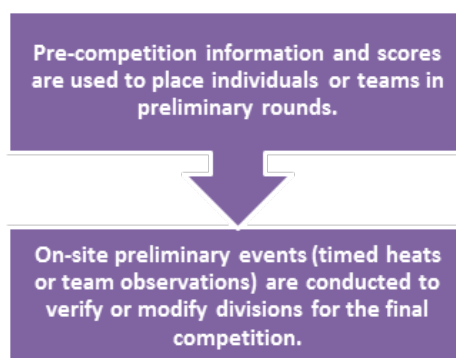
An athlete's ability is the primary factor in divisioning Special Olympics competitions. The ability of an athlete or team is determined by an entry score from a prior competition or the result of a seeding round or preliminary event at the competition itself. Other factors that are significant in establishing competitive divisions are age and sex. In the process of divisioning, athletes are firstly categorised as per their age group which is different for individual and team sports, followed by Gender and lastly by their ability.

#### 4.2.5. Process of Divisioning :

##### 1. Age

Team Sports	Individual Sports
15 & under	8-11 years
16-21 years	12 – 15 years
22 and above	16-21 years
	22-29 years
	30 and above

- Gender:** In the second step, athletes are grouped as per gender, in some circumstances gender can be combined too.
- Ability :** Finally athletes in Special Olympics are grouped according to their skill abilities scores which are recorded by committee through preliminary and on-site events.





This makes Divisioning in Special Olympics a process in which, before each competition, a time, score or skill assessment is submitted for each athlete or team. For events that are not timed or measured, such as football and badminton, there is a series of short games between athletes or teams or an assessment of each athlete or team's ability by a committee. The divisions are then set up based on the information on each athlete's skill level so that each set of competitors is closely matched. Towards fair divisioning, Athletes as well as coaches are expected to follow the Special Olympics Official Sport Rules and the Athlete's Code of Conduct.

**Maximum Effort Rule :** To achieve the intentions of fairness, there is a 'maximum efforts rule', wherein athletes are expected to give their maximum effort during divisioning process and coaches are expected to motivate all athletes towards giving their best. Special Olympics Athletes who do not participate honestly and do not adhere to the maximum effort rule in all preliminary trials or final rounds violate the true spirit of competition and may even be disqualified from competition.

**I. Tick the correct options**

1. Grouping process associated with Paralympics is referred as :
  - a. Divisioning
  - b. Classification
  - c. Grouping
  - d. Categorization
  
2. Grouping process associated with Special Olympics is referred as?
  - a. Divisioning
  - b. Classification
  - c. Grouping
  - d. Categorization
  
3. Rule used by Special Olympics to achieve the intentions of fairness is referred as :
  - a. Maximum Effort Rule
  - b. Honest Effort Rule
  - c. Best Effort Rule
  - d. Minimum Effort Rule



4. Which is the first step used in classification for Paralympics
  - a. Medical Assessment
  - b. Functional Assessment
  - c. Observation
  - d. Competition

**II. Answer the following questions.**

1. Describe 'Maximum Effort Rule' used in Special Olympics?
2. Describe the concept of classification in Paralympics?
3. Difference between Classification and Divisioning in disability sports?

**III. Answer the following questions in 150-200 words.**

1. Explain the objective and need for classification and divisioning in disability sports?

### 4.3 Concept of Inclusion in Sports, its need and implementation

With the introduction of the Right to Education, which makes education a fundamental right of every child between the ages of 6 and 14 all children - including those who are physically and mentally challenged, or afflicted with various types of disabilities and disorders - have the right to come to school to develop their abilities through the process of education. It is, therefore, the duty of all schools to provide them with such opportunities that they develop their learning.

#### Do you know

According to the WHO:

Disability is an umbrella term, covering impairments, activity limitations, and participation restrictions. An impairment is a problem in body function or structure; an activity limitation is a difficulty encountered by an individual in executing tasks or actions. Problems experienced by an individual in life situations are called participation restrictions.

In other words, disability is not just one health problem. It is a complex phenomenon, reflecting the interaction between features of a person's body and features of the society in which he or she lives.





Disability is more common among women, older people, children and adults who are poor. People with disabilities often have less education and have deprived living conditions—including insufficient food, poor housing, lack of access to safe water and sanitation. This causes disabled individuals to have the highest risks for infectious and non-infectious diseases.

People with disabilities often do not receive the needed health care and approximately half cannot afford it. Data from four countries in the Region found that only 26% to 55% of people received the medical rehabilitation they needed, while only 17% to 37% received the assistive devices they needed such as wheelchairs, prostheses and hearing aids.

### 4.3.1 Encouraging Inclusion through Physical Education and Sports

1. **Role of Family** - The role of family in encouraging a healthy, sports-oriented lifestyle for a child with a disability is crucial. At times the family may find it difficult to accept reality, and may give up on the child. It is essential to promote awareness and to treat a CWSN as equal in the family. A CWSN may require a structured life routine where participation in recreational games and sports plays a very important role in developing a healthy mind and body of the child. Parents should observe certain different abilities of the child and take professional help to enable her/him to excel in the area.
2. **Role of School** - School gives a structured programme to a child or a group where co-scholastic activities and sports are a part of the regular routine. All schools must have trained APE teachers to give a specially-abled child access to games where equipment and movements are adapted in a fun way for her/his holistic development. Here, a teacher or a coach helps a child to transit towards competitive sports under different organizations such as Special Olympics, Paralympics etc.. The school should take care to provide infrastructure that is compatible with the needs of CWSN e.g., a ramp along with stairs. Schools must run sensitization programmes so that CWSN are recognised for their efforts and organise intramural and extramural sports competitions or carnivals.
3. **Role of Organisations** - There are some organizations working at the grass root level to promote adapted sports. These organizations are responsible for training teachers and coaches for teaching, coaching and organizing sports events at Zonal, District, State, National and International levels.



### 4.3.2 INCLUSION - ITS NEEDS AND IMPLICATION

Each individual is different in terms of his physical, social, emotional and cognitive characteristics. This diversity is a reality, and everyone should respect the differences in each other. Inclusion is a vast concept that implies including everyone in education without being judgmental about the abilities, appearance, economic condition etc. of the participants. Inclusion in education refers to a model wherein CWSN spend most or all of their time with students with non-special needs. It is based on the notion that Inclusive Education is more effective for students with special needs since they get a mixed experience. This social interaction leads to success in later life.

Inclusion plays a big role in creating a safe, comfortable and emotionally secure environment in any educational institution. Inclusion is not a law to be forced on anyone. It is a process which enables a child smooth transition to understand, accept and implement the culture of inclusion in different situations. Physical education and sports play a very important role in promoting inclusion in any educational institute.

#### Need for Inclusive Education

Inclusive education provides a student training for real life situations as all students, with or without disabilities, learn to interact and work collectively.

1. **Builds Self Esteem** - Inclusive classrooms are filled with diverse learners. This lets kids observe and talk about diverse learning patterns and the manner in which everyone learns in their own way. CWSN may find that they have more in common with other students and this goes a long way in building self-esteem. It also helps reduce stigma faced by those who have learning and attention issues. Differently-abled individuals show marked improvement in self- confidence if they have studied in a regular school. It can also help students build and maintain friendships.
2. **Improves Social and Communication Skills:** Inclusive education provides ample opportunities for all students - students with disabilities and those without disabilities - to have better social relations amongst themselves. Since social skills are better learnt through observation and imitation, students with special needs get a better understanding of the world around them by being part of a regular classroom. This is especially true of students with intellectual impairment like autistic students.







3. **Enhances Sensitivity** - It has been noted that students without disabilities become more sensitive if they study in a classroom where they have students with special needs. They understand and appreciate their emotions and feelings and become more sensitive and caring towards them. They learn how to be more patient and to empathise with others. When children are involved in helping their peers, they not only derive immense satisfaction out of it, but often strike lifelong friendships with them.
4. **Creates Better Understanding and Appreciation of others** - In an inclusive classroom, students with or without special needs understand and appreciate the strengths and weaknesses of their classmates. They learn to understand and appreciate these differences.
5. **Creates a Sense of Belonging** - All children are able to be part of a community and develop a sense of belonging. This makes them better prepared for life as they learn to value each other despite their differences. CWSN enjoy the acceptance and develop a feeling of belonging to the group of students with or without special needs.
6. **Enhances Academic Performance** - Inclusive education leads to better academic performance than in exclusive education. It provides better opportunities for learning as children with varying abilities are often better motivated when they learn in classes surrounded by other children.
7. **Improves Performance** - Since the expectations of all the children are higher in a mixed abilities classroom, inclusion attempts to develop an individual's strengths and gifts by stretching each individual to optimal performance.

### Implementation of Inclusive Education in India

In India, the number of children/persons with disabilities or special needs is really large. As a result, they have a number of problems in getting education, especially inclusive education. It is important to implement inclusive education in India not only to provide benefits of inclusion to all individuals but also to ensure optimal utilisation of resources.

India should emphasize on the following measures for effective implementation of inclusive education.

1. Ensuring effective implementation of the Right to Education in all states so that no child is left out of the ambit of education so that we are able to take care of the needs of CWSN.



2. Equipping teachers, especially in rural areas, through appropriate training and in-service workshops to teach CWSN in an inclusive classroom.
3. Developing a support team through regular analysis of schools, curriculum and amenities in order to give access to the regular curriculum methods to children with difficulties in learning.
4. Encouraging a flexible approach towards curriculum transaction whereby teachers and students are able to diagnose and resolve the problems that they face during the teaching learning process.
5. Involving parents as partners and as a resource in the decision-making process for enhancing their child's learning so that a collaborative effort results in effective inclusive education.
6. Looking at all children at what they can do rather than what they cannot do. It is important for the student's self-esteem that a child with special needs is not looked at with sympathy, but is recognised for her/his talents, capabilities and abilities.
7. Designing schools and classes in ways that help children learn and achieve to their fullest potential. Enrolling of CWSN in regular schools requires a lot of adjustments in terms of classrooms, transport facilities and educational materials and assistive devices such as audio textbooks or Braille text books, etc.
8. Developing education goals according to each child's abilities. Curriculum experts should carefully design programmes so that the curriculum is made parallel for all the children with or without special needs in inclusive education. This also means that children do not need to have the same education goals in order to learn together in regular classes and will require the designing of a suitable examination system and putting in place periodic evaluation of CWSN to meet the challenges and changing trends.
9. Making sincere efforts to develop good relations and understanding between families of students with disabilities and without disabilities. In this way, all students will also develop good relations among themselves and thereby create an appropriate environment for implementing inclusive education.
10. Providing students related materials like uniforms, books, stationery, transport allowance, stipend for girls, boarding and lodging facilities, therapeutic services, teaching and learning materials, assistive devices, etc., to CWSN from the school.





11. While Inclusive Education implies that all children are educated in regular classrooms, it does not, however, mean that individual children cannot leave the classroom for specific reasons. For example, a child may require one-on-one assistance in a particular subject. This may or may not happen during regular class time. Once schools are inclusive, serious thought is given to how often a child may be out of regular classroom and the reasons why this may be happening. It does not mean that children with certain characteristics (for example, those who have disabilities) are grouped together in separate classrooms for all or part of the school day.

**I. Tick the correct options**

1. Inclusion is vast concept that implies
  - a. including learners with differing abilities, appearance and economic conditions in education
  - b. including learners with an emotional or intellectual impairment in mainstream education
  - c. integrating all children with intellectual disabilities into main stream schooling
  - d. integrating all children with physical disabilities into mainstream schooling
2. Right to education provides free education for all children within the age group of :
  - a. 5-10yrs
  - b. 6-14 yrs
  - c. 10-18 yrs
  - d. 2-7 yrs
3. Which of the following will be an inclusive school:
  - a. Mainstream school with separate classrooms for different abilities
  - b. Mainstream school with same classrooms for different abilities
  - c. Separate schools for Mainstream and for children with disability
  - d. All of the above



**II. Answer the following questions.**

1. What do you understand by inclusion in education?
2. How does inclusion in PE help improve communication skills of learners?
3. What do you understand by inclusion in education?
4. What do you understand by inclusion in physical education?
5. How does inclusion in PE help improve communication skills of learners?
6. List two benefits of inclusive education.

**III. Answer the following questions in 150-200 words.**

1. How does inclusion in Physical Education benefit CWSN?
2. How does inclusive education help integration of CWSN in society?
3. How can inclusive education be implemented in India?

**4.4 Advantages of Physical Activities for CWSN**

It is no secret that physical activities are an important aspect of a healthy lifestyle and can provide significant benefits for children in all developmental stages. Children with special needs have less opportunities to be less physically active and, therefore, are at higher risk for complications associated with inactivity. Regular physical activity for children with special needs provides physical, emotional and social advantages. CWSN demonstrate strength gains, increased flexibility, improved bone health, better endurance and cardiovascular fitness as a result of regular physical activity. In case of children with movement disabilities, physical activity is important in maintenance of mobility during the aging process. With enhanced physical health, children are better able to fight problems such as obesity and the associated health complications that may follow. Physical activity can also improve general mood and wellness. Regular fitness can be linked to improved self-esteem, social awareness, and self-confidence, which aid in empowering the lives of children with special needs.

1. **Physical benefits** - Scientific studies of disability groups have demonstrated that participation in physical activity and sport leads to improved levels of well-being and physical health. Children with intellectual disabilities may have additional physical disabilities resulting in below age-level performance in typical motor skills. Regular involvement in physical education and sport can help them to develop their gross motor and fine motor skills which may





improve their overall performance. When encouraged to participate in a regular fitness routine, many CWSN show improvement in everything from their hand-eye coordination and flexibility, to their muscle strength, endurance, and even cardiovascular efficiency. These are all simply the natural benefits of exercise. This development of better motor skills and enhanced physical health helps individuals to fight back against problems such as obesity, and the health complications that follow.

2. **Mode of Recreation and Fun** - CWSN frequently miss out on social activities, recreation and fun. Participation in extracurricular and sports activities can help them overcome this obstacle, providing them with the ability to engage in social interactions, make friends and initiate social skills.
3. **Improved Emotional Health** - Including physical activity in a healthy lifestyle is proven to decrease rates of depression. CWSN often tend to have more emotional problems like depression. Participating in regular exercise can be a life-changing benefit by improving mental health and wellbeing. Physical activity can also improve general mood and wellness, which aids in empowering the lives of children with special needs.
4. **Channelizing the Surplus Energy** - Children with disabilities like ADHD display hyperactivity which, if appropriately directed, can bear positive results related to cognitive benefits and constructive behaviour.
5. **Psychological benefits** - Regular participation in sports and physical activities is not just beneficial for the body, it is beneficial for the mind, too. Physical activity improves general mood and wellness in CWSN by improving their self-esteem, social awareness, and self-confidence, all of which are factors essential for empowering their lives. On the one hand the physical outlet provided by sports and physical activity reduces anxiety, stress and depression, and on the other, interaction and involvement with other students gives children a sense of accomplishment and confidence. For CWSN, developing a sense of self-esteem is particularly important, as they may often feel isolated and removed from the group.
6. **Healthy lifestyle** - CWSN are about twice as likely as other children to be overweight or obese often due to the greater likelihood of being sedentary due to their disability. As a result of their disability, their levels of participation in sports and physical activity is much lower than that of their peers. It is imperative that these children, as much or more, than other students must learn about the steps to leading a healthy lifestyle, within the context of the abilities and limitations of their respective conditions.



7. **Behavioural Benefits** - The energetic nature of physical education leads to cognitive improvements in CWSN, allowing them to develop skills that they may not develop in a traditional classroom setting. Sports and Games are a structured activity with a set of rules and organisation. They help the child learn to practice self-regulation and enhance their decision-making skills. In addition, CWSN can learn to focus on specific goals, and work on their verbal communication by interacting with peers on the sports field. Sports and Physical education teach children a range of skills that include teamwork, problem solving abilities, increased attention span, and focus on task-based behaviour. Eventually, these skills can transfer into other classroom settings too, so that CWSN have a greater ability to learn and engage with their peers outside of physical education.
8. **Increased Independence** - Participation in Physical Education and Sports is a mode to transit towards greater independence due to improved daily life skills. For a person with a disability, an increase in physical activity can lead to more independence and freedom. Increased physical strength and energy that comes from regular exercise allows persons with disability to do more daily tasks without assistance.

#### 4.5 Strategies to Make Physical Activities Accessible for CWSN

Participation in physical activity is beneficial for all children, including those with disabilities. In fact, participation of children with disabilities in sports and recreational activities promotes inclusion, minimizes deconditioning, optimizes physical functioning, and enhances overall well-being. Despite these benefits, children with disabilities are more restricted in their participation, have lower levels of fitness, and have higher levels of obesity than their peers without disabilities. Well-informed decisions regarding each child's participation must consider certain well-devised strategies.

**Communication** - Advance information about activity, space, resource person or any change in activity should be communicated clearly. A variety of different instructional strategies such as verbal, visual and peer teaching should be used for performing various types of physical activities so that children get opportunity to participate in physical activity. The teacher could use visuals or social story about the activity. Give positive, corrective or specific feedback. As per the ability of the child,

specific instruction must be provided in simple words and sentences. The tone should be low and one instruction should be given at a time. If necessary, a communication







board or communication book could be used.



**Space** - For CWSN, space should be approachable for people having physical disability. The area for the physical activity should be limited. Space for activities should be disturbance free (noise, heat, cold, texture of floor, audience etc.) It is always better to start with indoor space. Boundaries should be demarked clearly as starting point, finishing point, sitting area. In case of children who have autism, they must be provided specific area because they may need some time to relax. Once behaviours, discipline, understanding of instructions are clear then one can transit towards outdoor space also. It does not mean that one is not allowed to go to outdoor sports.



**Equipment** - A lack of appropriate equipment, coupled with a lack of professionals trained to support physical activity among children and youth with different ability levels, discourages participation. There are a growing number of disabled people who are interested in recreation and sport activities. In recent years several modified devices are on offer for adapted sports. There are many examples of simple and sophisticated equipment, including computerized devices like wheelchairs for recreation and sport activities. There are sport competitions involving four groups of disabled sportspersons, namely 1) the deaf, 2) people with physical disability, 3) people with intellectual (mental) disability, 4) people supported by specially





designed high level engineering equipment. All of them can use many kinds of equipment and facilities.



Table 7.4 Equipment Characteristics

<b>Weight</b>	Lighter	↔	Heavier
<b>Size</b>	Smaller	↔	Larger
<b>Shape</b>	Regular	↔	Irregular
<b>Height</b>	Lower	↔	Higher
<b>Speed</b>	Slower	↔	Faster
<b>Distance</b>	Closer	↔	Farther
<b>Sound</b>	Soft	↔	Noisy
<b>Color</b>	Pale	↔	Bright
<b>Trajectory</b>	Medium level	↔	High or low level
<b>Direction</b>	Forward	↔	Backward and sideways (right and left)
<b>Surface contact</b>	Increased	↔	Decreased
<b>Surface or texture</b>	Level or smooth	↔	Rough or uneven
<b>Length</b>	Shorter	↔	Longer
<b>Resiliency</b>	Less	↔	More







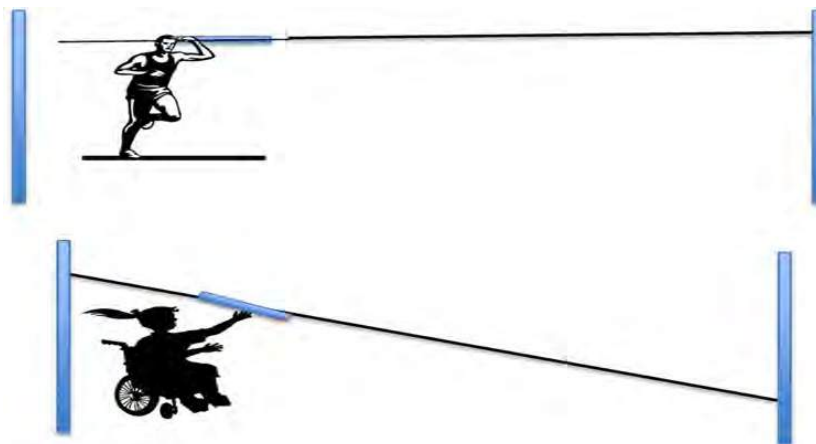
**Graded Activities-** During initial stage activities should be simple and each activity should be based on a single action. There should be a gradual move from non-locomotor to locomotor to manipulated activities. For these activities, the level of assistance should be physical, verbal and independent. CWSN need help in learning a fundamental motor skill. It will need to be practised with the students so they are able to visualize it through the teacher's body action. In addition, one can use videos. As they watch the video, words or phrases that highlight the important part on which the demonstration is focusing must be used. They could also be asked to demonstrate the skill to ensure the instructions have been understood before commencing practice and they must start practice immediately after viewing a demonstration. The activity must be practised with progressive count, or even performed dramatically with rhymes or songs with voice modulation so they enjoy the activities.

### Do you know?

Locomotor skills include running, jumping, hopping, galloping, rolling, leaping and dodging, horizontal jump, slide.

Manipulative skills are throwing, catching, kicking, striking and trapping, dribble, overhand throw, and underhand roll

Stability skills are balance, twisting, turning and bending



**Social strategies** - A CWSN must be allowed to choose a sport she/he enjoys. It's easier for children to be motivated when they enjoy the activity. At first, the CWSN should be encouraged to watch others. Once the child sees people having fun as they play, she/he will be motivated to participate too. Then, the child could be started on individual training, and transferred to a small group with supervision and reminder. The Teacher must act as a mediator, helping the CWSN to interact



with other members of group. There should be individual check on each person who is participating and they should be motivated with reminders whenever they get distracted. Each person should be greeted before the session and each lesson should end with positive feedback.

**Psychological strategies** - Because of previous exclusion or limited access, children with disabilities need a lot of motivation to participate in physical activity. It's all about the cycle of conditioning: active kids who stay active grow stronger and more physically literate as they age. The cycle of deconditioning works the same way: for children who don't participate, the less they do, the less they're able to do. In fact, "Psychological barriers are the most influential. Changing attitudes is the key to increasing participation..." These barriers include attitudes, opinions and perceptions preventing participation in sport.

- Personal attitudes of persons with disability
- Attitudes of non-disabled people

All individuals benefit from regular physical activity and children with special needs especially gain from these physical, mental and social benefits of being active. Once children see improvements in muscle strength, coordination, and flexibility and experience better balance, motor skills and body awareness, they will have positive changes towards sports. It has been found that children with a disability choose to play sport for a number of reasons including

- to improve and learn new skills,
- to have fun,
- stay fit
- be physically challenged

While children often choose easier tasks to obtain rewards, doing this decreases the child's enjoyment of and intrinsic motivation for the activity. So, the selection of a challenging activity may be a strong influence in children's participation in sport. However, it may be possible that if the challenge becomes too great, the intrinsic motivation to participate may decrease. Because the level of challenge frequently increases more quickly for the disabled it is likely that this is a strong factor in participation. Therefore, it is better to let the child initially participate with her/his own disability group. Coaches are also often afraid to 'push' individuals with a disability too far and causing 'harm' to the individuals. In contrast to intrinsic motivation, extrinsic motivation involves motivators from the environment (e.g. friends, parents and coaches).





Certainly, amongst children it can be expected that a huge part of their reasoning for participation in sport is to make friends. Children with strong peer relationships are more self-motivated in sport and, in addition, enjoy themselves more. It has also been found that a greater competence in sport coincides with stronger peer relationships. A PE teacher in UK revealed that her pupils “actively encourage and support the pupils with disabilities” in sport and that those pupils “grow in confidence as a result of their involvement”. Disability in sport is, evidently, becoming more accepted than it ever has been.

**I. Tick the correct options**

1. Development of Gross Motor and Fine Motor skills are benefits which are part of :
  - a. Physical benefits
  - b. Mental benefits
  - c. Social benefits
  - d. Emotional benefits
2. Graded activities as strategy for effective inclusive physical education program includes:
  - a. Complex to simple activities
  - b. Simple to complex activities
  - c. Challenging abilities
  - d. None of the above
3. Which of the following is least preferred strategy for making physical activities accessible:
  - a. Appropriate Space
  - b. Age appropriate Equipments
  - c. Trained coaches and scientific resources
  - d. Exclusive training venue for specific disability sports
  - e. Common venue with accessibility for multiple disability sports

**II. Answer the following questions briefly.**

1. How will you communicate with a classmate suffering from cognitive disability?



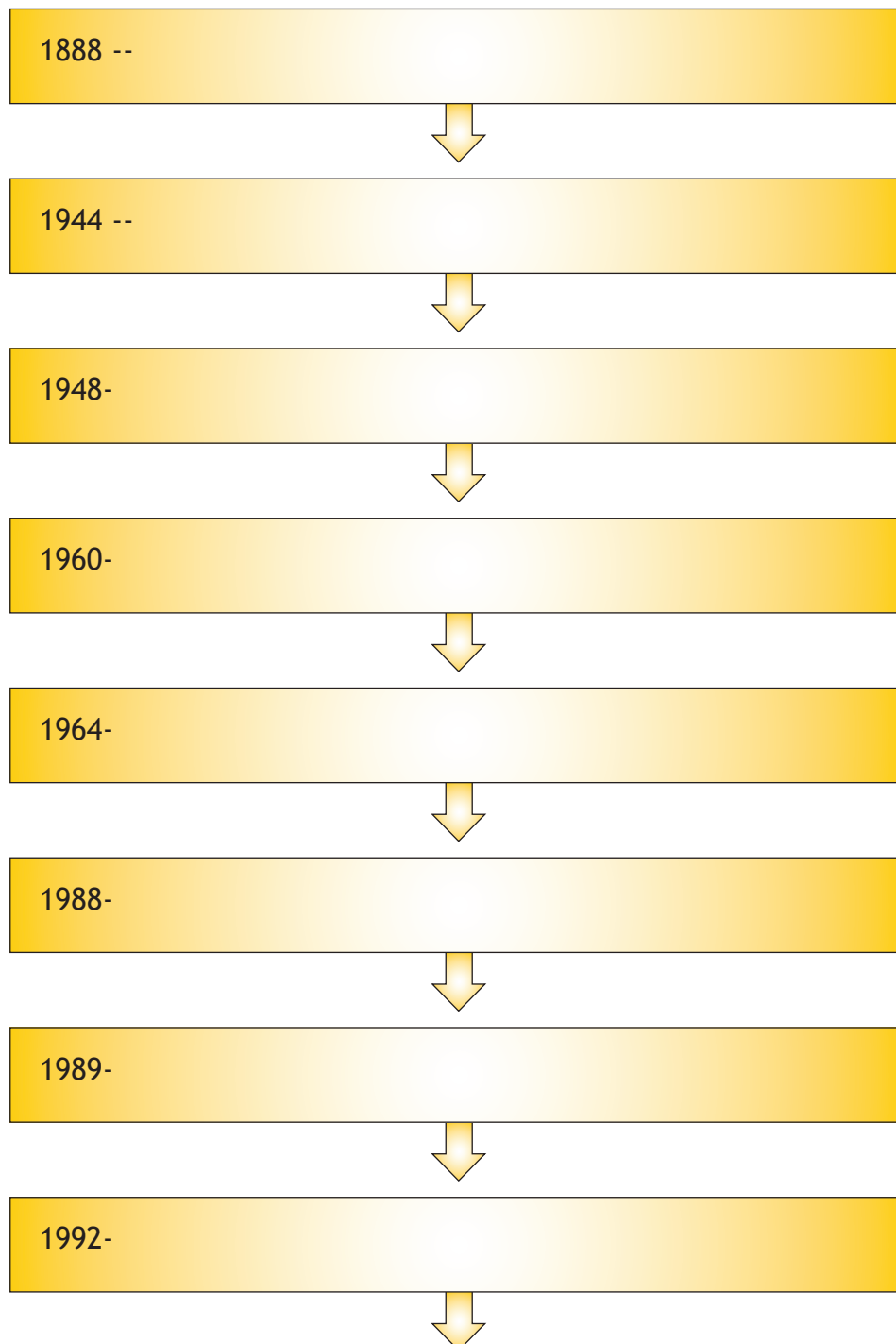


2. In what ways does participation in sports and games benefit a person with disability?

**III. Answer the following question in 150-200 words.**

1. How will you motivate a classmate with disability to take part in games and sports?

**IV Complete the flowchart outlining the history of Sports for People With Special Needs and Paralympics.**





## V. Case Study Question

1. In relation to the pictures, answer the following questions.



- What is the mission of the first organisation?
- What is the Motto of the first organisation?
- Until 1965 the games in the second picture were known as \_\_\_\_\_
- Second picture games are conducted after every \_\_\_\_\_years.

## VI. Art Integration - CREATING ZERO COST MATERIAL FOR CWSN

CWSN are at times excluded from PE activities. As a result, they are likely to have poorer health, less education, and have to deal with greater inequalities than their peers.

One of your classmates is a child with special needs. You would like to include her/him in your Sports/Games.

Using the available material, design equipment for her/him that is safe and usable so that she/he is able to participate in Physical Exercise.

### Weblinks

[https://en.wikipedia.org/wiki/Adapted\\_physical\\_education](https://en.wikipedia.org/wiki/Adapted_physical_education)

<https://blog.firstcrayon.com/the-essential-guide-to-special-needs-education-in-india-47769fc4d234>

<http://www.ymcacollege.ac.in/special-school.html>



# UNIT V SPORTS AND NUTRITION

## Overview

- ◆ Concept of Balanced Diet and Nutrition
- ◆ Macro and Micro Nutrients: Food sources and functions
- ◆ Nutritive and Non- Nutritive Components of Diet
- ◆ Eating for Weight control - A Healthy Weight, The Pitfalls of Dieting, Food Intolerance and Food Myths
- ◆ Importance of Diet in Sports-Pre, During and Post competition Requirements

## LEARNING OUTCOMES

*After studying this unit, students will be able to:*

- ◆ understand the concept of balanced diet and nutrition
- ◆ classify Nutritive and Non-Nutritive components of Diet
- ◆ identify the ways to maintain healthy weight
- ◆ know about foods commonly causing food intolerance
- ◆ recognize the pitfalls of dieting and food myths
- ◆ understand the importance of nutrition in sports
- ◆ comprehend the dietary requirements in pre-, during and post-competitions.

**Discussion: Find out and complete the worksheet groups.**

Vitamins	Benefits of Vitamins	Sources
A	Needed for healthy eyes, skin, nervous, respiratory, digestive systems	
B		
C		
D	Needed for bones	
E	Needed for restoration of cell membrane and body structure	
K		





## 5.1 Balanced Diet

Depending on the presence of nutrients in different food stuffs, foods have been divided into different **food groups**. These are:

1. **Cereals and Millets:** Cereals and millets include foods like wheat, rice, jowar, bajra, ragi etc. Majorly provide carbohydrates. Cereals also provide protein (protein quality can be improved by consuming it with pulses), B-vitamins, iron (bajra) and calcium (ragi).
2. **Pulses:** Pulses include all whole and washed dhals like red gram (lobia), Bengal gram (chana), lentils, green gram (moong) etc. Pulses provide protein (protein quality is improved by combining it with cereals). They are also a fair source of carbohydrates and B-vitamins especially thiamine and niacin. Whole pulses also provide iron and fibre; sprouts provide vitamin C.
3. **Milk and Milk Products:** This group includes foods like milk, curd, cheese, paneer, khoa etc. The major nutrient it gives is good quality protein, besides providing other nutrients like carbohydrates, fat (whole milk), calcium and riboflavin. Milk and milk products are generally sources of all nutrients except iron and vitamin C.
4. **Meat and Meat Products:** These include foods like meat, fish, chicken, egg and products made with these. This group is a major source of good quality protein. Other nutrients supplied by this group are B-vitamins, retinol (liver) and calcium (fish). Eggs particularly are good sources of most nutrients.
5. **Nuts and Oil Seeds:** Nuts and oil seeds eg., groundnuts, almonds, cashew nuts, til seeds, pistachio etc. are a good source of fat. They also provide protein, B-vitamins, calcium and other minerals.
6. **Green Leafy Vegetables (GLVs):** These include vegetables like mustard (sarson), bathua, fenugreek leaves (methi), spinach (palak). Green leafy vegetables are a good source of carotene (vitamin A, B-vitamins (especially riboflavin and folic acid), iron (especially sarson and bathua) and fibre. They are also a source of calcium, but presence of oxalates in GLVs bind calcium and make most of it unavailable for absorption and utilisation. Fresh GLVs provide vitamin C.
7. **Root Vegetables:** These include potato, colocasia, sweet potato, yam etc. Major nutrient supplied by root vegetables is carbohydrate. Carotene is provided only by yellow yam.
8. **Other Vegetables:** All other vegetables like brinjal, ladyfinger (okra), beans, cauliflower etc. provide fibre, vitamins, some amount of minerals.



9. **Fruits:** Wide variety of fruits is available in the market. Different fruits are sources of different nutrients; hence a combination of various fruits should be included in the balanced diet. Fruits like mangoes, apricots, oranges, papaya are rich in carotene, citrus fruits like orange, mausambi, amla and guavas are good sources of vitamin C, dried fruits like dates and raisins are rich in iron. Fibre is provided by most fruits.
10. **Sugar and Jaggery:** These are simply carbohydrates. Jaggery also has iron.
11. **Fats and Oils:** Include ghee, oil, butter etc. are a rich source of fat. Vitamin D also is provided by butter/fortified oils.

Food groups can also be classified according to their functions:

**Group 1. Energy giving foods-** This category includes foods rich in carbohydrate and fat

1. Cereals and roots and tubers
2. Sugar and jaggery
3. Fats and oils

**Group 2. Body building group** - this category includes foods rich in protein

1. Milk and milk products
2. Meat and meat products, fish, egg or poultry
3. Pulses
4. Nuts and oilseeds

**Group 3. Protective or regulatory foods** - This group include foods providing vitamins and minerals

I. Fruits-

- (a) yellow and orange fruits (mango, papaya)
- (b) citrus fruits (lemon, orange, mausambi)
- (c) others (apple, banana etc.)

II. Vegetables

- (a) Green leafy vegetables (spinach, mustard, fenugreek etc.)
- (b) Yellow and orange vegetables (carrot, pumpkin)
- (c) Others (beans, okra, cauliflower etc.)
- (d) Root vegetables- potatoes and yam (arvi) are rich in carbohydrates







It is important to consume a balanced diet in order to get all the nutrients in right amounts and right proportions. This means that in any given meal, foods from all the food groups should be included in such a manner that all the nutrients are supplied in adequate quantities. One has to ensure that each and every meal includes foods from the energy- giving, body building and protective/regulatory groups. eg., For breakfast include one source from energy giving foods (bread- 2 slices; jam), one food from body building foods (egg for non-vegetarians or paneer or sprouts for vegetarians along with milk) and any one or two foods from protective group (fruit/ fruit juice). Similarly, for lunch and dinner different foods from these food groups can be chosen in a variety of combinations. This way, the diet would provide all essential nutrients and would become balanced.

Thus, a balanced diet can be defined as one which contains different types of foods in such quantities and proportions that the need for calories, minerals, vitamins and other nutrients is adequately met and a small provision is made for extra nutrients to withstand the period of leanness ie., when adequate food or a particular nutrient is not consumed.

Moreover, the action and interaction of the nutrients should be considered. Foods promoting absorption of certain nutrients or hindering absorption of nutrients should also be kept in mind. eg., consuming tea along with meals hampers the absorption of iron while taking sources of vitamin C with meals increases the absorption of iron. Imbalance of nutrients sometimes does not allow proper absorption and utilisation of another nutrient. eg., calcium is needed for building of bones and teeth and phosphorus is also needed for the same. Excess amount of phosphorus in the diet does not allow body to utilise calcium properly and affects bone and teeth formation. Therefore, these two nutrients should be supplied in correct proportions and adequate amounts.

### 5.1.1 NUTRITION

It is well known that food is essential for survival. Food refers to any substance that nourishes our body or in other words, it is anything that we can digest, absorb and utilize, for various physiological functions of the body including growth and development. Since the time of conception in the mother's womb, providing energy for our sustenance, regulating activities of the body and repairing day to day wear and tear, the role of food is enormous. Food provides nutrition to the body. Nutrition is, thus, the science of food and a study of the process that includes everything that happens to food from the time it is eaten until it is used for various functions in the body. It is the scientific study of foods and the nutrients therein; their action



and interaction and balance, in health and diseases. It is the study of ingestion, digestion, absorption, utilization and assimilation of nutrients present in food.

When we see any food product we recognize it as chapatti, rice, dhal, ladyfinger, apple etc. but as the food enters our mouth it starts breaking down and our body identifies it as different chemicals present therein. These chemical substances which are present in food are called nutrients. Nutrients of physiological importance are carbohydrates, proteins, fats, vitamins, minerals, water and fibre (roughage). Different food stuffs contain these nutrients in different amounts and proportions and our body needs each nutrient in a certain specific amount for various physiological functions and overall growth and development.

Nutrients, as mentioned earlier, are those chemical substances in foods that are required by the body for energy, growth and maintenance.

**I. Tick the correct option.**

1. In which of the following food groups "Sugar and jaggery" come under?
  - a. Protective or regulatory foods
  - b. **Energy giving foods**
  - c. Body building foods
  - d. Immunity boosters foods
2. Nutrition is \_\_\_\_\_ Substance.
  - a. Biological
  - b. **Chemical**
  - c. Energy
  - d. Mechanical

**II. Answer the following questions briefly.**

1. Define Nutrition.
2. Write down the importance of Balance diet.

**III. Answer the following questions in 150-200 words.**

1. What do you understand by a balanced diet?





## 5.2 Macro and Micro Nutrients: Food sources and functions

Nutrients can be broadly classified as macro- and micro-nutrients depending upon their daily requirements by the body. Some nutrients are needed in larger amounts, these are called macronutrients. Nutrients like Carbohydrates, proteins and fats along with water are macronutrients. Other nutrients like vitamins and minerals are required in small amounts and are called micronutrients. Although these are required in smaller amounts but they are all equally essential for our health. Each of these nutrients plays a significant role in the body.

**Macronutrients** are required by the body in relatively large amounts. Carbohydrates, proteins and fats are macronutrients and are also called 'proximate principles' because they form the main bulk of the diet. In Indian meals, they contribute to the total energy intake in the following proportion: carbohydrates: 55-60%; protein: 10-15% and fats: 20-30%. Water does not provide energy but is a vital nutrient required in large quantity for functioning of metabolic processes in the body and various regulatory functions. Therefore, it is also considered a macronutrient.

### 5.2.1 CARBOHYDRATES

Carbohydrates are organic compounds made up of Carbon, Hydrogen and Oxygen. Carbohydrates are a major source of energy and provide 4kcal per gram. Carbohydrates are found in abundance in plant foods. There are three types of carbohydrates- monosaccharides, disaccharides and polysaccharides. Monosaccharides are simple single units of sugars like glucose, fructose and galactose.

**Disaccharides** are when two monosaccharides are combined together; these are maltose (glucose + glucose), lactose (glucose + galactose) and sucrose (glucose + fructose). Simple sugars (mono and disaccharides) are found in fruits (in the form of sucrose, glucose and fructose), milk (in the form of lactose) and sweets that are produced commercially and added to foods to sweeten, prevent spoilage, or improve structure and texture.

**Polysaccharides** are more than two units of monosaccharides joined together. These are starches and fibre (cellulose). These are also called complex sugars and are found in whole grain cereals, rice, oats, potatoes, bread, legumes, corn and flour.

All these carbohydrates have to be broken down to the smallest unit, i.e., glucose to get absorbed and utilized in the body. However, cellulose and other large carbohydrate molecules cannot be digested in the human digestive tract, and are termed as fibre or non-available carbohydrates. Sugars and starches can be digested and utilized



for various bodily functions, hence are known as available carbohydrates. Diets rich in complex carbohydrates are healthier than low-fibre diets based on refined and processed food.

Sources of carbohydrates are rice, cereal grains, breads, pasta, milk, fruit, root vegetables, sugar and products that are sweetened like jams, jellies etc., honey, and jaggery. Fibre is present in whole grain cereals (whole wheat atta), whole pulses, green leafy vegetables, peas, carrot, beans and other vegetables, fruits like guava, apple, orange, pineapple etc.

### Do you Know?

#### Carbohydrates are essential in the diet to prevent ketosis

Diets for weight-loss usually recommend avoiding carbohydrates. It is however, essential to have at least 50-100g of carbohydrate per day for complete oxidation of fat and avoidance of excessive production of ketone bodies. Therefore, according ICMR (2020) RDA/minimum requirement for carbohydrate is 130 g/day for adults and children, based on the amount of glucose used by carbohydrate-dependent tissues, such as the brain and erythrocytes. Inadequate supply of carbohydrates causes break down of body fat reserves for energy. This not only supplies energy but also produces ketone bodies. Some ketone bodies are used by muscle and other tissues for energy, but when produced in excess they accumulate in blood and cause ketosis (disturbance of normal acid- base balance). This condition is generally seen in Diabetics and is a life- threatening situation.

#### Summary - Macronutrients, their functions and sources

Nutrient	Function	Sources
Carbohydrates	<ul style="list-style-type: none"> <li>• Carbohydrates provide energy needed by the body (1g provides 4 Kcal);</li> <li>• Carbohydrates are main source of energy for the nervous system, brain and red blood cells;</li> <li>• These spare proteins for their important functions (if enough carbohydrates are not available, proteins are used for energy-giving);</li> <li>• Carbohydrates enable proper utilization of fat by providing substrates for fat metabolism.</li> </ul>	Fruits, cereal grains, milk, sugar, rice, root vegetables, pasta, breads





Roughage	<ul style="list-style-type: none"> <li>• Dietary fibre or roughage provides feeling of fullness i.e., one does not feel hungry soon after having a meal;</li> <li>• It provides bulk to the diet, helps in smooth elimination of stool or faeces;</li> <li>• Helps prevents diseases like cancer, diabetes and heart disease, has cholesterol lowering effect;</li> <li>• It is a negligible source of energy hence, can be eaten for weight control.</li> </ul>	Whole grain cereals (whole wheat flour, dalia, oats etc.), whole pulses, Green leafy vegetables (GLVs), peas, beans and other vegetables, fruits like guava, orange, pineapple etc
Proteins	<ul style="list-style-type: none"> <li>• Proteins build and repair body cells</li> <li>• Proteins form part of various enzymes, hormones, and antibodies</li> <li>• Also provide energy (4 Kcal/g)</li> </ul>	Milk and milk products, fish, eggs, poultry, meat, legumes and grains
Fats	<ul style="list-style-type: none"> <li>• Fats provide energy (9kcal/g);</li> <li>• Fats help transporting fat-soluble vitamins;</li> <li>• Fats are part of cell membranes, membranes around nerves, hormones, bile (for fat digestion)</li> </ul>	Visible Sources- vegetable oils, desi ghee, vanaspati ghee, butter, margarine, Invisible Sources- Cheese Meat, poultry, fish, milk and milk products, nuts and seeds

### 5.2.2 PROTEINS

#### List of Essential and Non-Essential Amino Acids

Essential	Nonessential
Histidine	Alanine
Isoleucine	Arginine
Leucine	Asparagine
Lysine	Aspartate
Methionine	Cysteine
Phenylalanine	Glutamate
Threonine	Glutamine
Tryptophan	Glycine
Valine	Proline
	Serine
	Tyrosine



Proteins are organic compounds containing nitrogen, besides, carbon, oxygen and hydrogen. Protein molecules have a complex structure, and are made up of nitrogen containing amino acids. Amino acids are linked together in chains to make different type of proteins in the body. From hair to nails, muscles to skin, organs to blood, hormones to enzymes, protein is a major structural and functional component of our body. There are around 20 amino acids joined together in varying sequences to form different kinds of proteins. There are nine amino acids which cannot be synthesized by the body; these are called Essential Amino Acids (EAA). These have to be supplied in the diet. Others are non- essential amino acids as these can be synthesized in the body.

Depending on the availability of these essential amino acids in foods, they are classified as complete protein foods, partially complete protein foods and incomplete protein foods. Complete protein foods are those which contain all essential amino acids in adequate amounts. These food sources include foods from animal sources like eggs, milk and milk products, meat and meat products and a plant source, soybean, that contains all essential amino acids. Protein quality is determined by the presence of complete protein foods in the diet; it improves the absorption and utilization of protein in the body. Partially complete protein foods are those which are lacking in any one essential amino acid e.g., cereals and pulses. Cereals lack lysine and pulses lack methionine. To improve the protein quality, cereals and pulses can be taken together in a meal or can be combined with sources of complete protein foods. Incomplete proteins are those which are lacking in more than one EAA. An example of this protein is maize protein.

Protein requirement for Indian adults is 0.83 g/kg body weight (according to RDA 2020; ICMR/NIN). Thus, for a man weighing 60 kg, the protein requirement would be 54 g/day and for a woman weighing 55kg the protein requirement will be 46 g/day. In terms of percentage of total energy intake, protein intake should be between 10-15% of total energy consumed. In no case, it should exceed 35% of total energy intake. Protein requirement, however, may increase to up to 2 g/ kg body weight during sports and exercise depending upon the type of sports and duration and intensity of training. Too little, or, excess intake of protein can have health implications, hence proteins should be consumed as required and recommended.





### 5.2.3 FATS (LIPIDS)

Lipids or Dietary Fats is a broader term used for both oils and fats. Oils are basically liquid at room temperature and fats are solid at room temperature. It is the presence of different types of fatty acids which make them liquid or solid.

Fatty acids are the building blocks of fats and oils. Fatty acids are classified as Saturated or Unsaturated Fats depending upon the presence of double bond in their chemical structure. Saturated fatty acids (SFA) contain no double bonds, monounsaturated fatty acids (MUFA) contain one, and polyunsaturated fatty acids (PUFA) contain more than one double bond. When the percentage of saturated fatty acids is higher, the fat is solid at room temperature and when the percentage of unsaturated fatty acids (MUFA or PUFA) is higher the lipid is liquid at room temperature and is called oil.

Saturated fats which are also called as animal fats are associated with increased health risks. They can increase risk of heart disease by increasing total and LDL (“bad”) cholesterol. It has been recommended that the intake of saturated fats be kept less than 7% of total calories. Desi ghee, butter, cheese, cream, red meats, baked products, and other full-fat dairy products are the main sources of saturated fats in most diets. Coconut and palm oils also contain saturated fats.

Monounsaturated and polyunsaturated fatty acids are unsaturated fats. When they replace saturated fats in the diet, they help to reduce blood cholesterol levels and thus lower the risk of heart disease. Canola, olive, peanut, palmolein, rice bran and til (sesame) oils and other nuts like walnuts are rich in monounsaturated fats. Sources of PUFA include vegetable oils, mustard, soybean, corn, safflower and sunflower oils and flaxseed.

Dietary fat can be attained from visible as well as invisible sources. Visible sources are ghee, butter, cooking oil etc. while invisible sources include nuts, cereals, pulses, milk, eggs, meat etc. Invisible fat contributes significantly to the total fat and essential fatty acid content of diet depending on the food stuffs present in the diet. The total fat (visible + invisible) should provide between 15-30% of total calories required and contribution of visible fat should be restricted to 20-30g per day depending upon the physical activity levels of the individual.





### Do you know?

It has been recommended that total fat intake should be 20-30% of calories for adults to meet daily energy and nutritional needs while minimizing risk of chronic diseases. The intake of saturated fats should be less than 7% of calories, cholesterol should be less than 300 mg/day, and trans fatty acid consumption should be as low as possible. Consumption of certain fatty acids (MUFA and PUFA) are encouraged because of their positive health effects, like oils from foods such as vegetable oils, nuts, rice bran and fish because of their healthy attributes. In view of this, an ideal quality fat for good health is one which maintains a balance between SFA, MUFA and PUFA. This can be maintained by combined use of various oils for example, mustard oil with sunflower oil, or safflower oil with palm oil etc.

Cholesterol is a fat-like substance which is synthesized in the body. It is necessary in many physiological processes such as: it is a component of cell membranes, it is required in the production of bile acids (which aid in food digestion), and in the production of sex hormones. An excess of cholesterol in the blood, however, can lead to deposits in the walls of blood vessels and reduce blood flow to major arteries, which can lead to a heart attack.

Dietary cholesterol is found only in animal foods such as egg yolks, butter, organ meats, beef and chicken. Vegetable oils are cholesterol-free. Excess intake of dietary cholesterol increases blood cholesterol levels, but not as much as saturated and trans-fats do.

Trans-fatty acids are basically produced by the process called hydrogenation. It is the process of adding hydrogen molecules directly to unsaturated fatty acids such as those found in vegetable oil to make it saturated or solid. Hydrogenated oils contribute important textural and stability properties in food.

Trans-fatty acids occur naturally in beef, lamb, and dairy products. However, the main sources of trans-fats are foods such as cookies, biscuits, mixtures, namkeens, pastries and other fried foods. Trans-fatty acids are similar to saturated fats and dietary cholesterol with regard to their effect on blood low-density lipoprotein (LDL - which is a "harmful" or "bad") cholesterol. Trans-fats may also lower high-density lipoprotein (HDL - which is a good) cholesterol.

### 5.2.4 WATER

Water is essential for life. Water is an inorganic compound made up of hydrogen and oxygen. Water is a major component of our body and it makes up to 60% of the total weight of an individual. It is the medium of all body fluids including blood, saliva, digestive juices, urine, faeces, sweat and perspiration.







Water plays an important role in the regulation of body temperature. It is also a universal solvent. Water bathes the body cells and keeps them moist. Hence, it acts as a lubricant. It is also an important lubricant for the joints.

Our body gets water mainly by ingestion of water in the form of liquids; water taken as such or in the form of beverages like tea, coffee, fruit juices and aerated drinks. In other foods like vegetables, fruits, milk, cereals and pulses, water is present in invisible form. It is important that clean, safe and wholesome water is consumed in order to avoid water-borne diseases such as diarrhoea, dysentery and cholera.

### Do you know?

Each red blood cell contains haemoglobin which is the iron-containing protein that transports oxygen from the lungs to other parts of the body. In haemoglobin, each subunit contains a heme group; each heme group contains an iron atom that is able to bind to one oxygen molecules.

## 5.2.5 VITAMIN

Vitamins are the chemicals which our body needs in small amounts to function properly. They work in a variety of ways, mostly as 'helpers' eg., many of the B-vitamins help the body use protein, fats, and carbohydrates.

Vitamins are divided into two categories:

1. **Water-soluble vitamins** include all the B vitamins and vitamin C. The amount of water-soluble vitamins that body doesn't use passes through the kidneys and leaves the body as urine or stool.

The body needs water-soluble vitamins in frequent, small doses, and they are unlikely to reach toxic levels.

2. **Fat-soluble vitamins** include vitamins A, D, E, and K. Fat-soluble vitamins are stored in the body cells and are not passed out of the body as easily as water-soluble vitamins. They are more likely to reach toxic levels if a person takes in too much of these vitamins.

The table-2.i and 2.ii lists the water-soluble and fat-soluble vitamins; their functions and their sources in the foods we eat.



**Table 2.i - Water-soluble vitamins**

Nutrient	Important Functions	Sources
Thiamine (vitamin B1)	<ul style="list-style-type: none"> <li>• Works as coenzyme- (Thiamine pyrophosphate- TPP) needed for energy metabolism;</li> <li>• important for nerve function;</li> <li>• needed for DNA and RNA synthesis</li> </ul>	Whole-grain cereals, pulses, peanuts and seeds, mushrooms, green peas, beans, egg yolk and meat
Riboflavin (vitamin B2)	<ul style="list-style-type: none"> <li>• Act as two coenzymes- Flavin mononucleotide (FMN) and Flavin adenine dinucleotide (FAD) needed for energy metabolism;</li> <li>• important for normal vision and skin health</li> </ul>	Milk and milk products; animal products like eggs, liver, kidney; green leafy vegetables eg., broccoli; whole-grain cereals; legumes
Niacin (vitamin B3)	<ul style="list-style-type: none"> <li>• Part of an coenzymes- Nicotinamide adenine dinucleotide (NAD) and nicotinamide adenine dinucleotide phosphate (NADP) needed for energy metabolism;</li> <li>• important for nervous system, digestive system, and skin</li> </ul>	whole-grain cereals, pulses, meat, poultry, fish, vegetables (especially mushrooms). Eggs and milk and milk products lack niacin but are rich sources of EAA- tryptophan which can be converted to niacin in the body when required. 60 mg of tryptophan can be converted to provide 1 mg niacin.
Vitamin B6 (Pyridoxal, pyridoxine and pyridoxamine)	<ul style="list-style-type: none"> <li>• Part of coenzyme pyridoxal phosphate needed for protein and amino acid metabolism and also involved in activity of many enzymes required for carbohydrate, fat and protein metabolism.</li> <li>• It also helps in making white blood cells and heme in haemoglobin.</li> </ul>	Meat, Poultry, fish, Nuts, sunflower seeds, pulses, whole grains, spinach, bananas, potatoes.





Biotin	<ul style="list-style-type: none"><li>• Functions as coenzyme in metabolic reactions.</li></ul>	Widespread in foods like organ meats, such as liver or kidney; egg yolk; nuts, such as almonds, peanuts, and walnuts; soybeans and other legumes; whole grains; bananas; cauliflower, mushrooms; also produced in intestinal tract by bacteria
Pantothenic acid	<ul style="list-style-type: none"><li>• Part of co-enzyme A (CoA) needed for energy metabolism</li></ul>	Widespread in foods: milk, meat, peanuts, eggs
Folic acid / Folate	<ul style="list-style-type: none"><li>• Part of an enzyme needed for making DNA and new cells, especially red blood cells,</li><li>• formation of neurotransmitters</li><li>• needed for maintenance of normal blood pressure and reducing risk of cancer</li></ul>	Green leafy vegetables particularly spinach, pulses, oranges and orange juice, and liver. Other vegetables like cabbage, cauliflower, broccoli are also good sources
Cobalamin (vitamin B12)	<ul style="list-style-type: none"><li>• Part of two coenzymes methyl cobalamin and 5- deoxy adenosyl cobalamin, needed for making new cells;</li><li>• important to nerve function</li></ul>	Meat, poultry, fish, seafood, eggs, milk and milk products; not found in plant foods
Ascorbic acid (vitamin C)	<ul style="list-style-type: none"><li>• Antioxidant, role in collagen formation hence in wound healing, part of an enzyme needed for protein metabolism;</li><li>• important for immune system, helps in iron absorption</li></ul>	Found in fruits and vegetables, especially citrus fruits, fresh vegetables in the cabbage family, sprouts, amla and guava

### Fat-soluble vitamins

Fat-soluble vitamins are stored in the body's cells and are not excreted as easily as water-soluble vitamins. Intake of high amounts of fat-soluble vitamins could become toxic. A balanced diet usually provides enough fat-soluble vitamins.



**Table 2.ii - Fat-soluble vitamins**

Nutrient	Important Functions	Sources
Vitamin A (Retinol and its precursor*, beta-carotene)  *A precursor is converted by the body to the vitamin.	<ul style="list-style-type: none"> <li>• Needed for vision in dim light, healthy skin and mucous membranes, growth of skeletal and soft tissues, immune system health</li> </ul>	Vitamin A from animal sources (retinol): milk, cheese, cream, butter, egg yolk, liver, Beta-carotene (from plant sources):, dark green leafy vegetables; red and yellow fruits and vegetables (carrots, pumpkin, mangoes, papaya)
Vitamin D	<ul style="list-style-type: none"> <li>• Needed for proper absorption of calcium and phosphorus;</li> <li>• deposition of calcium and phosphorus in bones</li> </ul>	Egg yolks, liver, fatty fish, fortified foods. When exposed to sunlight, the skin can make vitamin D.
Vitamin E	<ul style="list-style-type: none"> <li>• Antioxidant;</li> <li>• protects cell walls</li> </ul>	Polyunsaturated plant oils (soybean, corn, cottonseed, safflower); green leafy vegetables; wheat germ; whole-grain products; liver; egg yolks; nuts and seeds
Vitamin K	Needed for proper blood clotting	green leafy vegetables and cabbage; milk; also produced in intestinal tract by bacteria

### 5.2.6 MINERALS

Minerals are inorganic elements which are required by the body needs for various physiological functions. There are minerals required in larger amounts called macro-minerals and those required in smaller amounts are called micro-minerals (trace minerals).

Tables 3.i and 3.ii list important macro- and micro-minerals, their functions and their sources in the foods we eat.



**Table 3.i - Macro-minerals**

Mineral	Important Functions	Sources
Sodium	<ul style="list-style-type: none"><li>• Needed for proper fluid balance, regulating alkalinity and acidity of body fluids, nerve transmission, and muscle contraction</li></ul>	Table salt, soy sauce; large amounts in processed foods; small amounts in milk, breads, green leafy vegetables, and unprocessed meats
Chloride	<ul style="list-style-type: none"><li>• Needed for proper fluid balance, stomach acid</li></ul>	Table salt, soya sauce; large amounts in processed foods; small amounts in milk, meats, breads, and vegetables
Potassium	<ul style="list-style-type: none"><li>• Needed for proper fluid balance, nerve transmission, and muscle contraction</li></ul>	Meats, milk, fresh fruits and vegetables, whole grains, pulses
Calcium	<ul style="list-style-type: none"><li>• Important for healthy bones and teeth;</li><li>• helps muscles relax and contract;</li><li>• important in nerve functioning, blood clotting, blood pressure regulation, immune system health</li></ul>	Milk and milk products; fish with bones (eg., sardines); fortified soya milk; greens (broccoli, mustard leaves); pulses
Phosphorus	<ul style="list-style-type: none"><li>• Important for healthy bones and teeth; found in every cell;</li><li>• part of the system that maintains acid-base balance</li></ul>	Meat, fish, poultry, eggs, milk, processed foods
Magnesium	<ul style="list-style-type: none"><li>• Found in bones;</li><li>• needed for making protein, muscle contraction, nerve transmission, immune system health</li></ul>	Nuts and seeds; pulses; leafy, green vegetables; seafood; chocolate
Sulphur	Found in protein molecules	Occurs in foods as part of protein in meats, poultry, fish, eggs, milk, pulses, nuts



## Trace minerals (micro-minerals)

The body needs trace minerals in very small amounts. Although iron is considered to be a trace mineral, the amount needed is somewhat more than for other micro-minerals.

*Table 3.ii - Trace minerals*

Mineral	Important Functions	Sources
Iron	<ul style="list-style-type: none"> <li>Iron is a mineral found in every cell of the body. Iron is considered an essential mineral because it is found in red blood cells as part of haemoglobin that carries oxygen to every cell in the body;</li> <li>part of myoglobin needed for muscle contraction,</li> <li>needed for energy metabolism, hence crucial in helping perform physical work</li> </ul>	Organ meats; red meats; fish; poultry; egg yolks; whole pulses and whole grain cereals; dried fruits; dark green leafy vegetables (mustard greens, bathua); iron-enriched breads and cereals; and fortified cereals
Zinc	<ul style="list-style-type: none"> <li>Part of many enzymes needed for synthesizing protein and genetic material;</li> <li>has a function in taste perception, wound healing, normal foetal development, production of sperm, normal growth and sexual maturation,</li> <li>important for immune system</li> </ul>	Meats, fish, poultry, whole grains, vegetables
Iodine	<ul style="list-style-type: none"> <li>Found in thyroid hormone, which helps regulate growth, development, and metabolism</li> </ul>	Seafood, foods grown in iodine-rich soil, iodized salt, bread, dairy products
Selenium	<ul style="list-style-type: none"> <li>Antioxidant</li> </ul>	Meats, seafood, grains
Copper	<ul style="list-style-type: none"> <li>Part of many enzymes;</li> <li>needed for iron metabolism</li> </ul>	Pulses, nuts and seeds, whole grains, organ meats, drinking water





Manganese	<ul style="list-style-type: none"> <li>Part of many enzymes</li> </ul>	Widespread in foods, especially plant foods
Fluoride	<ul style="list-style-type: none"> <li>Involved in formation of bones and teeth;</li> <li>helps prevent tooth decay</li> </ul>	Drinking water (either fluoridated or naturally containing fluoride), fish, and most teas
Chromium	<ul style="list-style-type: none"> <li>Works closely with insulin to regulate blood sugar (glucose) levels</li> </ul>	Organ meats especially liver, whole grains, nuts, cheese
Molybdenum	<ul style="list-style-type: none"> <li>Part of some enzymes</li> </ul>	Pulses, breads and grains; green leafy vegetables, milk; liver

Other trace nutrients known to be essential in tiny amounts include nickel, silicon, vanadium, and cobalt.

### Extension Activity

Working in groups, prepare diet plans for the following:-

Name of the Activity.	
Diet plan for building muscle for a vegetarian athlete.	
Diet plan for building muscle for a non-vegetarian athlete.	
Eating strategies for a person who wants to lose 15kg.	
Eating strategies for a person who wants to gain 10kg.	

#### I. Tick the correct option.

1. Which is NOT a Micronutrient?
  - a. Macro Minerals
  - b. Trace Minerals
  - c. Vitamins
  - d. Protein





2. Which of the following is a water-soluble vitamin?
  - a. Vitamin A
  - b. **Vitamin B**
  - c. Vitamin D
  - d. Vitamin K
3. Iron is a part of
  - a. **trace minerals**
  - b. macro minerals
  - c. vitamins
  - d. carbohydrate
4. Fats and oils come under:
  - a. **protective or regulatory foods**
  - b. **energy giving foods**
  - c. **bodybuilding group**
  - d. **routine foods**
5. 1 gram of fat provides
  - a. 3 kcal
  - b. 4 Kcal
  - c. 5 Kcal
  - d. **9 Kcal**

**II. Answer the following questions briefly.**

1. What are macronutrients?
2. Explain the importance of fluid intake during a competition.
3. Write the source of 3 micro and 3 macro minerals.
4. What should be the basic nutrient in a weightlifter's diet? Why?

**III. Answer the following questions in 150-200 words.**

1. Explain different types of nutrients and their sources. List the essential nutrients, their sources and functions.
2. Critically explain the use of dietary supplements in heavy dose for longer duration. Justify your answer with suitable examples.







## 5.3 Nutritive and Non-Nutritive Components of Diet

Food is the basic requirement of every individual as it helps develop our body. It provides sufficient energy for workout and helps in the growth and development of the individual. The food which we eat contains various nutrients which are essential for our body. There are large number of nutrients required in our balanced diet. Some of them are “Nutritive components” like Carbohydrates, Fats, and Proteins, whereas some other components of diet have no nutritive value.

### 5.3.1 NON-NUTRITIVE COMPONENTS OF DIET

Foods we eat contain a wide range of organic chemical compounds some of which have nutritive value as discussed above, while some have no nutritional value. Chemical compounds in foods with no specific nutritional function are called non-nutritive components of foods. Some of these components act as anti-nutritional factors like phytate while some have various benefits like phytochemicals. Some materials with no nutritional value are added to food and beverage products to make the food smell better, taste better, last longer, and/or look better. Some of the non-nutritive components are discussed below.

### 5.3.2 NON-NUTRITIVE FACTORS THAT INTERFERE WITH NUTRIENT ABSORPTION

Non-Nutritive Factors or Anti-Nutritional Factors (ANFs), that interfere with nutrient absorption, are those biological compounds present in human or animal foods that reduce nutrient utilization or food intake, thereby contributing to impaired gastrointestinal and metabolic performance. These include:

1. **Phytates** - These are abundantly found in unrefined cereals and millets. These phytates bind iron, zinc, calcium and magnesium and make these nutrients unavailable for digestion. On germination the phytate content is reduced.
2. **Tannins**- These are present in legumes, millets like bajra, ragi, spices, tamarind, tea, turmeric and in certain vegetables and fruits. Tannins interfere with absorption of iron and protein.
3. **Trypsin Inhibitors**- These inhibit the activity of trypsin in the gut and interfere with digestibility of dietary proteins and reduce their utilisation. These are present in soya bean, and white of duck egg. Heat treatment inactivates trypsin inhibitors.



4. **Oxalates-** These are present in green leafy vegetables and some legumes. These interfere with calcium absorption.
5. **Goitrogens-** These are also known as anti-thyroid substances as these interfere with iodine uptake by thyroid gland and may contribute to development of iodine deficiency disorders when iodine intakes are marginal. These are present in cabbage, cauliflower, turnips, soybean, bajra, peanuts, lentils.

### 5.3.3 BENEFICIAL NON-NUTRITIVE FACTORS OF FOODS

1. **Phytochemicals-** Phytochemicals are chemical compounds produced by plants, generally to help them thrive or thwart competitors, predators, or pathogens. The name comes from Greek phyton, meaning 'plant'. They are found in fruits, vegetables, grains, beans, and other plants. Some of these phytochemicals are believed to act as antioxidants and protect cells from damage that could lead to cancer.

Risk of cancer can be reduced by eating more colourful vegetables, fruits, and other plant foods that have certain phytochemicals in them. Some of these phytochemicals are Beta carotene and other carotenoids in yellow, red, green vegetables and fruits, flavonoids in green tea, isothiocyanates in cruciferous vegetables (cabbage, broccoli, kale, mustard greens, turnip greens, and cauliflower).



2. **Anthocyanins:** Anthocyanins give grapes, blueberries, cranberries, and raspberries their dark colour. They have been shown in the laboratory to have anti-inflammatory and anti- tumour properties.
3. **Flavonoids or isoflavones:** These are found in vegetables, fruits and grains like soybeans, chickpeas and may act a little bit like oestrogen. The oestrogen-like





compounds in these plants are called phytoestrogens. These help in lowering the risk of osteoporosis, heart disease, breast cancer and symptoms of menopause

4. **Artificial Sweeteners:** These are synthetic compounds that duplicate the taste of sugar, but contain less energy, and, therefore, are often added to diet foods and beverages. The reason is to maintain the desired taste, but reduce the caloric value. Because artificial sweeteners are considered additives, they are often regulated. Therefore, their identifications and concentrations must be determined.
5. **Preservatives:** These are compounds that have the ability to inhibit microbial growth and are often added to food and beverage products to prolong shelf life. Preservatives are considered additives, and are typically regulated. Therefore, their identification and concentration levels must be determined.
6. **Spices:** A spice is a dried seed, fruit, root, bark or vegetable substance primarily used for flavouring, colouring or preserving food. Sometimes a spice is used to hide other flavours. Spices are distinguished from herbs, which are parts of leafy green plants also used for flavouring or as garnish. A spice may have other uses, including medicinal, religious ritual, cosmetics or perfume production, or as a vegetable. For example, turmeric roots are also consumed as a vegetable and garlic as an antibiotic.
7. **Coffee:** Coffee is a brewed beverage prepared from the roasted or baked seeds of several species of *Coffea*. The two most common sources of coffee beans are *Coffea arabica*, and *Coffea canephora*. Once ripe, coffee berries are picked, processed and dried to yield the seeds inside. The seeds are then roasted to varying degrees, depending on the desired flavour, before being ground and brewed to create coffee. Coffee can have a stimulating effect on humans because of its caffeine content. It is one of the most popular drinks in the world. It can be prepared and presented in a variety of ways.

I. **Tick the correct option.**

1. Anthocyanins give colour to
  - a. roots
  - b. coffee
  - c. wheat
  - d. grapes



2. Oxalates are presents in
  - a. green leafy vegetables
  - b. bajara
  - c. nuts
  - d. spices

**II. Answer the following questions briefly.**

1. Define Non-Nutritive components of food.
2. Explain the beneficial factors of Non-Nutritive foods.

**III. Answer the following questions in 150-200 words.**

1. Explain Non-Nutritive components of Diet

## 5.4 Healthy Weight

There are numerous advantages of maintaining healthy weight. Overweight or obese people can gain these health benefits by losing some weight. For most obese or overweight people, health benefits can come with losing the first 5-10% of weight. Conditions such as Type 2 diabetes are less likely to develop if an obese person loses even 10% of their weight. With a healthy body weight there is less likelihood of having heart disease, stroke, or obesity related cancers all of which can be life-threatening and the chances of living a long and healthier life increase.

### Do you Know

Body Mass Index (BMI) is used to broadly categorize a person as underweight, normal weight, overweight, or obese based on tissue mass (muscle, fat, and bone) and height. Overweight or Obesity can lead to a variety of health conditions, such as type 2 diabetes, high blood pressure, and cardiovascular problems. On the other hand, a weight that is too low can increase the risk of malnutrition, osteoporosis, and anaemia.

Waist-to-Hip Ratio (WHR) - or the ratio between the circumference of the waist and the circumference of the hip indicates risk of obesity. Greater circumference of trunk is an indicator of high risk of hypertension and type 2 diabetes.

Girth Circumferences or circumferences of different segments of the body help to document body size and to estimate the percentage of body fat. Skinfolds determine body fat quite accurately. The skinfold technique can only be performed by a trained technician using skinfold callipers.





Bioelectrical Impedance Analysis is a commonly used method for estimating body composition, in particular body fat and muscle mass. A weak electric current is allowed to flow through the body and the voltage is measured in order to calculate impedance (resistance) of the body. It is done using a portable machine, is easy to administer and gives reliable results of body composition. Hydrostatic Weighing or Underwater weighing is known as the gold standard method to measure mass per unit volume of a living person's body.

There are various ways of assessing healthy body weight that include weight for height charts or Body Mass Index (BMI) or assessment of body fat percentage. Body Mass Index (BMI) Quetelet's Index is a key index for relating weight to height. BMI is derived by taking a person's weight in kilograms (kg) divided by his or her height in meters squared. Now-a-days, BMI is used to define normal weight, overweight, and obesity rather than the traditional height/weight charts. BMI of 30 or more for either sex indicates obesity. BMI however, does not measure how much fat mass or muscle mass is there. A very muscular person might get a high BMI without health risks. It is, therefore, less accurate in people such as body builders and pregnant women.

BMI	Classification
< 18.5	Underweight
18.5-24.9	Normal weight
25.0-29.9	Overweight
30.0-34.9	Grade I obesity
35.0-39.9	Grade II obesity
≥ 40.0	Grade III obesity

Intra-abdominal or visceral fat has a particularly strong correlation with cardiovascular disease. Women with abdominal obesity have a cardiovascular risk similar to that of men. This can be evaluated by measuring waist circumference or by calculating waist to hip ratio. A waist circumference of >102 cm (>40 inches) in men and >88 cm (>35 inches) in women or the waist-hip ratio (the circumference of the waist divided by that of the hips of >1.0 for men and >0.85 for women) are used to define central obesity. In those with a BMI under 35, intra- abdominal body fat is related to negative health outcomes independent of total body fat. Body fat percentage is total body fat expressed as a percentage of total body weight that can be assessed by methods like skinfold measurements, bioelectrical impedance, dual X-ray absorptiometry (DEXA) etc. but to measure body fat percentage,

special equipment and technical expertise is needed. There is no generally accepted definition of obesity based on total body fat. Most researchers have used >25% in men, and >32% in women, as cut-points to define obesity and higher health risks.



### 5.4.1 EATING FOR WEIGHT CONTROL

Eating right is important to stay at a healthy weight. Maintaining body weight is a balancing act, meaning that the amount of energy we consume should be expended. If we eat more calories than we burn, we gain weight. And if we eat fewer calories than we burn, we lose weight. The balance between calorie intake and calories used or expended is essential to keep the weight maintained. The best way to have energy balance is to make better choices, thus, choosing foods that are lower in fat and have fewer calories and increasing physical activity are the best ways to reduce body weight.

We can lose weight by making smart choices every day, we can develop new eating habits and preferences that will leave us feeling satisfied and winning the battle of weight loss. Remember, slow and steady wins the race. So, aim to lose one to two kilos a week to ensure healthy weight loss. Losing weight too fast can take a toll on the mind and body, making one feel sluggish, drained, and sick. Caloric restriction for weight reduction is essential to get results. Dietary modification must be accompanied by moderate amounts of exercise to get effective results in weight loss or weight maintenance. Aerobic exercise increases the daily energy expenditure and is particularly useful for long-term weight maintenance. Exercise also preserves lean body mass and partially prevents decrease in basal metabolic rate which comes when caloric intake is restricted. Additionally, most of the benefits of exercise come from improvements in body composition, overall fitness and metabolic health, not just weight loss. Risk of cardiovascular diseases, diabetes and other obesity related health problems also lower. Once stress is reduced, stress related intake of food is also curtailed. The person should be put in negative energy balance to upto 500-1000 kcal to get ideal reduction in weight of 500g - 1 kg / week. To lose weight, we have to eat fewer calories than what we expend. But that doesn't necessarily mean we have to eat less food. We can fill up our stomach while on a diet, as long as we choose foods wisely.

#### *Modifications in the diet to be made*

1. Diet should consist of foods from all food groups including, milk and milk products, meat and meat products, cereals, pulses, fruits and vegetables.
2. High-fibre foods are higher in volume and take longer to digest, which makes them filling. High-fibre foods include:
  - **Fruits and vegetables** - Eat whole fruits, salads, and green leafy vegetables of all kinds. Soups and salads can be liberally eaten. The high water and fibre content in most fresh fruits and vegetables makes them hard to overeat. Eat vegetables raw or steamed, not fried or breaded.







- **Beans** - Select beans of any kind. Add them to soups, salads, and meals.
  - **Whole grains** - High-fibre cereals, oatmeal, brown rice, whole-wheat pasta, whole-wheat or multigrain bread.
3. Add nuts to the daily diet but only in moderation.
  4. Switch to fat-free or low-fat milk and milk products. Use low-fat milk in place of cream thereby reducing the overall caloric intake of the day.
  5. Baking or grilling foods rather than frying them reduces the calorie count of foods
  6. Limit intake of high sugar foods like jams, jellies, sweetened curd etc.
  7. Cut on high cholesterol and saturated fat foods like mixtures, mathris, namkeens and bakery products. Instead choose on high fibre biscuits, or khakhra type snacks.
  8. Eat low-fat proteins like egg whites, fish, lean meats, nuts, and poultry.
  9. Serve smaller portions. One easy way to control portion size is by using small plates, bowls, and cups. This will make portions appear larger. Don't eat out of large bowls or directly from the food container or package, which makes it difficult to assess how much has been eaten. Using smaller utensils, like a teaspoon instead of tablespoon, can slow eating and help feel full sooner.
  10. Cooking meals at home allows controlling both portion size and what goes in to the food. Restaurant and packaged foods generally contain a lot more sodium, sugar, fat and calories than food cooked at home—plus the portion sizes tend to be larger.
  11. Avoid consuming high salt foods like pickles, papad etc. as these foods induce water retention.
  12. Be especially careful to avoid high-calorie snacks and convenience foods.
  13. Soft drinks (including soda, energy drinks, and coffee drinks) are a huge source of calories in many people's diets. One can of soft drink contains between 10-12 teaspoons of sugar and around 150 calories, so a few soft drinks can quickly add up to a good portion of your daily calorie intake. Instead homemade lemon water, coconut water, lassi or chachh are better replacements of commercially available juices and soft drinks.
  14. Reduce daily calorie intake by replacing soda, alcohol, or coffee with water. Thirst can also be confused with hunger, so by drinking water, one can avoid consuming extra calories.



15. Eating frequently throughout the day (3 small meals and 2-3 snacks) will stimulate metabolism. Skipping meals (including breakfast) can decrease metabolism. Skipping meals usually turns into eating more at the end of the day.

Reducing portion sizes, changing ways of cooking, right food selection would go long way in helping weight management.

#### 5.4.2 THE PITFALLS OF DIETING

Maintaining a calorie deficit always leads to weight loss. Without exercise, a calorie deficit must be created through a lower calorie intake. The main problem with dieting alone is the sacrifice needed to sustain a very low-calorie intake for a long period of time, which is too much for most people to handle. On a very low-calorie diet, most people tend to breakdown and go back to their old habits causing any weight loss to return quickly.

The body's reaction to dieting is also different. In case of a sudden and drastic reduction in calorie intake, the body adjusts its metabolism accordingly. Eating very little calories for a long time would turn body into starvation mode means slowing down metabolic processes which is the body's way of protecting itself against long periods with little or no food. This starvation mode causes body to drastically cut its energy requirements and the person stops losing weight.

#### Do you Know

Anorexia nervosa is an eating disorder characterized by an abnormally low body weight, an intense fear of gaining weight and a distorted perception of weight. People with anorexia place a high value on controlling their weight and shape, using extreme efforts that tend to significantly interfere with their lives.

To prevent weight gain or to continue losing weight, people with anorexia usually severely restrict the amount of food they eat. They may control calorie intake by vomiting after eating or by misusing laxatives, diet aids, diuretics or enemas. They may also try to lose weight by exercising excessively. No matter how much weight is lost, the person continues to fear weight gain.

Diets, especially fad diets or "quick-fix" pills and plans, often lead to failure because diets that cut out entire groups of food, such as carbohydrates or fat, are simply impractical and unhealthy. The key is moderation. Diets that severely cut calories, restrict certain foods, or rely on ready-made meals might work in the short term but don't include a plan for maintaining weight, so the weight quickly comes back.







Severely restricted diet also lead to deficiency of various other nutrients. Once we start eating normally, we will gain weight until our metabolism bounces back. Special shakes, meals, and programmes are not only expensive, but they aren't practical for long-term weight loss. Hence, instead of dieting alone and looking for miraculous foods to reduce or maintain weight, regular exercise and good eating habits are crucial to health and well-being.

### 5.4.3 FOOD INTOLERANCE

Food intolerance is the non-IgE mediated food hypersensitivity or non-allergic food hypersensitivity, which is characterized by difficulty in digesting certain foods. Food intolerance is different from food allergy. Food allergies trigger the immune system, while food intolerance does not. The symptoms of food intolerance generally take longer to emerge, compared to food allergies. In food intolerance, some people suffer digestive problems after eating certain foods. Foods most commonly associated with food intolerance include dairy products, grains that contain gluten, and foods that cause intestinal gas build-up, such as beans and cabbage. Gluten in wheat is one of the most common causes of food intolerance. Some people are intolerant to several groups of foods, making it harder to determine whether it might be a chronic illness or food intolerance. Identifying which foods are the reasons can take a long time.

The symptoms to food intolerance are varied and can include stomach-ache, bloating, nausea, irritable bowel, hives, migraine, mild fever, cough etc. Some types of food intolerance are given below:

**Absence of an enzyme:** Enzymes are needed to digest foods fully. If some of these enzymes are missing, or are insufficient for digesting a particular foodstuff, proper digestion may be affected. Some food intolerance is caused by the lack of a particular enzyme like lactose intolerance which is caused due to deficiency of lactase enzyme in the body. Hence, the person is unable to digest lactose from milk and gets intolerant to milk and all milk products. People who are lactose intolerant do not have enough lactase, an enzyme that breaks down milk sugar (lactose) into smaller molecules and absorb through the intestine. If lactose remains in the digestive tract, it can cause stomach-ache, spasms, bloating, gas and diarrhoea.

**Chemical causes of food intolerance:** Certain chemicals in foods and drinks can cause intolerance, including amines in some cheeses, and caffeine in coffee, tea, and chocolates. Some people are more susceptible to these chemicals than others.

**Toxins due to Food poisoning:** Some foods have naturally-occurring chemicals that can have a toxic effect on humans, causing diarrhoea, nausea, and vomiting. Peanuts or undercooked beans have aflatoxins that can cause extremely unpleasant digestive problems.



**Salicylates:** Salicylates are derivatives of salicylic acid, which occurs naturally in plants as a defence mechanism against harmful bacteria, fungi, insects, and diseases. Salicylates are present in most plant-sourced foods, including the majority of fruits and vegetables, spices, herbs, tea, and flavour additives. Mint-flavouring, tomato sauce, berries, and citrus fruits have particularly high levels of salicylates. Salicylate intolerance, also known as salicylate sensitivity, occurs when somebody reacts to normal amounts of ingested salicylate. These chemicals are found in many foods and most people can consume salicylate-containing foods without any adverse effects. However, some people suffer symptoms after eating large amounts. Salicylate intolerant individuals should avoid foods that contain high levels. Processed foods with flavour additives are usually high in salicylates as well.

**Gluten intolerance:** Gluten is a protein found primarily in wheat, barley and rye. If a person has a gluten intolerance, this protein can cause digestive problems such as gas, abdominal pain or diarrhoea. Gluten intolerance is sometimes confused with Celiac disease, or thought of as a food allergy. Anyone who suspects they may have a gluten intolerance should see a doctor before giving up gluten, as cereals can be an important source of various nutrients.

**Food additives and intolerance:** Additives are used to enhance flavours, make foods look more appealing, and to increase their shelf life. Food additive intolerance has been a steadily- growing problem over the last many years because more and more foods contain additives. Nitrates are known to cause itching and skin rashes. Processed meats are generally high in nitrates and nitrites. MSG (monosodium glutamate) is used as a flavour enhancer known to cause headaches. Some colourings - especially carmine (red) and annatto (yellow) also cause food intolerance.

It is very difficult to determine whether somebody has a food intolerance or allergy because the signs and symptoms often overlap. Patients are advised to keep a diary and write down which foods are eaten, what the symptoms were like, and when they appeared. The data in the diary can help a dietician or doctor identify which foods are causing adverse reactions, and what steps to take. Apart from lactose intolerance and celiac disease, there is no accurate, reliable, and validated test to identify food intolerance. The best diagnostic tool is an exclusion diet, also known as an elimination or diagnostic diet. Exclusion diets are extremely useful in isolating the causative foods. In a typical exclusion diet, the suspected food is removed from the diet for a period of 2 weeks to 2 months. If during this period the adverse reactions do not appear, it becomes more likely that the cause has been recognized. The best current treatment for food intolerance is to either avoid certain foods or eat them less often and in smaller amounts.





#### 5.4.4 FOOD MYTHS

**The fewer the carbohydrates, healthier you are-** Choosing the healthiest carbohydrates, especially whole grains, is important for health and well-being. Refined carbohydrates should be avoided however, choosing whole grains is associated with a decreased risk of chronic diseases and premature mortality.

**Oils/Margarine have fewer calories than Ghee/butter-** Ghee/Butter and Oils/Margarine have about the same amount of calories. Margarine, which is made from vegetable oils, was seen as a healthier alternative to butter (which contains cholesterol and saturated fat), but later it was found that some margarines are actually unhealthier because they contain trans-fats, which have even more adverse effects on cholesterol and heart health.

**Apples and brinjals are rich in iron because they turn brown when cut-** One of the greatest myths about apples and brinjals is that they are good sources of iron. They are an excellent source of fibre but not of iron. This change in colour is an enzymatic reaction and has nothing to do with iron.

**Milk should be avoided after eating fish-** A lot of Indians think that drinking milk right after consuming fish causes skin disease like leukoderma, or white patches on skin. This is not true.

**Drinking water in between meals affects digestion-** Most people think that drinking water during meals will affect the capacity to digest food. The truth is that drinking water simply fills up stomach and as a result one tends to eat less which is especially good when someone is trying to lose weight.

Similarly, you may come across many such beliefs, but for any belief try to learn the science behind to understand the fact.

#### Art Integration

Start an awareness campaign in your school regarding importance of nutrition in our life.

You could include the following activities:

- Poster making Competition on the benefits of
  - ◆ Healthy Eating
  - ◆ Healthy Lifestyle
- Talk Show by inviting a Dietician.
- Making and screening a video film on dietary imbalances.
- Cooking competition for cooking healthy.
- If possible, develop a school vegetable garden to increase awareness about various vegetables.



**I. Tick the correct option.**

1. What is an ideal weight to be reduced in one week?
  - a. 250 gms to 500gms
  - b. 500 gms to 1 kg
  - c. 1kg to 1.5 kg
  - d. kg to 2 kgs
2. BMI between 25.0-29.9 is \_\_\_\_\_
  - a. under weight
  - b. normal
  - c. overweight
  - d. obese

**II. Answer the following questions briefly.**

1. List the points to be considered for weight maintenance.
2. Point out the pit falls of dieting

**III. Answer the following questions in 150-200 words.**

1. What is food Intolerance? Enlist the foods which are commonly associated with food intolerance.
2. How you can modify your diet for weight control
3. Enumerate any five food myths and the related facts.

### 5.5. Importance Of Diet In Sports And Pre, During And Post Requirement

Nutrition is an important aspect of training and performance. Athletes should make appropriate dietary manipulations for better performances and long-term health benefits by choosing right foods and a diet including variety of foods. The concepts of nutrition and basic principles of balanced diet are applicable to the field of sports as well. A sports person needs to increase or decrease his energy intake and proportions of macronutrients and micronutrients depending upon the nature of her/his sport or game. Diet of sportspersons should aim at maintaining body weight and body composition desired for their specific sport, maintaining adequate pool of nutrient levels in the body, adopting healthy nutritional practices during





training and competition and carrying on with healthy nutritional practices during off-season as well i.e., when competitions are not taking place. Any imbalances in nutritional intake, both deficiency or excess of certain nutrients, can be detrimental to the performance of athletes and may reduce their ability to play up to maximum potential. A nutritious diet meeting nutritional demands of athletes not only helps in better performance but will also support good health.

### 5.5.1 IMPORTANCE OF DIET IN SPORTS

1. The body needs nutrition to repair and recover. Sports persons have greater demands on their body. If these are not met through proper diet, outcome will suffer and post training recovery process will be affected.
2. For different games, there are different body composition requirements which can be manipulated to certain extent by nutrient composition of diet besides training, thus helping in achieving body composition goals.
3. Right kind of nutritional composition in pre-competition meals, during competition and post competition meals can help improve performance, delay fatigue and speed up recovery.
4. Knowledge of nutrition is essential to make fitness, weight loss and weight gain programmes successful in athletes. Those sports persons who play in weight categories can achieve body weight goals with appropriate diets. During off-season or no practice period, the diet should be such that it does not alter too much of body composition and prevents excessive weight gain.
5. Certain nutrients are taken as ergogenic aids, their ergogenic potential and psychological and physiological effects can help sports persons in their performance.
6. Dehydration can impair athletic performance. Therefore, sufficient intake of fluids and electrolytes ensures maximum hydration before, during and after exercise
7. Adequate diet enhances physiological adaptations during training.

### 5.5.2 CARBOHYDRATES IN SPORTS AND EXERCISE

As we all know that carbohydrates are the major source of energy for any activity. For athletes engaging in strength-sports (wrestling, boxing, judo etc.) 55% of total calories should be provided by carbohydrate sources. While in endurance sports like running, swimming, football, hockey and other similar type of sports 60-70% of calories should be derived from carbohydrates in the diet. Besides the total



amount of carbohydrates in the diet, the type and time of carbohydrate intake is also important. Appropriate type and time of carbohydrate intake prior to, during and post exercise can improve exercise performance.

Before competition, complex carbohydrates should be taken and consuming simple sugars prior to exercise (<1 hour) should be discouraged as it may increase insulin levels which in turn increases carbohydrate metabolism resulting in low blood glucose levels during exercise. This induces early fatigue and light-headedness due to hypoglycaemia. Excessive intake of highly concentrated sugars, such as candy and soft drinks in a short period of time can also result in cramps and bloating. However, simple carbohydrate foods are the best sources of energy replacement after strenuous exercises; complex carbohydrate foods are preferred as pre-exercise carbohydrate sources.

It takes about 4 hours for carbohydrates to be digested and begin to be stored as muscle and liver glycogen. Therefore, pre-exercise meals should be consumed about 4 to 6 hours before exercise. A light carbohydrate and protein snack 30 to 60 min prior to exercise (e.g., 50 g of carbohydrate and 5 to 10 g of protein) serves to increase carbohydrate availability toward the end of an intense exercise bout. This also serves to increase availability of amino acids and decrease exercise-induced breakdown of protein.

### 5.5.3 PROTEINS FOR EXERCISE AND TRAINING

During exercise and training, muscle bulk is increased and also there is breakdown of muscle tissues. During prolonged exercises, protein is oxidised to provide energy. For these purposes, increased amount of protein is recommended in sports persons. ICMR (1985) has recommended protein intake of 12-14% of total caloric intake and range of protein intake as 1g/kg body weight to 2 g/kg body weight; lower limit for endurance sports and sports of light weight category and upper limit for strength sports.

Eating sufficient calories from a well-balanced diet generally provides adequate proteins. However, sources of good quality protein should be included. Milk and milk products, meat and meat products should be incorporated. Low fat protein sources like skim milk, egg white, fish, and chicken are more helpful in enhancing performance as well as maintaining long term health. Cereal pulse combination or supplements with complete protein also improves the quality of protein.

Protein and amino acid supplementation is becoming widely popular in athletes. Markets are flooded with protein and amino acid supplements. However, additional





supplementation of protein is not necessary as long as athletes maintain energy balance and take 15% of their total caloric intake in the form of proteins.

The protein intake in excess of twice the recommended (i.e. >2g/kg BW) could increase the risk of renal degeneration and bone porosity. When protein intake is increased, urea production increases and more water is drawn in urine to eliminate metabolic products putting athlete into a dehydrated state. High protein intake also leads to urinary calcium loss, which in long term would affect calcium status particularly of women athletes.

#### 5.5.4 FAT INTAKE IN SPORTS AND TRAINING

Fat intake in athletes contributes to energy density and offers other protective roles, however, higher than recommended could pose health problems. Hence athletes, like other population, should restrict dietary fat intake within the suggested amounts i.e. 25-30% of total calories.

Within this limit, dietary fat choices also make a difference. A diet that includes polyunsaturated fatty acids (PUFA; vegetable oils, nuts and oil seeds) and monounsaturated fatty acids (MUFA ground nut oil, fish oil etc) has definite advantages over a diet rich in saturated fatty acids (animal fat/ desi ghee; butter etc) in terms of improving total cholesterol, LDL, HDL and triglyceride levels. Thus, these healthy fats should account for the majority of fat in athlete's diet. Invisible fat sources should also be chosen wisely. Like inclusion of egg whites, fish and skimmed milk in place of high fat animal foods would be helpful in keeping the total cholesterol levels below 200mg/day.

#### 5.5.5 VITAMINS AND MINERALS

Vitamins and minerals perform functions for athletes and non-athletes alike. Athletes, however, have high energy needs and high production of free radicals. Therefore, they require higher amounts of B-vitamins and vitamins with anti-oxidant properties. The required amount can be obtained by eating a variety of foods especially fruits and vegetables. Taking more than required vitamins and minerals does not improve performance, if there are no deficiencies of any vitamin or mineral in the body.

The key to obtain the adequate vitamins and minerals is to eat a wide variety of nutrient-dense foods in amounts that will maintain energy balance. Fruits and vegetables are particularly rich in vitamins and antioxidants as well. Supplements are not replacements for food.





### 5.5.6 PRE-EXERCISE OR PRE-EVENT MEAL

For pre-exercise or pre-event meal, fuelling up of glycogen stores to obtain energy and proper hydration are the primary goals. This would control hunger, fatigue, weakness, light-headedness which could interfere in the sports performance. Pre-exercise meal should also provide a comfortable gastrointestinal state for sports performance. During night, our blood glucose levels and storage levels of glycogen go down and therefore, eating carbohydrate-containing foods before exercise refills liver glycogen stores and can replenish muscle glycogen stores. In pre-exercise meal our main considerations should be as follows:

- A meal comprising high-carbohydrate, moderate protein and low fibre and low-fat foods providing 500-1000 kcal should be consumed. Examples of good pre-event meal would be banana milk shake or pasta and fruits with curd or potato sandwich with fruit juice.
- High sugar foods must be avoided to prevent insulin rush that results in early fatigue, cramping, dehydration, nausea and diarrhoea.
- On regular training days, instead of large meals, small meals or a snack every 2-3 hours should be taken.
- Meals should be taken about 2-4 hours before exercise.
- If eating within two hours of exercise eat less and take semi-solid or liquid meals.
- Dinner on the previous night of the competition is also important. The meal should be such that it ensures proper sleep and adequate fuelling up.
- Familiar and easily digestible foods should be consumed. Any newer food or foods with known allergies or known to cause gastrointestinal upsets should be avoided.
- Foods heavy on stomach like fried foods or high fibre foods should be avoided on the day prior to competition.
- Too much of protein intake should also be avoided as it increases water excretion leading to a state of dehydration. Moreover, proteins are digested slower.
- Take sufficient liquids or a small snack an hour (or less) before exercise.

Maintaining optimal hydration status along with sufficient muscle glycogen stores delays the onset of fatigue and enables the athletes to exercise longer before getting exhausted. High intensity games lead to heavy sweat loss resulting in fluid and electrolyte (sodium, potassium, chloride) imbalance. Hence, sufficient







amounts of fluids to maintain water and electrolyte balance need to be consumed at regular intervals. The best fluid for this purpose is always water. Water intake at a level of 150-250 ml every 15 minutes depending upon the exercise intensity and environmental conditions, would prevent dehydration. Commercially available sports drinks particularly having sugar levels up to 2% could be taken. Signs of dehydration include dark urine, decreased amount of urine, reduced frequency of urination, rapid heart rate, headache, irritability, and confusion. In sports of weight category, athletes dehydrate themselves for the purpose of reducing weight in order to get placed into lower weight categories, this practice may affect their performance, hence, it should be discouraged.

### 5.5.7 DURING EXERCISE

Dealing with nutritional needs during training is crucial for optimal performance. The main aim during exercise and training should be to maintain water balance, control body temperature, sustain normal blood sugar levels and delay fatigue. In order to maintain fluid balance and normal body temperature during exercise, water that is lost through sweating during exercise needs to be replaced. Even slight dehydration brings in mental and physical fatigue and weakens the performance. During small breaks in the events like in tennis, boxing etc. the consumption of adequate carbohydrate and fluids may be taken care of. In shorter breaks, carbohydrate rich foods like banana, juices, carbohydrate-based drinks (less than 2% concentration) or simply water may be taken. Carbonated beverages, fizzy drinks and drinks that contain caffeine are not recommended.

If exercising for more than 60 minutes, carbohydrate-electrolyte beverages like diluted fruit juices containing 5 percent to 8 percent carbohydrates can be ingested. As the duration of high intensity events continues, muscle glycogen levels diminish. Therefore, for endurance athletes, in events lasting longer than two hours, carbohydrate rich solids or liquid meals are recommended during exercise.

### 5.5.8 POST-TRAINING/COMPETITION

Post training or sports competition, recovery of the best body state is required to play or to train the next day to the maximum potential and reduce the chances of injury. The main emphasis during recovery phase must be on the following:

- To replace fluids lost during exercise.
- To refill carbohydrate stores (muscle and liver glycogen)
- To replace electrolytes (sodium, potassium, chloride)



First of all, the fluids lost during exercise must be replaced to restore fluid balance. Because restoration of normal fluid levels takes time, re-hydration needs to begin during exercise and continue after exercise ends. It is recommended that athlete should drink more fluid than is lost because some of the fluid that is taken during recovery is eliminated as urine. Achieving adequate re-hydration before the next training session is crucial for quality training. After exercise fluids should be taken until body returns to its pre-exercise weight or urine is clear or pale colour.

Athletes benefit from consuming high carbohydrate foods immediately after ending repeated intervals of intense exercise or prolonged exercise. The body replaces the glycogen energy stores in the muscle within first few hours of exercising. Immediately after an event, refuelling body with some carbohydrates such as juice, fruit, sweet curd or cereal is required. Eating a balanced meal is recommended that includes carbohydrates and good quality protein within two hours after the event.

**I. Tick the correct option.**

1. Range of protein intake is
  - a. 5g/kg body weight to 1 g/kg body weight
  - b. **1g/kg body weight to 2 g/kg body weight**
  - c. 2g/kg body weight to 3 g/kg body weight
  - d. 3g/kg body weight to 4 g/kg body weight
2. Approximately, how much carbohydrate is required for strength dominant sports?
  - a. 40%
  - b. **55%**
  - c. 70%
  - d. 80%

**II. Answer the following questions briefly.**

1. Discuss the importance of Protein in regard to sportsperson.
2. Which diet should a sportsperson take during the competition?

**III. Answer the following questions in 150-200 words.**

1. Elaborate the importance of food during and after competition.





IV. Complete the following Graphic Organiser giving the Macro- and Micro-nutrients present in the following food groups.



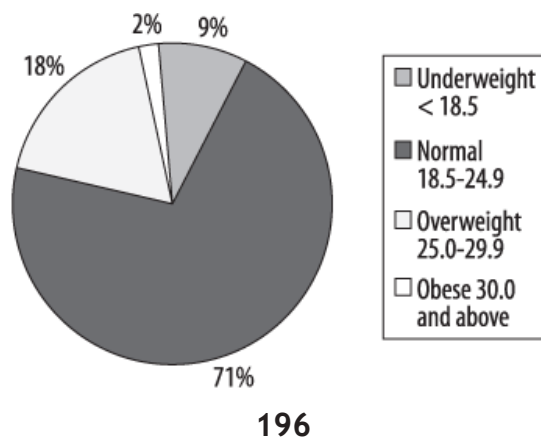
### I. Sports Integration

Start an awareness campaign in your school regarding importance of nutrition in our life.

You could include the following activities:

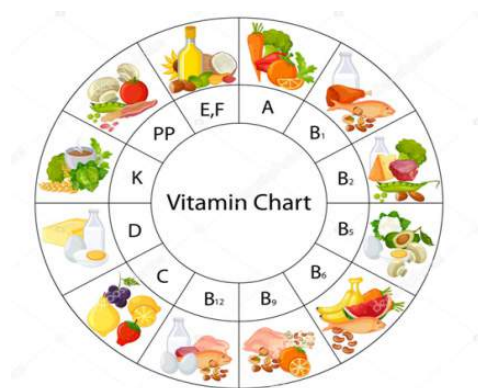
- Poster making Competition on the benefits of Healthy Eating and Healthy Lifestyle
- Talk Show by inviting a Dietician.
- Making and screening a video film on dietary imbalances.
- Survey on sportsperson's diet
- If possible, develop a school vegetable garden to increase awareness about various vegetables.

### II. Sports and Nutrition



Picture Reference: <https://www.oreilly.com/library/view/statistics-in-a/9780596510497/ch04.html>

1. Based on the above pie chart
  - a. The major category of students fall in \_\_\_\_\_
  - b. Which category is overweight?
  - c. 25-29.9 is \_\_\_\_\_ category.
- 2.



In reference to the picture answer the following questions

- a. What is the other name of Vitamin B1?
- b. Deficiencies of B9 can cause\_\_\_\_\_.
- c. Vitamin \_\_\_\_\_ helps in maintaining hair colour.

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**UNIT****VI****TEST AND MEASUREMENT  
IN SPORTS****Overview**

- ◆ Fitness Test - SAI Khelo India Fitness Test in school [Age group 5-8 yrs/ class 1-3: BMI, Flamingo Balance Test, Plate Tapping Test; Age group 9-18yrs/ class 4-12: BMI, 50mt Speed test, 600mt Run/Walk, Sit & Reach flexibility test, Strength Test (Abdominal Partial Curl Up, Push-Ups for boys, Modified Push-Ups for girls)];
- ◆ Measurement of Cardio-Vascular Fitness - Harvard Step Test - Duration of the Exercise in Seconds  $\times 100 / 5.5 \times$  Pulse count of 1-1.5 Min after Exercise;
- ◆ Computing Basal Metabolic Rate (BMR);
- ◆ Rikli & Jones - Senior Citizen Fitness Test - Chair Stand Test for lower body strength, Arm Curl Test for upper body strength, Chair Sit & Reach Test for lower body flexibility, Back Scratch Test for upper body flexibility, Eight Foot Up & Go Test for agility, Six Minute Walk Test for Aerobic Endurance;
- ◆ Johnsen - Methney Test of Motor Educability (Front Roll, Roll, Jumping Half-Turn, Jumping full-turn)

**LEARNING OUTCOMES**

*At the end of the unit, students will be able to:*

- ◆ perform SAI Khelo India Fitness Test in school [Age group 5-8 yrs/ class 1-3: BMI, Flamingo Balance Test, Plate Tapping Test; Age group 9-18yrs/ class 4-12: BMI, 50mt Speed test, 600mt Run/Walk, Sit & Reach flexibility test, Strength Test (Abdominal Partial Curl Up, Push-Ups for boys, Modified Push-Ups for girls)]
- ◆ compute Basal Metabolic Rate (BMR)
- ◆ determine physical fitness Index through Harvard Step Test/Rockport Test
- ◆ describe the procedure of Rikli and Jones - Senior Citizen Fitness Test
- ◆ demonstrate Johnsen - Methney Test of Motor Educability





## Discussion

### Discuss with your group

- What are the areas that a physical fitness test evaluates?
- How many of you can test your own fitness?
- What are the criteria that you will employ to test your own fitness?
- What is the aim of testing for physical fitness?
- Have you heard of motor fitness? What is it? How is it tested?
- Have you heard about broad jump?

## Do you Know

**Test protocol** is the correct procedure for carrying out a test. If a test is done incorrectly, it might affect the results.

**Valid** A test is valid if it measures what it sets out to measure e.g., a test for upper body strength should not measure leg strength.

**Motor fitness** refers to the neuromuscular components of fitness, which enable a person to perform successfully at a particular motor skill, game, or activity. Specific motor fitness components include agility, balance, coordination, power, reaction time, and speed. Motor fitness is sometimes referred to as skill-related fitness.



केन्द्रीय माध्यमिक शिक्षा बोर्ड  
( शिक्षा विभाग, भारत सरकार के अधीन एक स्वायत्त संस्थान )  
**CENTRAL BOARD OF SECONDARY EDUCATION**  
(An Autonomous Organisation under the Ministry of Education, Govt. of India)



CBSE/ DIR(SE&T)/KIFA/2020

19.03.2021

Circular No: Acad-25/2021

Heads of all the Institutions affiliated to CBSE

**Subject:** Awareness Programme on 'Whole School Approach to Fitness' and 'Khelo India National Fitness Assessment Programme' by CBSE in collaboration with Sports Authority of India (SAI) under the FIT INDIA MISSION in online mode

Dear Principal

This is in continuation to CBSE Notification no. 38/2018 dated 12.12.2018, Circular no. 01/2019 dated 09.01.2019, Circular No: Acad-83/2019 dated 30.12.2019 and Acad-38/2020 dated 28.05.2020 regarding the 'Khelo India National Fitness Assessment Programme for Schools'.

Ministry of Youth Affairs and Sports, under the aegis of FIT INDIA and as per NEP, CBSE is organizing an Online Physical Education Training Programme for all PE Teachers. These programmes are aimed at equipping the Physical Education Teachers of CBSE schools with the Knowledge, Skills and Attitude to perform Physical Fitness Assessment tests in their schools. These programmes shall be conducted from 24<sup>th</sup> March 2021 onwards. These trainings are being offered free of cost to all participants.

Post the training, PE Teachers will be able to register their schools, create profile for themselves, upload student's data, usage of KIFA and learn how to do Assessment. Once the schools reopen, they will be able to start Assessments using Mobile app in their schools.

Please refer to annexures for more details about the programme and registering your school.





Please read the letter above and try to think about few of the questions asked below:

- I. Why do government and CBSE need to plan for a 'whole school approach to fitness'?
- II. What will be the fitness test items for Khelo India Fitness Assessment for school children?

## 6.1 Fitness Test - SAI Khelo India Fitness Test in School

**Overview:** Fitness defines the ability to perform physical activity, and encompasses a wide range of abilities. Each activity and sports requires a specific set of skills, and so being fit for an activity or a sport does not necessarily make you fit for another. Fitness is generally divided into specific fitness categories or components, and each can be tested and trained individually. The following pages will help you do the Fitness Test Administration in your school more effectively using Khelo India Fitness Assessment App and viewing the School Dashboard on School Interface.

### BATTERY OF TESTS

#### **AGE GROUP 5-8 YEARS | CLASS 1 to 3 At Primary class 1-3,**

Children should acquire Fundamental Movement Skills (FMS) leaving the learning of specific physical activities to later stages. FMS provide the building blocks for many physical activities, such as playing games, dance, and sport. Locomotor, Manipulative & Body Management abilities are key to success in most sports and physical activities. Abilities of children in class 1-3 which need to be measured and tracked are

1. Body Composition (BMI)
2. Coordination (Plate Tapping)
3. Balance (Flamingo Balance)

Which are important for controlling the body in various situations.

#### **AGE GROUP: 9-18+ YEARS | CLASS 4 to 12 For Class 4 to 12,**

It is important for students to have an overall physical fitness. The following Components are to be considered in Physical Health and Fitness Profile:

1. Body Composition (BMI)
2. Strength a. Abdominal (Partial Curl-up) b. Muscular Endurance (Push Ups for Boys, Modified Push Ups for Girls)







3. Flexibility (Sit and Reach Test)
4. Cardiovascular Endurance (600 Meter Run/Walk)
5. Speed (50 mt. Dash)

### 6.1.1 BODY MASS INDEX (BMI)

**Purpose:** Body Composition refers primarily to the distribution of muscle and fat in the body. Body size such as height, lengths and girths are also grouped under this component.

**Infrastructure/Equipment Required:** Flat and Clean surface, Weighing Machine, Stadiometer/Measuring Tape pasted on a wall

**Procedure:**

#### *Measuring Height Accurately*

Remove the participant's shoes, bulky clothing, and hair ornaments, and unbraid hair that interferes with the measurement. Take the height measurement on flooring that is not carpeted and against a flat surface such as a wall with no moulding. Have the participant stand with feet flat, together, and back against the wall. Make sure legs are straight, arms are at sides, and shoulders are level. Make sure the participant is looking straight ahead and that the line of sight is parallel with the floor. Take the measurement while the participant stands with head, shoulders, buttocks, and heels touching the flat surface (wall). (See illustration.) Depending on the overall body shape of the participant, all points may not touch the wall. Use a flat headpiece to form a right angle with the wall and lower the headpiece until it firmly touches the crown of the head. Make sure the measurer's eyes are at the same level as the headpiece. Lightly mark where the bottom of the headpiece meets the wall. Then, use a metal tape to measure from the base on the floor to the marked measurement on the wall to get the height measurement. Accurately record the height to the nearest 0.1 centimeter.

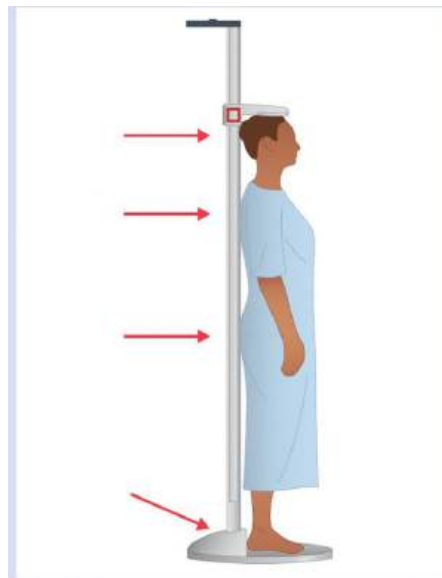
#### *Measuring Weight Accurately*

Use a digital scale. Avoid using bathroom scales that are springloaded. Place the scale on firm flooring (such as tile or wood) rather than carpet. Have the participant remove shoes and heavy clothing, such as sweaters. Have the participant stand with both feet in the center of the scale. Record the weight to the nearest decimal fraction (for example, 25.1 kilograms).





**Scoring:** The test performed is Body Mass Index (BMI), which is calculated from body Weight (W) and height(H).  $BMI = W / (H \times H)$ , where W = body weight in kilograms and H = height in meters. The higher the score usually indicating higher levels of body fat. Height recorded in cm and mm. Weight will be recorded in kilogram (kg) and grams (gms). Record the weight to the nearest decimal fraction (for example, 25.1 kilograms). Accurately record the height to the nearest 0.1 centimeter.



### 6.1.2 PLATE TAPPING TEST

**Purpose:** Tests speed and coordination of limb movement

**Infrastructure/Equipment Required:** Table (adjustable height), 2 yellow discs (20cm diameter), rectangle (30 x 20 cm), stopwatch



**Procedure:** If possible, the table height should be adjusted so that the subject is standing comfortably in front of the discs. The two yellow discs are placed with their centers 60 cm apart on the table. The rectangle is placed equidistant between





both discs. The non-preferred hand is placed on the rectangle. The subject moves the preferred hand back and forth between the discs over the hand in the middle as quickly as possible. This action is repeated for 25 full cycles (50 taps).

**Scoring:** The time taken to complete 25 cycles is recorded

### 6.1.3 FLAMINGO BALANCE TEST

**Purpose:** Ability to balance successfully on a single leg. This single leg balance test assesses the strength of the leg, pelvic, and trunk muscles as well as Static balance.

**Infrastructure/Equipment Required:** Non-slippery even surface, Stopwatch, can be done while standing on beam.

Procedure:

Stand on the beam. Keep balance by holding the instructor's hand (if required to start). While balancing on the preferred leg, the free leg is flexed at the knee and the foot of this leg held close to the buttocks. Start the watch as the instructor lets go of the participant/subject. Pause the stopwatch each time the subject loses balance (either by falling off the beam or letting go of the foot being held). Resume over, again timing until they lose balance. Count the number of falls in 60 seconds of balancing. If there are more than 15 falls in the first 30 seconds, the test is terminated.



**Scoring:** The total number of falls or loss of balance in 60 seconds of balancing is recorded. If there are more than 15 falls in the first 30 seconds, the test is terminated.

#### 6.1.4 AGE GROUP: 9-18+ YEARS | CLASS 4 TO 12

For Class 4 to 12, it is important for students to have an overall physical fitness. The following Components are to be considered in Physical Health and Fitness Profile:

1. Body Composition (BMI)
2. Strength a. Abdominal (Partial Curl-up) b. Muscular Endurance (Push Ups for Boys, Modified Push Ups for Girls)
3. Flexibility (Sit and Reach Test)
4. Cardiovascular Endurance (600 Meter Run/Walk)
5. Speed (50 mt. Dash)

#### 6.1.5 BODY COMPOSITION (BMI)

See 6.1.1

#### 6.1.6 ABDOMINAL (PARTIAL CURL-UP)

**Purpose:** The curl up test measures abdominal muscular strength and endurance of the abdominals and hip flexors, important in back support and core stability.



**Infrastructure/Equipment Required:** Flat clean cushioned surface with two parallel strips (6 inches apart), Stopwatch, Recording sheets, Pen

**Procedure:** The subject lies on a cushioned, flat, clean surface with knees flexed, usually at 90 degrees, with hands straight on the sides (palms facing downwards)





closer to the ground, parallel to the body. The subject raises the trunk in a smooth motion, keeping the arms in position, curling up the desired amount (at least 6 inches above/along the ground towards the parallel strip). The trunk is lowered back to the floor so that the shoulder blades or upper back touch the floor.

**Scoring:** Record the maximum number of Curl ups in a certain time period (30 seconds).



### 6.1.7 PUSH UPS (BOYS)/MODIFIED PUSH UPS (GIRLS)

**Purpose:** Upper body strength endurance, and trunk stability.

**Infrastructure/Equipment Required:** Flat clean cushioned surface/Gym mat

**Procedure:** A standard push up begins with the hands and toes touching the floor, the body and legs in a straight line, feet slightly apart, the arms at shoulder width apart, extended and at a right angles to the body. Keeping the back and knees straight, the subject lowers the body to a predetermined point, to touch some other object, or until there is a 90-degree angle at the elbows, then returns back to the starting position with the arms extended. This action is repeated, and the test continues until exhaustion, or until they can do no more in rhythm or have reached the target number of push-ups. For Girls: push-up technique is with the knees resting on the ground.



**Scoring:** Record the number of correctly completed pushups.

### 6.1.8 SIT AND REACH



**Purpose:** Common measure of flexibility, and specifically measures the flexibility of the lower back and hamstring muscles. This test is important because tightness in this area is implicated in lumbar lordosis, forward pelvic tilt and lower back pain.

**Infrastructure/Equipment Required:** Sit and Reach box with the following dimensions: 12" x 12" (sides) 12" x 10" (front and back) 12" x 21" (top).

Inscribe the top panel with centimeter/mm gradations. It is crucial that the vertical plane against which the subject's feet will be placed is exactly at the 23 cm mark. Flat clean cushioned surface/Gym Mats

**Procedure:** This test involves sitting on the floor with legs stretched out straight ahead. Shoes should be removed. The soles of the feet are placed flat against the Sit and Reach box. Both knees should be locked and pressed flat to the floor - the tester may assist by holding them down. With the palms facing downwards, and hands on top of each other, the subject reaches forward along the measuring line as far as possible. Ensure that the hands remain at the same level, not one reaching further forward than the other. After some practice reaches, the subject reaches out and holds that position for at one-two seconds while the distance is recorded. Make sure there are no jerky movements.







**Scoring:** The score is recorded (difference between initial position and final position), in cm and mm, as the distance reached by the hand.

### 6.1.9 600 MTR RUN/WALK

**Purpose:** Cardiovascular Fitness/Cardiovascular Endurance

**Infrastructure/Equipment Required:** Stopwatch, whistle, marker cone, lime powder, measuring tape, 200 or 400 mts with 1.22 mt (minimum 1 mt) width preferably on a flat and even playground with a marking of starting and finish line.

**Procedure:** Participants are instructed to run 600 mts. at the fastest possible pace. The participants begin on signal, "ready, start". As they cross the finish line, the elapsed time should be announced to the participants. Walking is permitted but the objective is to cover the distance in the shortest possible time.

**Scoring:** Time taken for completion (Run or Walk) in min and sec.



### 6.1.10 50 MTR DASH (STANDING START)

**Purpose:** Determines acceleration and speed

**Infrastructure/Equipment Required:** Measuring tape or marked track, stopwatch, cone markers, flat and clear surface of at least 60 metres.

**Procedure:** A thorough warm up should be given, including some practice starts and accelerations. Start from a stationary position, with one foot in front of the other. The front foot must be on or behind the starting line. This starting position should be static (dead start). The tester should provide hints for maximizing speed (such



as keeping low, driving hard with the arms and legs) and encouraged to continue running hard through the finish line.

**Scoring:** Time taken for completion

### Do you Know?

#### General Instructions before Exercise/Testing

**Clothes-** Students should wear comfortable, loose fitting sportswear during the test.

**Food-** Students should take food at least three hours before testing. Plenty of fluids should be taken 24 hours before testing. Alcohol and caffeine should be avoided 24 hours before testing.

**Rest-** Students should take proper rest and sleep on the night of testing. Any strenuous exercise should be avoided on the day of tests.

**Warming up and cooling down-** Students should do proper warm up and cooling down exercises before and after the testing respectively.

**Equipment-** Equipment should be calibrated, organized, sterilized and tested before the test. **Administration-** Temperature should not be too hot, cold, or humid. All stationary item should be ready before the test. Students should be informed about the procedure of the test and consent should be taken well in advance.

#### I. Tick the correct options

1. 50 Mtr Dash is conducted to test:
  - a. Strength
  - b. **Acceleration**
  - c. Flexibility
  - d. Endurance
  
2. Which test can be applied to test Endurance?
  - a. Sit and Reach
  - b. Push Ups
  - c. 600 Mtr Run/Walk
  - d. Plate Tapping Test







3. Partial curl up is to test .
  - a. agility and speed
  - b. leg strength and endurance
  - c. abdominal strength and endurance
  - d. upper body strength and endurance
4. Sit and reach test measures
  - a. endurance
  - b. flexibility
  - c. strength
  - d. speed

**II. Answer the following questions briefly**

1. Enlist the general equipment used for measuring SAI Khelo India Fitness Test.
2. Explain the procedure to test strength.
3. Write down the process to determine the upper body endurance.
4. Explain the process of 600meter run/walk.

**III. Answer the following questions in 150-200 words**

1. Describe the procedure of SAI Khelo India Fitness Test.
2. Write down the procedure to conduct SAI Khelo India Fitness Test in school for 5 to 8 years old students.

## 6.2 Measurement of Cardio-Vascular Fitness

### Harvard Step Test

Harvard step test was developed by Brouha in 1943 for the purpose of measuring physical fitness for work and the ability to recover from work. The test was originally designed for young men of college age. In the original validation of the step test Brouha tested 2200 males.

**Purpose:** To determine aerobic fitness.

**Objective:** To perform step test continuously without break for 5 minutes or until





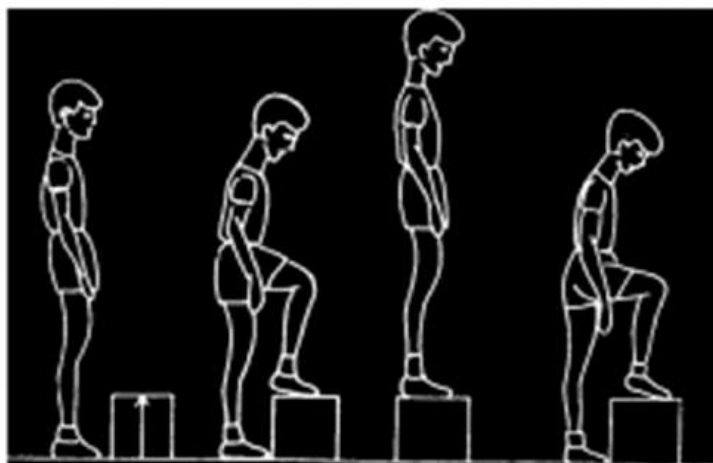
exhausted.



**Equipment:** Bench or wooden block 20 inches in height; stopwatch; metronome.

**Procedure:** Student will start test at the command "Go" and will step up and down, on and off the wooden block or bench at the rate of 30 steps per minutes for 5 minutes.

Participant is given instructions that on the command 'up' or the first sound of the metronome, he/she should place one foot on the bench; on the second command 'up' or the second sound of the metronome, he/she should place both feet fully on the bench with the body erect straightening the legs and back.



Exactly five minutes of steps, on the signal 'stop', the participant immediately sits down on the bench. If the student is unable to maintain the pace, then she/he is considered to be exhausted and the test is brought to an end before completion of





5min.

The tester will note the duration of the exercise in seconds and use short formula.

### Pulse Count

After completion of the test, the student sits down and the tester takes the hearts beats between 1 to 1½ minutes.

**Scoring:** Fitness Index score will be determined by applying following equation:

$$\frac{\text{Duration of the Exercise in Seconds} \times 100}{5.5 \times \text{Pulse count of 1 - 1.5 min after Exercise}} = \text{Fitness Index score}$$

### Norms for Harvard Step Test

Upto 49	Poor
50-80	Average
81 or Above	Good

Norms Reference: Dr. D. K. Kansal (2008), Textbook of Applied Measurement, Evaluation and Sports Selection, Sports and Spiritual Science Publication, Delhi, ISBN No.8190228234

## 6.3 Computing Basal Metabolic Rate (BMR)

The Basal Metabolic Rate (BMR) is the number of calories needed to maintain body function and resting condition. In another words BMR is the number of calories burnt by the body while performing basic life sustaining functions. That is, a person, who does not engage in any work, still requires energy for the functioning of their internal organs. This energy is called Basal Metabolic Rate. Unit of BMR is calculated in Kcal. There are factors that may affect BMR like Muscle Mass, age, state of mind, Gender, Genetics, Body composition etc. Environment changes like change in heat and cold may change the requirement of the body.

**Purpose:** determine Basal Metabolic Rate

**Equipment:** Stadiometer, Weight machine, Pen and paper

**Procedure:** method to measure height and weight is given at BMI

**Formula used:** The mifflin-St Jeor BMR Equation





**Male calculation** =  $(10 * \text{weight(kg.)}) + (6.25 * \text{height(cm)}) - (5 * \text{age}) + 5$

**Female calculation** =  $(10 * \text{body weight(kg.)}) + (6.25 * \text{height(cm)}) - (5 * \text{age}) - 161$

### Extension Activity

Every student will prepare their own profile of fitness testing as per below format.

	Week 1	Week 2	Week 3	Week 4
Fitness Index (Harvard step test)				
50M standing start				
600 M Run/ walk				
Sit and reach Test				
Push-ups				
Partial Curl Up				

#### I. Tick the correct options.

1. The test duration for the Harvard fitness test is
  - i. 3 minutes
  - ii. 4 minutes
  - iii. 5 minutes
  - iv. 6 minutes
  
2. The Harvard step test is developed by
  - i. Harvard
  - ii. Brouha
  - iii. Kansal
  - iv. SAI
  
3. What is BMR?
  - i. Bodily Mass Index
  - ii. Body Mass Index
  - iii. Boldy Mass Index
  - iv. Bodley Mass Index





4. Which parameter is not required to assess the BMR
  - i. Weight
  - ii. Height
  - iii. Age
  - iv. Name

**II. Answer the questions briefly.**

1. Write down the procedure of Harvard fitness test.
2. What is a formula to find out Fitness Index score? And enlist equipment which can be used in Harvard fitness test.
3. How can BMR be assessed?

**III. Answer the question in 150-200 words.**

1. Briefly describe the test used for assessing aerobic fitness

### 6.4 Rikli and Jones Senior Citizen Fitness Test

The senior citizen's fitness test (SFT) was developed by Rikli and Jones for older people aged between 60 to 94 years. The purpose of the test was to evaluate functional ability and monitor the physical fitness status of older people and to identify problems and work on the weakness. This test should not be practiced by those who have any medical conditions like chest pain, dizziness, high blood pressure, heart problems etc. This test is economical and easy to administer. The test includes the following items:

1. Chair Stand Test for lower body strength
2. Arm Curl Test for upper body strength
3. Chair Sit and Reach Test for lower body flexibility
4. Back Scratch Test for upper body flexibility
5. Eight Foot Up and Go Test for agility
6. Six Minute Walk Test for aerobic endurance Source of all Pictures<sup>4</sup>

#### 6.4.1 30 SECOND CHAIR STAND TEST

**Purpose:** To determine lower body strength.

**Objective:** To complete maximum stands in 30 seconds.



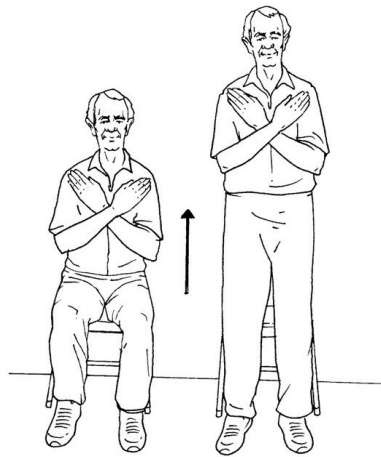


**Equipment:** Straight back chair without arms; stopwatch.

**Procedure:** The chair should be placed against the wall or somewhere where it gets stabilized.

Initially, the individual will sit on the chair, back straight, arms crossed and feet firmly on the floor, shoulder width apart.

On the command "Go" the individual will stand up completely, then return back to the initial position. This will be counted as one stand. The individual should be motivated to do maximum stands in 30 seconds.



**Scoring:** Maximum number of complete stands will be counted as score. If the individual is in half way of the stand and time is over, then it will be counted as a full stand.

### 6.4.2 ARM CURL TEST

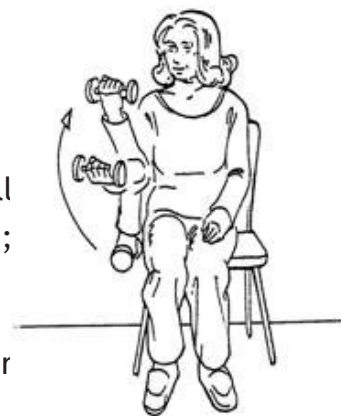
**Purpose:** To determine upper body strength.

**Objective:** To complete maximum arm curls in 30 seconds.

**Equipment:** Straight back chair without arms; Dumbbell for men- 8 pounds (3.6kgs) and women- 5 pounds (2.3kgs); stopwatch.

**Procedure:** The chair should be placed against the wall or somewhere where it gets stabilized.

The individual sits on the chair with back straight, feet on floor, holding dumbbell with dominant hand using handshake grip.





On the command “Go” the individual flexes the elbow or curls the arm with full range of motion then returns back to its initial position.

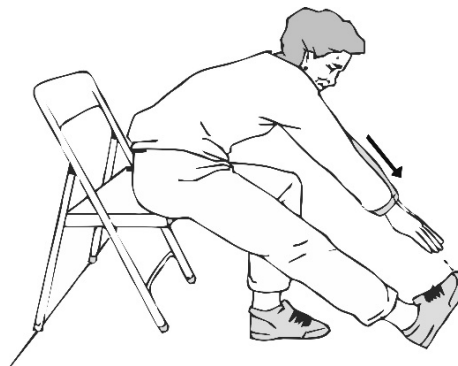
In the down position dumbbell will return to handshake grip.

The individual can perform as many arm curls as possible in 30 seconds.

**Scoring:** Maximum number of correct arm curls in 30 second will be counted.

### 6.4.3 CHAIR SIT AND REACH TEST

**Purpose:** To determine lower body flexibility.



**Objective:** To stretch the lower body as far as possible.

**Equipment:** Straight back chair without arms; 18 inches ruler.

**Procedure:** The chair should be placed against the wall or somewhere where the chair gets stabilized.

Participant sits on the chair with one foot flat on the floor and the other leg extended forward with the knee straight, heel on the floor, and ankle bent at 90°.

The participant, then, tries to touch the toe of that foot by bending at the hip and sliding her/his hands towards the toes.

To clock score, participant must hold that position for 2 seconds.

**Scoring:** Measurement will be taken between extended long finger and tip of the toe and minimum to .5 inches will be recorded as score. If fingers cross the toe, then + will be indicated before the score and if the participant is unable to touch the toe, then - sign will be indicated.



#### 6.4.4 BACK STRETCH

**Purpose:** To determine upper body flexibility

**Objective:** To touch or overlap the finger of the both hands behind the back.

**Equipment:** 18 inches ruler



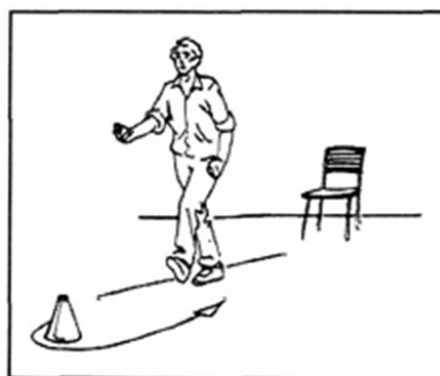
**Procedure:** In standing position participant will place one hand over the shoulder and one hand middle of the back and try to touch or overlap each other.

**Scoring:** Measurement will be taken by measuring the distance between the tips of the middle fingers. If the fingertips touch, then the score is zero. If they do not touch, measure the distance between the finger tips (a negative score), if they overlap, measure by how much (a positive score).

#### 6.4.5 FOOT UP AND GO

**Purpose:** To determine physical mobility (power, speed, agility and balance).

**Objective:** To stand and walk 16 feet and sit back as fast as possible (without running). **Equipment:** Straight back chair without arms; cone; stopwatch,







**Procedure:** A chair should be placed against the wall or somewhere where the chair get stabilized.

The participant sits on the chair with both feet on the floor.

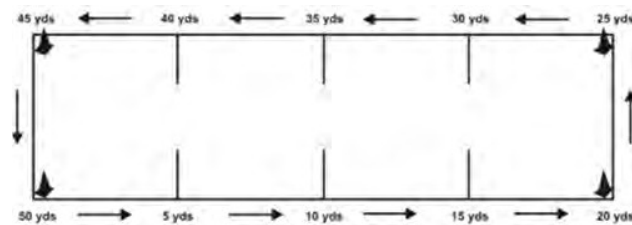
At the command "Go" he/she walks as fast as possible (not running) and returns back after walking to and around the cone which is placed 8 ft away from the chair.

There should be enough space around the cone from where participant can take an easy turn.

**Scoring:** Two attempts will be made and the best score will be taken for record. Fastest time taken between command "Go" and return to the chair will be recorded.

### 6.4.6 MINUTE WALK TEST

**Purpose:** To determine aerobic endurance



**Objective:** To walk maximum distance in 6 minutes.

**Equipment:** Walking area of 20 yards each between parallel lines connected with 5 yards lines making rectangles; stopwatch; cone.

**Procedure:** Participant will start walking after the command "Go" and continuously walk on the track for 6 minutes.

He /she has to cover maximum distance in 6 minutes but without running.

**Scoring:** Maximum distance covered in 6 minutes will be recorded as score.





### 6.4.7 MINUTES STEP TEST

**Purpose:** To determine aerobic endurance.



**Objective:** To count maximum number of steps in 2 minutes. **This test is performed as an alternative to the 6- minute walk test** for people who use orthopaedic devices when walking, as well as in the case of people who have difficulty balancing.

**Equipment:** tape for marking the wall; stopwatch; wall.

**Procedure:** The participant up straight next to the wall while a mark is placed on the wall at the level corresponding to midway between the patella (knee cap) and iliac crest (top of the hip bone).

The participant then marches in place for two minutes, lifting the knees to the height of the mark on the wall. Resting is allowed, and holding onto the wall or a stable chair is allowed.

Stop after two minutes of stepping.

**Scoring:** The total number of times the right knee reaches the tape level in two minutes is recorded.

#### *Normal Range of Score for Men*

**Reference:** The Journal for Active Aging, March April 2003 Page No. 28





	60-64	65-69	70-74	75-79	80-84	85-89	90-94
Chair stand							
(no. of stands)	14 - 19	12 - 18	12 - 17	11 - 17	10 - 15	8 - 14	7 - 12
Arm Cud							
(no. of reps)	16 - 22	15 - 21	14 - 21	13 - 19	13 - 19	11 - 17	10 - 14
6-Min Walk							
(no. of yds)	610 - 735	560 - 700	545 - 680	470 - 640	445 - 605	380 - 570	305 - 500
2-Min Step							
(no. of steps)	87 - 115	86 - 116	80 - 110	73 - 109	71 - 103	59 - 91	52 - 86
Chair Sit-&-Reach							
(inches +/-)	-2.5 - +4.0	-3.0 - +3.0	-3.5 - +2.5	-4.0 - +2.0	-5.5 - +1.5	-5.5 - +0.5	-6.5 - -0.5
Back Scratch							
(inches +/-)	-6.5 - +0.0	-7.5 - -1.0	-8.0 - -1.0	-9.0 - -2.0	-9.5 - -2.0	-10.0 - -3.0	-10.5 - -4.0
8-Ft Up-&-Go							
(seconds)	5.6 - 3.8	5.7 - 4.3	6.0 - 4.2	7.2 - 4.6	7.6 - 5.2	8.9 - 5.3	10.0 - 6.2

### Normal Range of Score for Women

Reference: The Journal for Active Aging, March April 2003 Page No. 28

	60-64	65-69	70-74	75-79	80-84	85-89	90-94
Chair stand							
(no. of stands)	12 - 17	11 - 16	10 - 15	10 - 15	9 - 14	8 - 13	4 - 11
Arm Cud							
(no. of reps)	13 - 19	12 - 18	12 - 17	11 - 17	10 - 16	10 - 15	8 - 13
6-Min Walk							
(no. of yds)	545 - 660	500 - 635	480 - 615	430 - 585	385 - 540	340 - 510	275 - 440
Chair Sit-&-Reach							
(inches +/-)	-0.5 - +5.0	-0.5 - +4.5	-1.0 - +4.0	-1.5 - +3.5	-2.0 - +3.0	-2.5 - +2.5	-4.5 - +1.0
Back Scratch							
(inches +/-)	-3.0 - +1.5	-3.5 - +1.5	-4.0 - +1.0	-5.0 - +0.5	-5.5 - +0.0	-7.0 - -1.0	-8.0 - -1.0
8-Ft Up-&-Go							
(seconds)	6.0 - 4.4	6.4 - 4.8	7.1 - 4.9	7.4 - 5.2	8.7 - 5.7	9.6 - 6.2	11.5 - 7.3



### Do you Know

We can improve fitness through following activities: Muscular Strength: Jumps, throws, weight training

**Muscular Endurance:** Pull ups, Push-ups, Sit-ups, weight training Cardiovascular Endurance: Long distance running, swimming, cycling Flexibility: Yoga Asana

**Speed:** 10m, 30m, 50m, 100m sprint etc.

**Coordination:** ball throw and catching, kicking and stopping ball Agility: Cone, ball, balloon and ladder drills

#### I. Tick the correct options.

- Which is not an item of Rikli and Jones Test?
  - 8 Foot Up and Go
  - Sit and Reach test**
  - 6 Minute Walk Test
  - Arms Curl Test
- What is the weight of dumbbell for men in arm curl of Rikli and Jones Test?
  - 5 pounds
  - 6 pounds
  - 8 pounds
  - 10 pounds

#### II. Answer the questions briefly.

- Explain any two test that form part of the Rikli and Jones Test.
- Write down the purpose of all the tests that form a part of Rikli and Jones Test.

#### III. Answer the questions in 150-200 words.

- Discuss any three tests for testing the endurance and agility of senior citizens.





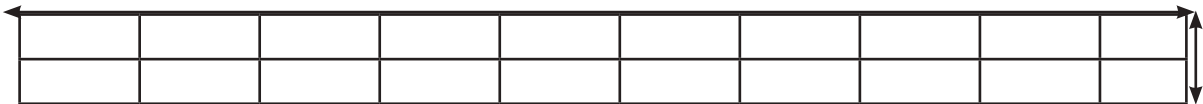
## 6.5 Johnson - Metheny Test of Motor Education

**Objective:** Johnson- Metheny Test battery is revised version of Johnson Educability Test which was designed in 1932. The purpose of the Johnson battery was to measure neuromuscular skill capacity which have ten items. In 1938 Metheny studied the test and eliminated six items. The test battery consist of four motor stunts are given below:

- I. Front Roll
- II. Back Roll
- III. Jumping Half-Turns
- IV. Jumping Full- Turns

Four stunts are to be performed by the boys and three stunts for girls.

**Test Area:** Mat area length is 15 feet and it is 2 feet wide. The 15 feet length divided in to ten sections for 18” each. The width of transverse line is  $\frac{3}{4}$ ” and 3” alternatively. Centre of lines remains 18” apart. Another  $\frac{3}{4}$ ” wide line is marked lengthwise in the middle of the mat area.



### Procedure:

1. **Front Roll:** Ignoring the long middle dividing line, the subject is asked to start outside the marked area and perform two front rolls, one up to 7.5' i.e. 3” wide centre line and the second in the other half of 7.5'. The subject is to perform the rolls without touching the limits or over reaching the zones mentioned above.

**Scoring:** Each correct roll gets 5 points, hence maximum of 10 points. Two points are deducted for over-reaching side line, right or left for each roll; one point is deducted for over reaching the end limit on each roll and full five points are deducted when the subject fails to perform a true front roll

2. **Back Roll:** The test is similar to front roll both in performing and scoring. The subject is to start outside the marked chart area and is to 'perform two back rolls in the 2 feet lane area, one up to first half and the second back roll in the second half.





3. **Jumping Half Turns:** The subject is asked to start with feet on first 3” line, jump with both feet to second 3” wide line, executing a half turn either right or left; jump to third 3” line executing half turn in opposite direction to first half-turn and then to 4th and 5th 3” wide lines executing half turns, right or left alternatively.

**Scoring:** Perfect execution of four jumps is worth ten points. Only 2 points are deducted for each wrong jump when the subject either does not land with both feet on the 3” line or turns the wrong way or both.

4. **Jumping Full Turns:** The subject is asked to start with the feet outside the marked area at about the centre of the lane. He/She is required to jump with feet together to second rectangular space, executing a full turn with the body either right or left; continue jumping to alternate rectangular spaces across the marked mat executing full turns, rotating body in the same direction, landing on both feet every time.

**Scoring:** Perfect execution of five jumps is worth ten points. Two points are deducted, if the subject fails to keep balance on landing on both feet; turns too far or oversteps the squares.

I. **Tick the correct options.**

1. Johnson- Metheny Test battery has \_\_\_\_\_Items.
- 6
  - 5
  - 4
  - 10
2. Johnson- Metheny Test battery does not consist of \_\_\_\_\_motor stunts
- Front Roll
  - Back Roll
  - Side Roll**
  - Jumping Full- Turns

II. **Answer the questions briefly.**

1. Explain the procedure of Jumping Half-Turns and Jumping Full- Turns in Johnson - Methney battery.





III. Answer the question in 150-200 words.

1. How can we test Motor Educability? Explain in detail.

IV. Complete the following table about some important tests for assessing physical fitness in school.

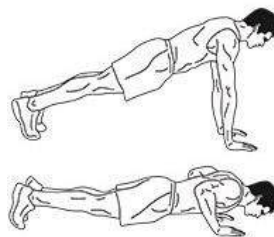
Name of Test	What it tests?	Procedure	Scoring
Plate Tapping Test			
Flamingo Balance Test			
Partial Curl up			
Push ups			
Sit and Reach Test			
600m Run			
50m Dash			
Harvard Step Test			
Johnson-Metheny Test			





#### V. Case Study Questions.

1. Sports department of ABC school is conducting fitness tests for all the students of the school. As studies in chapter test and measurement in sports answer the following questions.
  - a. Name the test items for class 1-3.
  - b. Name the test items for classes 4-12.
  - c. Which tests are common in both the categories 1-3 & 4-12?
2. Students of class X were gathered on the playground during their games period and were informed that a fitness test will be conducted for them. Students had some questions related to the test items.



- a. What is the purpose of conducting Push-ups?
- b. Which test will be conducted for speed?
- c. What is the time duration for performing Partial curl ups?

#### IV. Art Integration

The Sports department of your school is conducting fitness tests for all the students of the school.

Based on the chapter Test and Measurement in Sports,

Plan tests for

- (a) Classes 1-3.
- (b) Classes 4-12.
- (c) Are there any tests that are common to both the categories 1-3 & 4-12?
- (d) Students of class III and X were gathered on the playground during their games period and were informed that a fitness test will be conducted for them. Students had some questions related to the test items.







1. What is the purpose of conducting Flamingo Test/ Push-ups?
2. Which test will be conducted for speed for both categories?

Prepare a short speech informing students about the tests, their objective, procedure and method of scoring.

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# UNIT VII

## PHYSIOLOGY AND INJURIES IN SPORTS

### Overview

- ◆ Physiological factors determining components of Physical Fitness
- ◆ Effect of exercise on Muscular System
- ◆ Effect of exercise on Cardio- Respiratory System
- ◆ Physiological changes due to ageing
- ◆ Sports injuries: Classification (Soft Tissue Injuries - Abrasion, Contusion, Laceration, Incision, Sprain & Strain; Bone & Joint Injuries - Dislocation, Fractures - Green Stick, Comminuted, Transverse, Oblique & Impacted)

### LEARNING OUTCOMES

*At the end of the chapter, you will be able to:*

- ◆ recognize the physiological factors determining the components of physical fitness
- ◆ comprehend the effects of exercise on Muscular system
- ◆ know the effects of exercise on cardiorespiratory system
- ◆ figure out the physiological changes due to ageing
- ◆ identify and classify sports injuries

### Discussion

- ◆ The injuries you have suffered on the Games field.
- ◆ The Sport/Game you were playing when the injury occurred.
- ◆ The cause of the injury.
- ◆ The treatment.
- ◆ Could the injury have been prevented?
- ◆ Share your information with the class.





## 7.1 Physiological Factors Determining the Component of Physical Fitness

Exercise physiology is a study of the body's response to exercise. In the human body we majorly study skeletal, muscular, nervous, endocrine, cardiovascular, metabolic, respiratory, digestive, urinary and reproductive systems which are somehow affected by exercises. During exercise, all systems of our body work jointly but responses of these systems are independent. Metabolic system produces energy and takes care of intake and output of energy. Cardiovascular system controls circulation, transports oxygen and energy to muscles and waste products from muscles to kidney. Respiratory system takes in air, diffuses oxygen to lungs and muscle tissue and removes carbon dioxide from body. Neuromuscular and skeletal system allows body movements through muscle contraction. Neuroendocrine and Immune system help to maintain homeostasis of the body. To develop fitness, each component has a different exercise, which is performed with different intensity, and volume, so the responses of systems are different. Here we will study on three major physiological factors that determine the various components of fitness.

### 7.1.1 SKELETAL MUSCLES FACTOR

Skeletal muscles are made up of muscles fibres which are divided into two categories Slow twitch fibres or Type I fibres and Fast twitch fibres or Type II fibres. Mostly muscles contain a mix of both fast and slow twitch fibres and the proportion of these fibres is dependent on genetics, hormones, and habits of exercises. Composition of fibres in muscles plays a dominant role in development of strength, endurance, and speed performance. Skeletal muscles have four properties contractility, excitability, extensibility, and elasticity. These characteristics present in muscles determine different components of fitness.

Slow twitch fibres or Type I fibres or slow oxidative fibres contain large numbers of oxidative enzymes, have more capillaries, higher concentration of myoglobin and mitochondrial enzyme than fast twitch fibres which promote aerobic activity and resistance against fatigue. Due to higher concentration of capillaries the colour of fibres becomes red and has greater supply of blood. Such types of fibres contract at low rate and keep contracting for longer duration without fatigue; thus, producing large amounts of energy slowly. Slow twitch fibres help in long distance running, swimming, cycling etc.



Fast twitch fibres or Type II fibres or Fast glycolytic fibres contain a good volume of glycolytic enzymes which promote anaerobic activity but due to a smaller number of mitochondria they have limited aerobic capacity and low fatigue resistance. Fast twitch fibres do not require blood supply to produce energy, so their colour is lighter as compared to slow twitch fibre. Such fibres have fast contraction rate, tire rapidly and Type consume lots of energy, and can produce small amount of energy quickly. Fast twitch muscle fibre helps in anaerobic activities like jumps, throws, sprint etc.

Muscles fibres play a dominant role in sports performance. Regular training can change the proportion of slow and fast twitch fibres.

There are variations of types of fibres among athletes participating in the same sports also Sprinters generally have a higher percentage of Type II fibres and a lower percentage of Type I fibres, while endurance athletes have a higher percentage of Type I fibres and a lower percentage of Type II fibres. The amount of force generated through muscle contraction depends on the number and types of motor units, length of muscles, nature of neural stimulation of the motor units and contractile history of muscle.

<b>Do you Know?</b>		
<b>Sports</b>	<b>Slow Twitch Fibre</b>	<b>Fast Twitch Fibre</b>
<b>Long Distance Runners</b>	70 to 80 %	20 to 30 %
<b>Sprinters</b>	25 to 30 %	70 to 75 %
<b>Non-Athletes</b>	48 to 52 %	48 to 52 %

### 7.1.2 ENERGY PRODUCTION FACTOR

Cellular respiration is a process in which ATP (Adenosine triphosphate) is formed through food. Main source of energy in food is in form of carbohydrates, proteins, and fats. Each has different complex chemical process to form ATP energy. During exercise, the load on the metabolic system increases manifold because of increase in the demand of energy by different systems. In this process, carbohydrates give instant energy as compared to fats and proteins, but fats give a larger amount of energy as compared to carbohydrates and proteins. Higher intensity aerobic activity requires carbohydrates in the form of glucose and glycogen as fuel.





### Do you know?

**Metabolism:** is the process of overall energy transformations occurring in the body.

**Anabolism:** is the process where the simple molecules combine to generate complex

**molecules:** Catabolism: is the process of breakdown of food and stores to produce energy for work.

Carbohydrates work as a fuel for short duration exercise, fats are utilized for long duration exercises and proteins contribute a small but important proportion of nourishment. Basically, three energy system works in our body ATP-CP (Creatine phosphate) system, anaerobic system, and aerobic system. ATP- CP system provides energy if the activity is less than 10 second. Such activities are dynamic in nature and of very short duration and very intensive. They include jumps, throws, sprints, weightlifting, powerlifting etc. Anaerobic system provides energy for less than two minutes, in activities like 200m, 400m races. Aerobic system provides energy for long duration activities like marathon, football, hockey etc. Aerobic and anaerobic systems work simultaneously, but which system is predominant depends upon type, duration, intensity of exercise, long and short-term nutritional status, proportions of types of muscle fibres etc.

### 7.1.3 CARDIORESPIRATORY FACTOR

The Cardiorespiratory system is combination of respiratory and cardiovascular systems which jointly work to transport oxygen to the cells and support metabolism by delivering nutrients, which provide energy to neuromuscular system and neuroendocrine system. During exercise, the demand for energy increases and to meet the demand, oxygen is required in appropriate volume to achieve the same. Demand of energy depends on intensity, duration, and type of activity. To match the same, the respiratory system -- pulmonary ventilation, external respiration, and internal respiration work together. The cardiovascular response to exercise is directly proportional to the demands of the skeletal muscles for Oxygen. Maximal oxygen consumption ( $VO_2$  Max), Blood pressure, blood volume, oxygen diffusion and extraction, muscle and arterial blood flow etc. simultaneously increase as per activity.





### Do you know?

In games where ATP-CP system or anaerobic system works to produce energy for strength training. Stroke volume (the volume of blood pumped out of the left ventricle of the heart during each systolic cardiac contraction) is a vital parameter as far as cardiovascular system is concerned

#### 7.1.4 PHYSICAL FITNESS COMPONENTS DETERMINED BY THE PHYSIOLOGICAL FACTORS

Strength

Endurance

Speed

Flexibility

Now we will understand how the above-mentioned physiological factors determine fitness. We have taken four components of physical fitness namely strength, endurance, speed and flexibility.

**Strength** - Strength is the ability of the body to work against resistance and has varied sub-types such as Maximum Strength, Explosive Strength, Strength, Endurance etc. Each has different types of exercise, intensity and duration so physiological factors vary. Different sports require different amount of strength and according to that, mixture of the slow twitch fibre and fast twitch fibre is needed. Generally in all the strength related sports where sudden burst of energy is required, high percentage of fast twitch fibre is required. In games like weightlifting, jumps, sprint or power, agility and strength dominating sports where force production is high, fatigue is quick, and fast twitch fibre percentage must be high in muscles.





### Do you know?

Nameirakpam Kunjarani Devi (born 1 March 1968) is the most decorated Indian sportswoman in weightlifting. She is a recipient of Arjuna Award, Padma Shri and Rajiv Gandhi Khel Ratna.

**Endurance:** Endurance is the ability of the body to work for a longer period without getting fatigued. Endurance also varies from brisk walk to running to marathon. While in each activity intensity and duration varies, but one thing is common in all these activities: that is long duration and low fatigue activity. Activities like cycling, swimming or long duration activities come under endurance component. Slow twitch fibre percentage must be higher in comparison with fast twitch fibres to give better performance in endurance. Aerobic system provides energy in endurance training. Maximal oxygen consumption ( $Vo_2$ ), ventilation capacity plays dominating role in endurance training.

**Speed:** Speed is the ability to cover maximum distance in shortest period. In speed training percentage of fast twitch fibres is very high in muscles, these activities include 100m race, roller skating, or any movements that require work to be done in minimum possible time. A vital physiological factor to give best speed performance is motor neuron stimulation. The brain sends a message to the muscles to act fast. To meet the demand of energy, the ATP CP system works.





### Do you know?

In 100 m sprint event:

The current men's world record is 9.58 seconds, set by Jamaica's

Usain Bolt in 2009, while the women's world record of 10.49

seconds set by American Florence Griffith-Joyner in 1988 remains unbroken.

**Flexibility:** It is the ability of muscle and tendons to lengthen without getting damaged. Activities of stretching or yoga require a good deal of flexibility. Physiological factors like elasticity and extensibility of muscles, type of joint, homothermic temperature are key determinants of flexibility. Muscles, tendons, and ligaments are key components that affect flexibility. Muscles groups like agonists, antagonists, neutralizers, and stabilizers should be understood for training purpose. Agonists are the muscles which contract to perform a certain action. Antagonists are muscles which oppose the prime movers as they relax and lengthen progressively to allow agonists to move. Synergists are muscles that work together in a close cooperation as they either contract or relax to modify the action of the agonist. Synergists include Conjoint, Neutralizer and Stabilizer muscles.

### Do you know?

**Aerobic Exercise** is any type of cardiovascular conditioning. It can include activities like brisk walking, swimming, running, or cycling. You probably know it as "cardio." By definition, aerobic exercise means "with oxygen." Your breathing and heart rate will increase during aerobic activities.

**Anaerobic Exercise** is any activity that breaks down glucose for energy without using oxygen. Generally, these activities are of short length with high intensity. The idea is that a lot of energy is released within a small period of time, and your oxygen demand surpasses the oxygen supply.

**ATP** The Full form of ATP is Adenosine Triphosphate. ATP is a complex organic chemical that provides energy to drive many processes in living cells, eg., nerve impulse propagation, muscle contraction, and chemical synthesis

**ATP-PCr** Known also as immediate energy system, phosphagen system, and alactic anaerobic system, the ATP - PCr system is the main energy provider for a high intensity exercise of short duration up to 10 seconds, for example lifting a weight, swinging a golf club, doing a push - up, and throwing a hammer







**Myoglobin** a red iron-containing protein pigment in muscles that is similar to haemoglobin Mitochondrion any of various round or long cellular organelles of most eukaryotes that are found outside the nucleus, produce energy for the cell through cellular respiration, and are rich in fats, proteins, and enzymes

### Extension Activity

Think of an activity/exercise you would suggest for improving

Muscular strength	_____
Power	_____
Speed	_____
Muscular endurance	_____
Agility	_____
Flexibility	_____

#### I. Tick the correct answers.

- \_\_\_\_\_ system provide energy during 5000m race.
  - ATP CP system
  - Anaerobic System
  - Aerobic System**
  - Endurance System
- Slow twist fibres are of \_\_\_\_\_ colour.
  - Red**
  - White
  - Black
  - Blue





3. Vo<sub>2</sub> max is related to \_\_\_\_\_
  - a. Muscular system
  - b. **Respiratory system**
  - c. Cardiovascular system
  - d. Energy production system
4. Which is NOT a property of muscles?
  - a. Contractility
  - b. Excitability
  - c. Extensibility
  - d. **Durability**

**II. Answer the following questions briefly.**

1. Point out physiological factor for strength.
2. Briefly describe the energy production system in our body.
3. Explain different properties of muscles.
4. Write a few points on cardiorespiratory factors determining fitness.

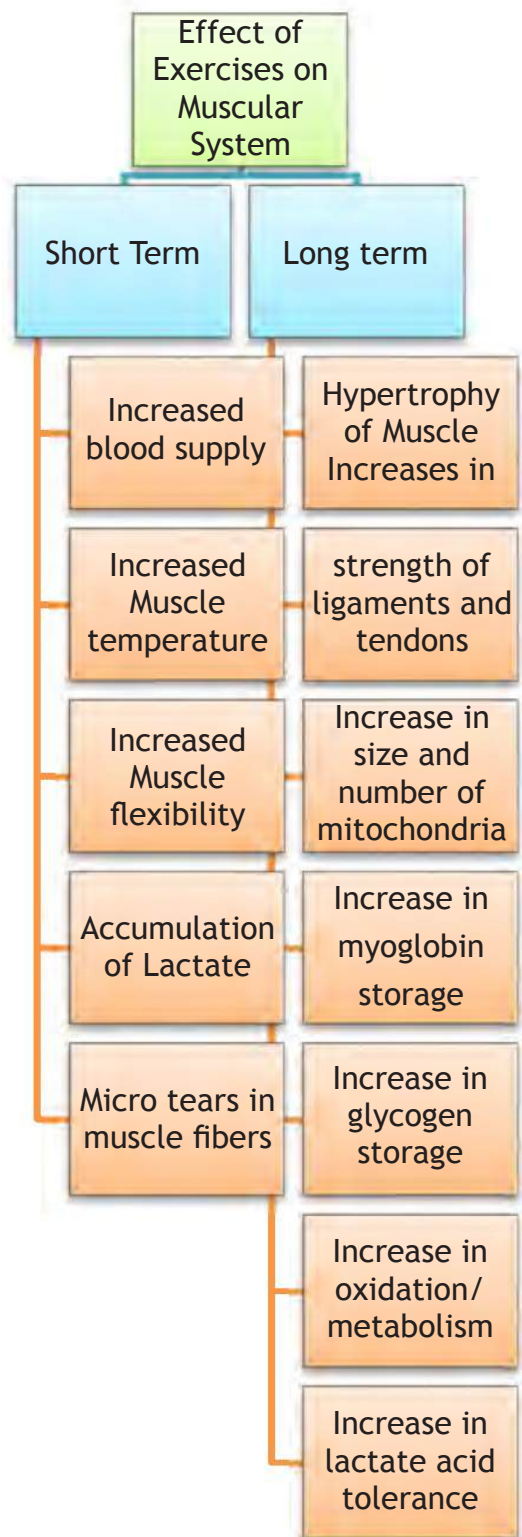
**III. Answer the following questions in 150-200 words.**

1. Explain Physiological factors determining fitness.

## 7.2 Effect of Exercise on Muscular System

Exercise involves a series of sustained muscle contractions, of either long or short duration, depending on the nature of the physical activity. Effects of exercise on muscles can be considered short-term or immediate, both during and shortly after exercise; as well as long-term, lasting effects.





### Short Term Effect of Exercises on Muscular system

**Increased blood supply:** During exercise, in order to match demand of fuel to muscle, the supply or concentration of blood increases in the whole body or, in the particular muscle group where activity is largely impacted.



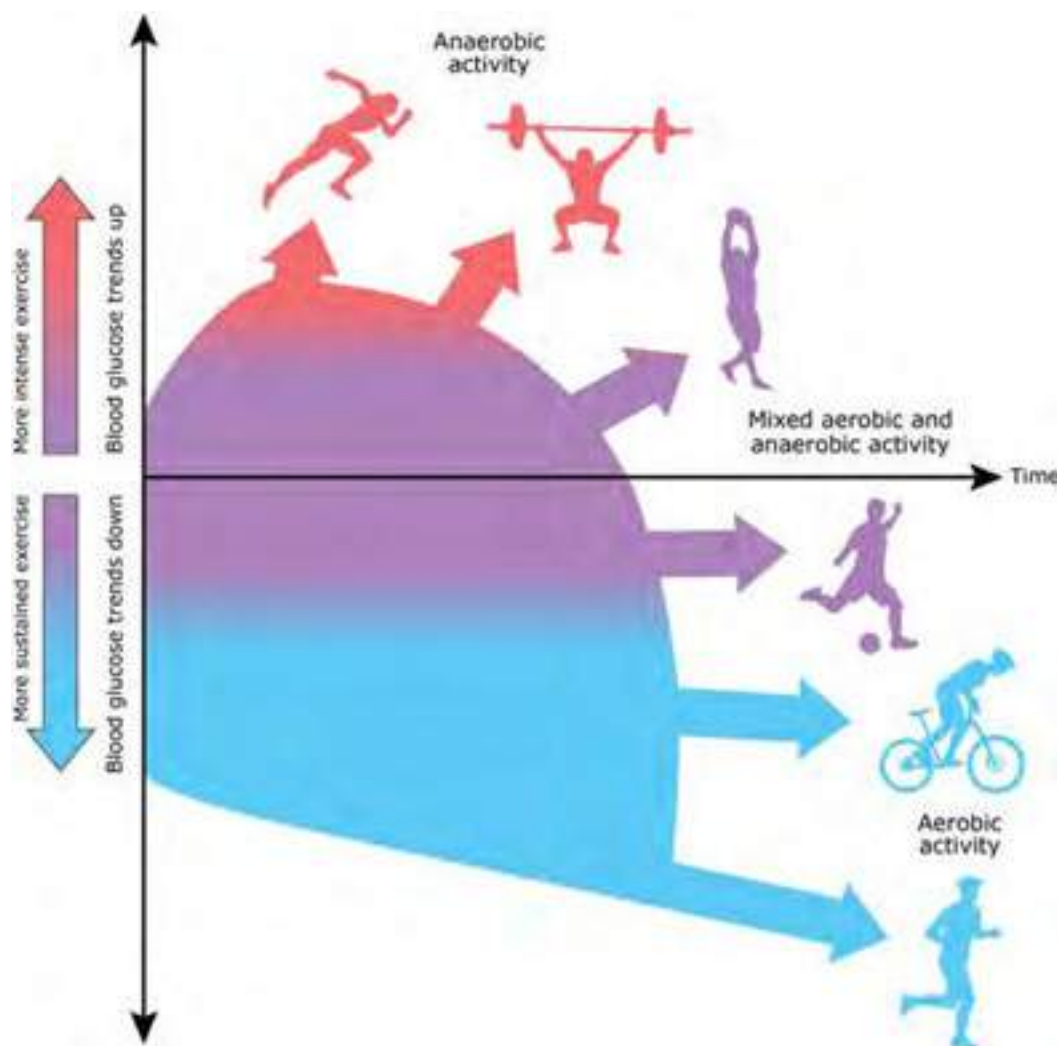


**Increased muscle temperature:** During exercises muscles demand energy, which comes from contracting muscles. During the process, a lot of heat energy is generated which increases the temperature of muscles, and/ or the body.

**Increased muscle flexibility:** Due to increase in blood flow and rise in temperature, elasticity of muscles increases. Stretching and mobility exercises also play a dominant role in increasing muscular flexibility.

**Accumulation of Lactate:** Muscles requires oxygen. If blood supply does not provide appropriate volume of oxygen to muscles, it leads to accumulation of lactate acid in muscles which result in pain, and soreness in muscles.

**Micro-tears in Muscle Fibres:** During exercises muscle tissue is placed under stress which results in micro-tears in muscle fibres. The body responds by repairing the muscle fibres and making them larger. When a muscle gets bigger, this process is called hypertrophy.





### Long term effects of Exercise on Muscular system

**Hypertrophy of Muscle:** Scientific and systematic exercise leads to increase in thickness of muscle fibres that results in increase in muscle size also known as muscle hypertrophy.

**Increase in Strength of Ligaments and Tendons:** regular exercise helps to strengthen bones, ligaments, and tendons. This helps prevent injury and promotes performance.

**Increase in Size and Number of Mitochondria:** Aerobic exercises leads to increase in size and numbers of mitochondria, and which take in more oxygen and produce more ATP and energy.

**Increase in Myoglobin Storage:** Long term effect of aerobic exercise is to increase the storage of myoglobin which transports oxygen to mitochondria. Large amount of myoglobin means large amount of oxygen and large amount of energy.

**Increase in Glycogen Storage:** Glycogen is generally stored in muscles and liver. Regular exercise helps the body to increase the storage of glycogen which may give continuous energy for 90 to 120 minutes.

**Increase in Oxidation/ Metabolism:** Endurance exercise training increases the capacity of skeletal muscle fat oxidation by increasing mitochondrial density. Long term exercises demand a lot of energy, and to meet this demand, metabolism increases due to oxidation of fat. This leads to increase in provision of energy.

**Increase in Lactate Acid Tolerance:** Regular exercises help to tolerate pain and sourness in muscles due to accumulation of lactate acid.

#### I. Tick the correct answers:

1. Which is **not** a long term effects of exercise on muscular system?
  - a. Hypertrophy of muscle
  - b. Increased metabolism
  - c. Increased Myoglobin
  - d. Increased blood supply
2. Which is **not** a short term effects of exercise on muscular system?
  - a. Accumulation of Lactate
  - b. Micro-tears in muscle fibers



- c. Increase muscle temperature
  - d. Increase in lactate acid tolerance
3. Physical activity helps to increase \_\_\_\_\_.
- a. size of muscle
  - b. size of bone
  - c. size of brain
  - d. size of liver
4. Increase in glycogen stored in muscle is an effect of \_\_\_\_\_
- a. Aerobic Training
  - b. Anaerobic Training
  - c. Cross Training
  - d. Multi training

**II. Answer the following questions briefly:**

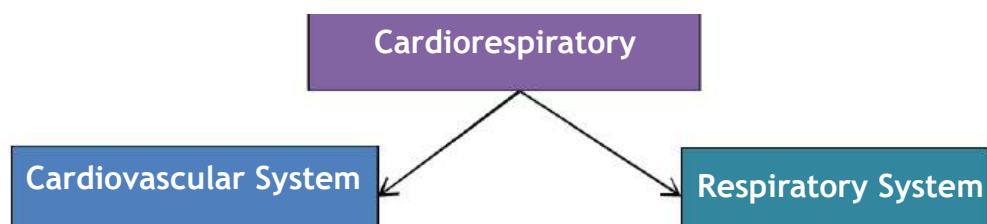
1. Explain long term effects of exercise on muscular system
2. Explain short term effects of exercise on muscular system

**III. Answer the following questions in 150-200 words:**

1. Describe the various effects of exercises on muscular system

### 7.3 Effect of Exercise on Cardiorespiratory System

Cardiorespiratory system consists of two parts. They are



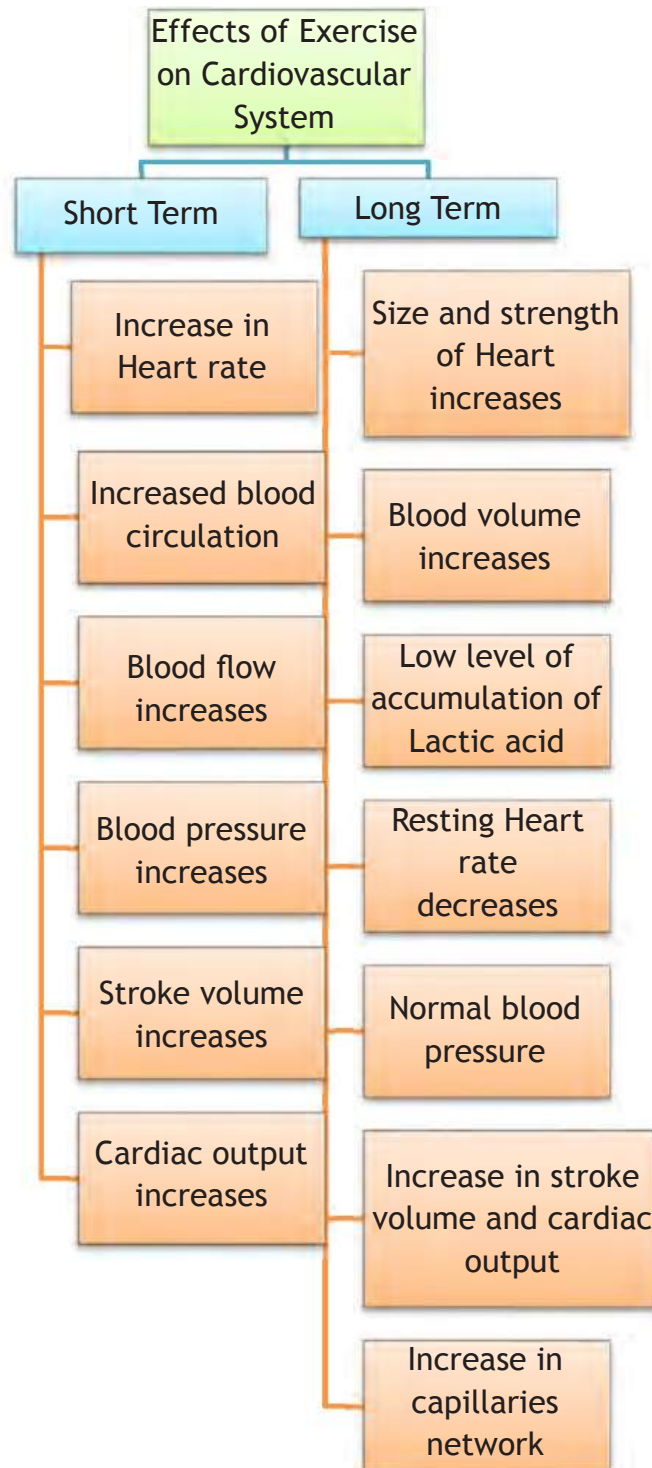
**Cardiovascular system** - It consists of three parts: the heart, blood vessels and blood. Its major function is to deliver oxygen and nutrients, remove CO<sub>2</sub> and other metabolic waste products, to transport hormones and other molecules, to support thermoregulation and control of body fluid balance and lastly to regulate immune function.





**Respiratory system** - The important parts of the respiratory system are the nose, nasal cavity, pharynx, larynx, trachea, bronchi, and lungs. Air can also enter the respiratory system through the oral cavity. Its major functions include, transporting air to the lungs, exchanging gases (O<sub>2</sub> and CO<sub>2</sub>) between the air and blood, and regulating blood pH.

### 7.3.1 EFFECT OF EXERCISE ON CARDIOVASCULAR



### Short Term Effects of Exercise on Cardiovascular System

**Increased Heart Rate:** Exercise makes the body work harder and therefore muscles require more oxygen to continue to work effectively. This sudden increase in demand of oxygen is met by an increase in blood circulation which is achieved by the heart. In this process, the heart rate increases.

**Increased Blood Circulation:** As the heart rate increases, blood circulation increases in the body to deliver the oxygen to muscles. As a result, the movement or flow of blood increases to tissues or organs.

**Increased:** Endurance exercise leads to increase in systolic blood pressure which is in direct proportion to the increase in exercise intensity. The increased systolic blood pressure is because of the increased cardiac output that accompanies increasing rates of work. With most types of training there is minimal change in diastolic blood pressure.

**Increased Stroke Volume:** The volume of blood pumped during one beat (contraction) is called stroke volume. During exercise, stroke volume increases as more oxygen is required. This is accomplished by delivering blood to muscles. After an endurance training programme capacity of heart to pump blood in one contraction increased by 20 to 50 percent.

**Increased Cardiac Output:** Cardiac output is the amount of blood pumped out by each ventricle of the heart in 1 minute. It is the product of the heart rate (HR) and the stroke volume (SV). Resting cardiac output is approximately 5.0 L/min but differs according to the size of the person. Maximal cardiac output varies between less than 20 L/min in sedentary individuals to 40 or more L/min in elite endurance athletes. Increase in heart rate and stroke volume results in increase in cardiac output.

### Long Term Effects of Exercise on Cardiovascular System

**Increased Size and Strength of Heart:** Continuous aerobic exercises help to increase the strength and the size of heart which helps in better performance. It is also referred as cardiac hypertrophy.

**Low Level of Accumulation of Lactic Acid:** Anaerobic respiration is the process of converting glucose into energy without oxygen. During the conversion from glucose to energy, lactic acid, a waste product, is created. Lactic acid makes muscles tired and painful. Regular exercises prepare muscles to adjust to working with lower levels of oxygen and the circulatory system develops itself to transport oxygen to







different parts of the body, thereby resulting in low levels of lactic acid.

### Extension Activity

#### Discuss in your group

The heart is an important part of the cardiovascular system. What can you do to keep your heart healthy?

What should you avoid doing?

What can happen if the cardiovascular system becomes unhealthy?

Your heart is a muscle about the size of your fist. Compare it to other muscles. Can you control it like you do the muscles in your arms or legs?

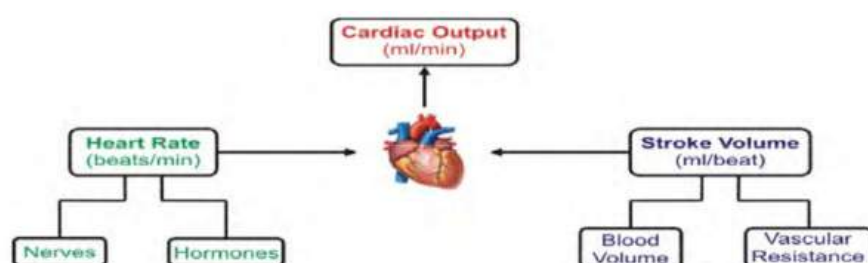
Can you exercise it like you do other muscles?

**Decrease in Resting Heart Rate:** Due to improved efficiency of the heart, it is required to pump less blood to meet the needs of the body. As a result, the heart rate at rest decreases. It is also called as Bradycardia.

**Normal Blood Pressure:** In response to endurance training, there can be substantial reduction in both systolic and diastolic blood pressure. Regular exercise helps keep the blood pressure normal.

**Increase in Stroke Volume and Cardiac Output:** Since the size and strength of the heart increases, heart pumps blood more efficiently with increase in stroke volume and cardiac output.

**Increase in Capillaries Network:** To achieve the demand for oxygen, capillaries network increases. Due to the demands placed on different parts of the body during exercise, the capillary density at muscle sites improves. Increased capillary density allows for greater oxygen being transported to the muscles, improving their ability to perform intense exercise. Moreover, exercise helps in preventing the decline in capillary function that happens with age.

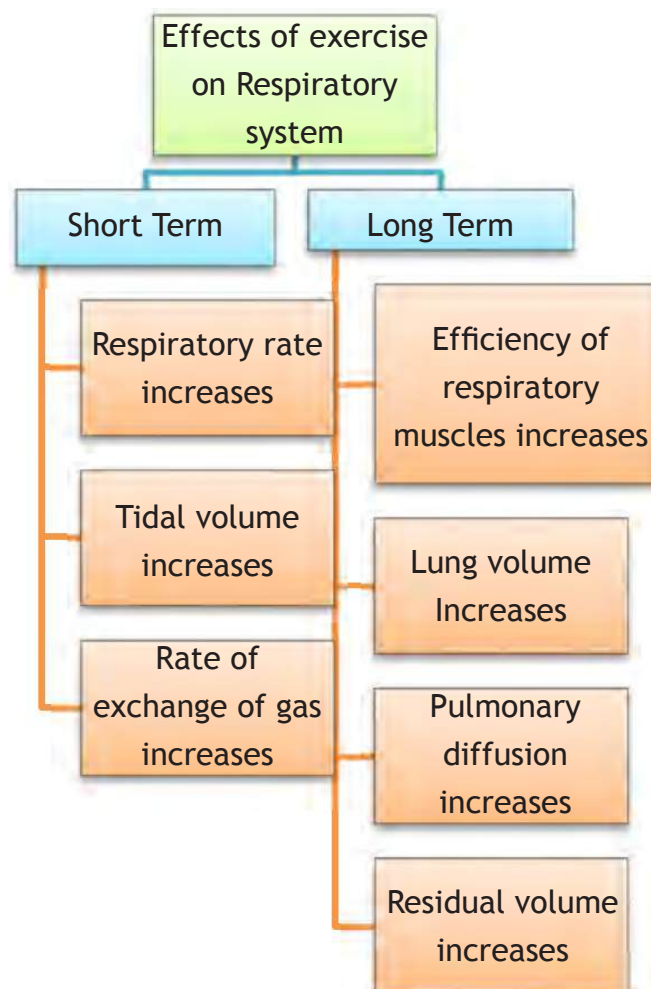




### Do you know?

Most veins carry deoxygenated blood from the tissues back to the heart; exceptions are the pulmonary and umbilical veins, both of which carry oxygenated blood to the heart.

### 7.3.2 Effect of Exercise on Respiratory System





### Extension Activity

- ◆ Working in groups, create a working model of lungs.
- ◆ Research respiratory diseases and how they affect the function of the respiratory system.
- ◆ Can you alter your model to show what happens to the lungs with these diseases?
- ◆ Can you demonstrate on their models what has been done to help people with respiratory problems?

### Short Term Effects of Exercise in Respiratory System

**Respiratory Rate Increases:** Our body requires more oxygen during exercise, and to meet this increased demand, the respiratory rate (breathing rate) increases. The normal respiration rate for an adult at rest is 12 to 20 breaths per minute, but during exercise it increases to 40 breaths per minutes.

**Tidal Volume Increases:** The amount of air inhaled and exhaled in one breath is known as tidal volume. Tidal volume increases as a result of exercise to take in more oxygen and remove carbon dioxide from our body.

**Rate of Exchange of Gas Increases:** Regular exercise increases the rate of exchange of gas in lungs.

### Long Term Effects of Exercise in Respiratory System

**Increased Efficiency of Respiratory Muscles:** Due to regular exercise efficiency of respiratory muscles increases, inhalation and exhalation become fluent. This helps to meet the demand of oxygen.

**Increased Lung volume:** Continuous exercises done for long duration help to increase the capacity and volume of lungs. Vital capacity increases almost 100 % as compared to that of a normal individual.

**Increased Pulmonary Diffusion:** Pulmonary Diffusion refers to the capacity of the lungs to allow oxygen and carbon dioxide to pass in and out of the blood. Regular sub-maximal exercise training develops the scope of increasing the exchange of gases, and in this process the size of the alveoli also increases.

**Increased Residual Volume:** Residual volume is the volume of air that remains in the lungs after forceful expiration. Regular exercise increases residual volume that helps to exchange the gases in normal limits.





### Do you know?

Universal donors are those with an O negative blood type. Why? O negative blood can be used in transfusions for any blood type. Types O negative and O positive are in high demand. Only 7% of the populations are O negative. However, the need for O negative blood is the highest because it is used most often during emergencies. The need for O+ is high because it is the most frequently occurring blood type (37% of the population).

#### I. Tick the correct options

- The resting Cardiac output is approximately.
  - 10.0 lt.
  - 1.0 lt.
  - 5.0 lt.
  - 15.0 lt
- The volume of blood pumped during one beat (contraction) is called,
  - Blood flow
  - Stroke volume
  - Veins and arteries
  - Capillaries
- Cardiac hypertrophy is
  - plateauing of heart rate due to maximal exercise intensity
  - enlargement of heart due to chronic endurance training
  - lowering of heart rate due to physical training
  - increase in ventricular volume because of exercise
- The amount of breath per minute increases during exercise to:
  - 20 breath per minute
  - 40 breath per minute
  - 30 breath per minute
  - 10 breath per minute

#### II. Answer the following questions briefly.

- What is Stroke Volume?





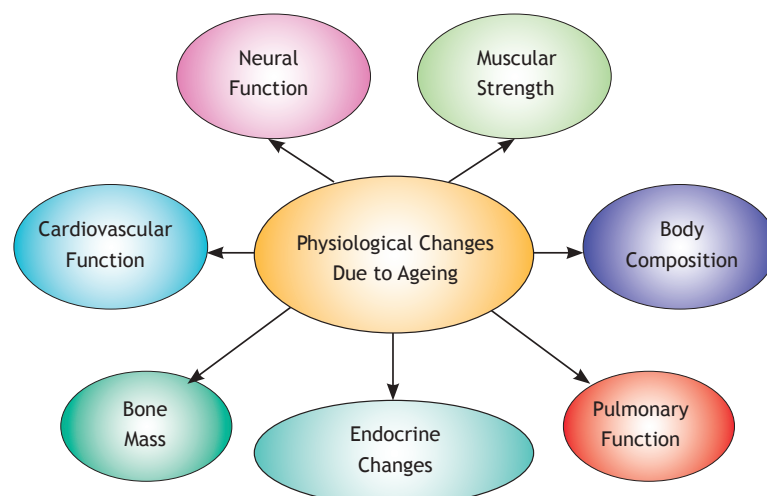
2. What is Residual Volume?
3. What are the effects of exercise on the heart?
4. Write briefly about the effect of training on
  - a. Blood flow
  - b. Blood volume
5. How does cardiac output respond to training?
6. What is pulmonary diffusion? How does it respond to training?

**III. Answer the following questions in 150-200 words.**

1. Write briefly about the effect of training on
  - a. Lung Volume
  - b. Heart rate
2. What is blood pressure? Briefly explain its response to exercise.
3. Define and explain the effect of exercise on:
  - a. Total Volume
  - b. Stroke volume

## 7.4 Physiological Changes Due to Ageing

Ageing, an inevitable and extremely complex multifactorial process, is characterized by the progressive degeneration of organ systems and tissues. It is largely determined by genetics, and influenced by a wide range of environmental factors, such as diet, exercise, exposure to micro-organisms and pollutants.





**Muscular Strength** - It is defined as the maximal force that a muscle or muscle group can generate. Men and women usually attain their highest strength levels between ages 20 and 40, the time when muscle cross-sectional area is largest. Concentric strength of most muscle groups declines, slowly at first and then more rapidly after middle age. Decline in eccentric strength begins at a later age and progresses more slowly than those in concentric strength.

Strength loss begins at a later age for women than for men. A 40% to 50% reduction in muscle mass from muscle fibre atrophy and actual loss of motor units between ages 25 and 80 is the primary cause of reduced strength, even among healthy, physically active men and women.

**Neural Function** - A nearly 40% decline in the number of spinal cord axons and a 10% decline in nerve conduction velocity reflects the cumulative effects of ageing on central nervous system functioning. These changes are likely to contribute to the age-related reduction in neuromuscular performance assessed by simple and complex reaction and movement times. Ageing most adversely affects the time required to detect a stimulus and process the information to produce the response.

**Endocrine Changes with Ageing** - The endocrine system consists of a host organ (gland), minute quantities of chemical messengers (hormones), and a target or receptor organ. Approximately 40% of individuals aged between 65 and 75 years and 50% of those older than age 80 have impaired glucose tolerance leading to Type 2 diabetes. Thyroid dysfunction, primarily from lowered pituitary gland release of the thyroid-stimulating hormone thyrotropin (and reduced output of thyroxine), is common among the elderly. This directly affects metabolic function, including decreased glucose metabolism and protein synthesis. Mean pulse amplitude, duration, and fraction of secreted growth hormone (GH) gradually decrease with ageing, a condition termed somatopause.

**Pulmonary Function** - Mechanical constraints on the pulmonary system progress with age to cause deterioration in static and dynamic lung function measures. Also, pulmonary ventilation and gas exchange kinetics during the transition from rest to submaximal exercise slow substantially.

**Cardiovascular Function** - Cardiovascular function and aerobic capacity do not escape age-related effects. Because of a lower maximum heart rate, maximum cardiac output typically decreases with age in trained and untrained men and women. Reduced peripheral blood flow capacity accompanies age-related decreases in muscle mass. Sedentary living produces losses in functional capacity at least as great as the effects of ageing.





**Body Composition** - In physical fitness, body composition is used to describe the percentages of fat, bone, water, and muscle in human bodies. After age 60, total body mass decreases despite increasing body fat.

**Bone Mass**- Bone Mass is a measure of the amount of minerals (mostly calcium and phosphorous) contained in a certain volume of bone. Osteoporosis poses a major problem with ageing, particularly among postmenopausal women. In this condition it produces loss of bone mass as the ageing skeleton demineralizes and becomes porous. Bone mass can decrease by 30% to 50% in persons older than age 60.

**Do you know?**

Oldest woman who lived on earth was Jeanne Calmenta from France (born on 21 February 1875, died on 4 August 1997, lived for 122 years, 164 days).

Oldest man to have lived on earth was Jiroemon Kimura from Japan (born on 19 April 1897, died on 12 June 2013, lived for 116 years, 54 days).

**I. Tick the correct answers:**

1. Men and women usually attain their highest strength levels between the ages of
  - a. 1 and 2
  - b. 5 and 7
  - c. 7 and 11
  - d. 20 and 40
2. It is a measure of the amount of minerals (mostly calcium and phosphorous) contained in a certain volume of bone,
  - a. Body composition
  - b. Bone Mass
  - c. Pulmonary function
  - d. Neural function
3. The chemical substances synthesized by specific host glands, secreted into the blood, and carried throughout the body are called
  - a. hormones
  - b. sugar



- c. electrolytes
  - d. capillaries
4. It is a disease in which bone weakening increases the risk of a broken bone
- a. Measles
  - b. Osteoporosis
  - c. Atherosclerosis
  - d. Beriberi
5. Decrease in size of a body part, cell, organ, or other tissue is called
- a. a. Myopia
  - b. b. Atrophy
  - c. c. Cardiac arrest
  - d. d. Cardiac cycle

**II. Answer the following questions in 150-200 words:**

1. Describe the changes in endocrine system due to ageing.

### 7.5 Sports Injuries

Sports participation and exercise engagement have always witnessed an interruption among athletes towards active participation or lead to painful experience due to some or the other form of injuries. The injuries may be due to incorrect movement, hitting or colliding with equipment or aggressive sporting actions like diving and sliding, overtraining or lack of conditioning. All these injuries caused due to different reasons may not be of the same type, which means they may need different remedies and specific understanding towards each injury to avoid and prevent such injuries. The injury in sports and exercise refers to the physical damage caused to tissue, bone, or any other organ of the body while in action and further leading to withdrawal from participation or experience pain while performing movement actions.

#### Definitions

An athletic injury is defined as “some physical damage or insult to the body that occurs during athletic practice or competition causing a resultant loss of capacity or impairing performance.” Morris (1984)<sup>5</sup>

A sports injury may be defined as damage to the tissues of the body that occurs as a result of sport or exercise. IOC Manual of Sports Injuries (2012)<sup>6</sup>







Sports injury may be defined as any stress or overstretch put on soft tissues or bone on or off the field resulting in pain and hindering performance. Cut, tear, overstretching of tissues, breakage of bone or dislocation of joints are common injuries in sports. The injuries that occur during sport, athletic activities or during certain exercises.

### 7.5.1 CLASSIFICATION OF SPORTS INJURIES

Sports Injuries can be classified according to the cause of the injury:

**Direct Injuries:** They are sustained from an external force causing injury at a point of contact.

**Indirect Injuries:** It usually involves the athlete damaging the soft tissues such as ligaments tendons or muscles of the body through internal or external force.

**Soft Tissue Injuries:** Any injuries to skin muscles or ligaments are soft tissue injuries.

**Hard Tissue Injuries:** Injuries that occur in bones and cartilages.

**Overuse Injuries:** They are sustained from continuous or repetitive stress, incorrect technique, or equipment or too much training.

#### Extension Activity

##### Working in groups discuss

Have you ever had a sports injury? How did you get it?

Are there any ways for fellow athletes to avoid similar injuries?

Why is it important to take time to heal after a sports injury?

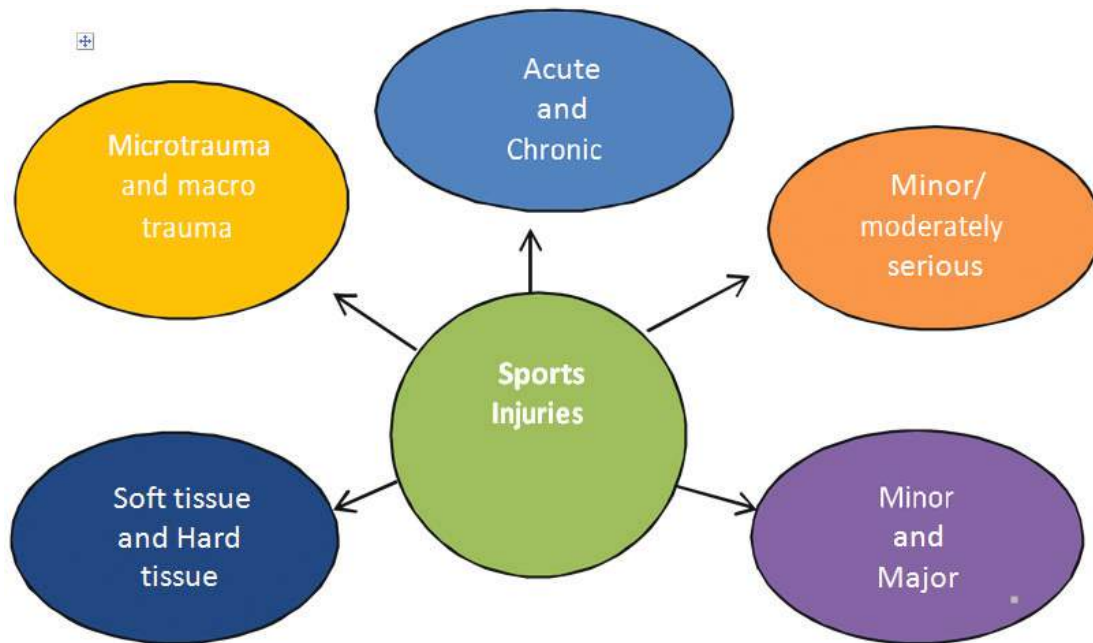
Why is it not a good idea to ignore any pain that you feel while playing a sport?

Why should you warm up before playing a sport? What can happen if you don't warm up?





## 7.5.2 TYPES OF SPORTS INJURIES



Injuries	Types
Skin injuries	<p><b>Abrasion</b> - injury caused by falling on rough or firm surface.</p> <p><b>Laceration</b> - tears in the skin.</p> <p><b>Incision</b> - cut caused by a sharp edge of an object.</p> <p><b>Puncture wound</b> - wound caused by piercing by a sharp and pointed object.</p> <p><b>Avulsion</b> - tearing away of a part of the skin.</p>
Soft tissue injuries (eg., muscles, ligaments)	<p><b>Contusion</b> - bruise caused by a direct blow to some part of the body. eg., knee of a player knocks against the thigh of another person.</p> <p><b>Sprain</b> - injury of ligament of joints, caused by the violent overstretching of ligament in a joint or the movement of the joint in abnormal directions. It is characterised by pain, tenderness, swelling at the joint.</p> <p><b>Strain</b> - injury of muscle or tendon, three types- mild, moderate, severe.</p>

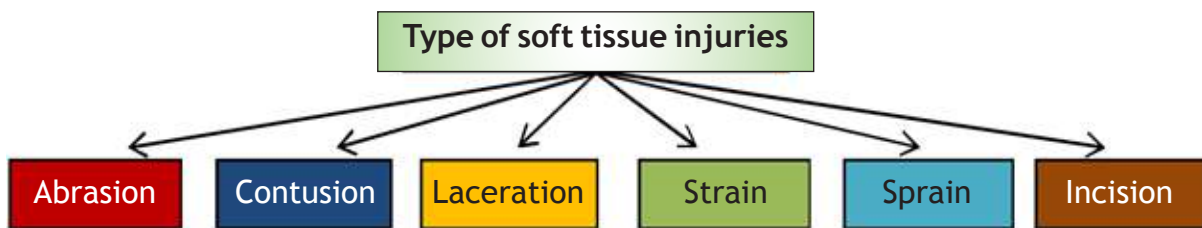




Joint injuries	Joint injuries are very common in sports. They are known as joint dislocation. "Dislocation is the displacement of contiguous surfaces of two or more bones which are in a joint." It is caused by an external force which forces the joint to move beyond the limits of a joint. If the joint is forced to move in an abnormal direction, this dislocation can be a complete or a partial displacement of the bones.
Bone injuries	Fractures (Fracture is a break in the continuity of the bone). The fractures can be open/compound fracture or a closed/simple fracture. Severity of the fracture varies from a mild crack in the bone to the severe shattering of the bone into many pieces.

### 7.5.3 SOFT TISSUE INJURIES

A soft tissue injury is the damage of muscles, ligaments and tendons throughout the body.



#### Abrasion

Abrasion injuries most commonly occur due to moving contact with a rough surface, causing a grinding, or rubbing away of the upper superficial layers of the epidermis.

**Cause** - Abrasion injuries commonly occur when exposed skin encounters a rough surface, causing a grinding or rubbing away of the upper layers of epidermis.





Treatment - Clean the surface of the affected part. Stop bleeding at the earliest by compression bandages. Anti-tetanus injection should be provided.

## Contusion

It is the type of hematoma, which refers to any collection of blood outside of a vessel.

**Cause** - When a part of the body is struck by enough force to crush underlying muscle fibres and connective tissue without breaking the skin, a contusion may occur. It can be due to a blow from a collision with a player or a piece of equipment or because of a heavy fall.

**Prevention** - All the safety gear to be worn upon while playing (Helmet, anal guards,) should be worn.



**Treatment** - Non-steroidal anti-inflammatory drugs such as Ibuprofen, or other medications for pain relief as prescribed by the doctor.

## Laceration

The irregular tear-like wounds caused by some blunt trauma.

**Cause** - Mostly, laceration is the result of the skin hitting an adjacent object, or an object hitting the skin with force.

**Prevention** - Proper personal equipment, including eye protection can be helpful in preventing the same.





**Treatment** - Clean the surface of the effected part. Stop bleeding at the earliest by compression bandages.



## Strain

Strain is an injury to the muscles which are attached to a bone. A strain is an injury to either a muscle or a tendon generally caused by overuse, force, or stretching. Depending on the severity of the injury, a strain may be a simple overstretch of the muscle or tendon, or it can result in a partial or complete tear. A strain could be an acute or chronic soft tissue injury that is a twist, pull or tear of a muscle or the tendon.

**Cause** - Strains occur suddenly (acute strain) or develop slowly over time (chronic strain). Causes include lifting of heavy objects, running, jumping, throwing etc.

**Prevention** - Regular stretching and strengthening exercise for any kind of sport can be the preventive measure for strain.

**Treatment** - It can be managed by applying ice packs and maintaining the strained muscle in a stretched position. (RICE: rest, ice, compression, and elevation).



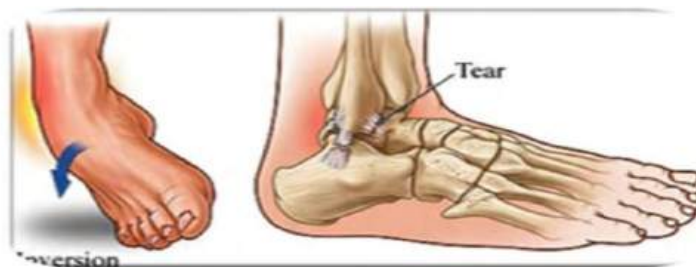


## Sprain

Sprain is the stretching or tearing of ligaments, the fibrous tissue that connects bones in the joints. A sprain occurs when you overextend or tear a ligament while surely stressing a joint. The most common location for a sprain is in your ankle.

**Cause** - A sprain occurs when one overextends or tears a ligament while severely straining a joint.

**Prevention** - Regular stretching and strengthening exercises for any kind of sport can be the preventive measure for such kind of sports injury.



**Treatment** - RICE (rest, ice, compression and elevation).

## Incision

An incision is a cut made into the tissues of the body to expose the underlying tissue, bone or organ.

**Cause** - Can be caused by a clean, sharp-edged object - such as a knife, razor or glass splinter.

**Prevention** - The area should be free from the sharp edges.

**Treatment** - Gently wash the affected area with soap and water to remove the dirt. Dry the incision with a clean, fresh towel before applying the dressing.

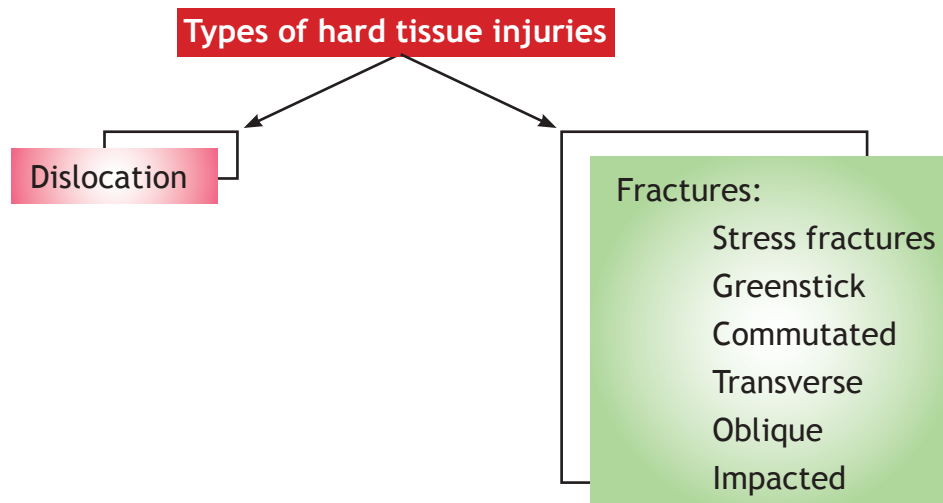






### 7.5.4 HARD TISSUE INJURIES

An injury to the skeletal system of the body is termed as the hard tissue injury. They are the injuries where the bone fractures, ie., the bone either cracks or breaks.



#### Dislocation

Dislocations are joint injuries that force the ends of bones out of position. The cause is often a fall or a blow, sometimes from playing a contact sport. A joint dislocation, also called luxation, occurs when there is an abnormal separation in the joint, where two or more bones meet. A partial dislocation is referred to as a subluxation. Dislocation can be caused by a trauma (accident or fall) or the weakening of muscles and tendons. A dislocated joint can be treated through medication, manipulation, rest or surgery.

**Causes** - Trauma that forces a joint out of place causes a dislocation. Accidents, falls, and contact sports such as football are common causes of this injury. Dislocations also occur during regular activities when the muscles and tendons surrounding the joint are weak. These injuries happen more often in older people who have weaker muscles and balance issues.

**Symptoms** - Symptoms of a dislocation vary depending on the severity and location of the injury. The symptoms of a dislocated joint include:

- Pain
- Swelling
- Bruising
- Instability of the joint





- Loss of ability to move the joint
- Visibly deformed joint (bone looks out of place)

**Treatment** - Treatment can vary based on the severity of the injury, and the joint that is dislocated. Applying ice and keeping the joint elevated can help reduce pain while you wait to see a doctor. Treatment includes:

**Medication:** Your doctor may recommend medication to reduce pain from a dislocation

**Manipulation:** A doctor returns the bones to their proper places.

**Rest:** Once the joint is back in place, you may need to protect it and keep it immobile. Using a sling or splint can help the area heal fully.

**Rehabilitation:** Physical therapy exercises strengthen the muscles and ligaments around the joint to help support it.

**Surgery:** Your doctor may recommend surgery if:

manipulation does not work to put the bones back in place. the dislocation damaged blood vessels or nerves.

the dislocation damaged bones, tore muscles or ligaments that need repair.



## Fractures

A fracture is a break in a bone. Fractures are caused by a direct impact, such as a fall or a severe tackle. Stress fractures develop over time and are caused by overuse.







## Stress fracture

Stress fractures may occur because of overuse injuries and the failure to have adequate equipment to protect the body.

**Causes** - Stress fractures often result from increasing the amount or intensity of an activity too quickly.

**Prevention** - Low impact activities added to exercise regimen to avoid repetitively stressing a particular part of the body.

**Treatment** - Rest, cold therapy ice packs, cold compresses, apply ice to the injured area, anti-inflammatory medications such as Ibuprofen, aspirin etc and a recovery time of 6 to 8 weeks is required for healing.



## Greenstick

A fracture in a young, soft bone, in which the bone bends.

**Causes** - These fractures most commonly occur with a fall.

**Prevention** - Promotion of regular exercise, ensuring the child's safety by providing proper safety equipment and adequate calcium in the child's diet can also help to prevent this kind of fracture.

**Treatment** - Removable splints result in better outcomes than casting in children with - Torus fractures of the distal radius.





## Comminuted

A fracture in which a bone is broken, splintered, or crushed into number of pieces.

**Causes** - Direct and indirect trauma or violence can be causes for commuted fracture. **Prevention** - Maintaining strong bones by eating food that is rich in calcium and regular exercise can help in the prevention of this type of fracture.

**Treatment** - An X-ray is important for diagnosing of the condition. An open reduction when the bone fragments are jammed-together using surgical nails, wire plates etc. is required for comminuted fracture.



## Transverse

Transverse fracture is when there is a straight break right across a bone.

**Causes** - When a large amount of force is transmitted directly i.e., perpendicularly to the bone.

**Prevention** - Physical activity and weight bearing exercises will make the bones stronger and denser. Bones can also be strengthened by eating foods rich in calcium and taking regular exercise.

**Treatment** - Can be treated at home along with rest and medicine. A back brace (called TSL) or abdominal binder may be prescribed to reduce the pain by limiting motion at the fracture site.





## Oblique

Oblique fracture is one in which the bone breaks diagonally.

**Causes** - This fracture is usually caused by an injury to the bone as the result of a fall, accident, or other trauma.

**Prevention** - Bones can be strengthened by eating food rich in calcium and exercising regularly to help prevent this type of fracture.

**Treatment** - It depends upon the severity of the crack or break. Anti-inflammatory medication, reduction (Resetting the bone) can also help to some extent.



### Extension activity

Write down the examples of dislocation and fracture on the various body parts and its treatment.

## Impacted

This type of fracture occurs when the broken ends of the bones are jammed together by the force of the injury.

**Causes** - It is caused mainly when someone falls from height with a great impact.

**Prevention** - Increased physical activity, weight bearing exercises and maintaining good intake of calcium in food can help in preventing this type of fracture.

**Treatment** - In an impacted fracture the bones get broken into fragments. Therefore, a sling or a splint may be required to keep the broken bones in place, so that movement of the sharp ends of the broken bone is prevented. This is essential to prevent further damage to the bone.





I. Tick the correct answers:

1. A sprain is an injury to:
  - a. Muscle
  - b. Tendon
  - c. Ligament
  - d. Bone
2. A fracture is an example of injury to
  - a. skin
  - b. soft tissue
  - c. hard tissue
  - d. eyes
3. A soft tissue injury damages
  - a. ligaments and tendons
  - b. bone
  - c. cartilage and muscles
  - d. carpals
4. A fracture in which the bone breaks diagonally is called a \_\_\_\_\_ fracture.
  - a. Greenstick
  - b. Impacted
  - c. Oblique
  - d. Transverse





**II. Answer the following questions briefly:**

1. What is comminuted fracture? Write its cause, prevention and treatment.
2. What is a sprain? Write its cause, prevention and treatment.

**III. Answer the following questions in 150-200 words:**

1. Name the more common types of fractures and describe them.
2. What is a soft tissue injury? Name four types of soft tissue injury and describe it.

**IV. Complete the chart given below listing common sports injuries, their causes, prevention and treatment.**

Common Sports injuries	Causes	Prevention	Treatment
Skin injuries			
Soft tissue injuries			
Joint injuries			
Bone injuries			





## V. Sports Integration

1. Conduct a survey on types and frequencies of different injuries to sportsperson. (take any ten sportsperson)
2. Make a 3D model of the knee showing any ONE of the injuries that may occur on the field.
3. Get information from newspapers regarding current injury to an International player.
4. Experience sharing session of different sportsperson studying in school.

## VI. Case Study

1.



1. Which types of injury is illustrated above?
  - a. Soft tissue
  - b. **Hard tissue**
  - c. Joint injury
  - d. Ligament injury
2. Recognise the type of fracture is illustrated above:
  - a. Green Stick
  - b. Comminuted
  - c. **Transverse**
  - d. Oblique





3. In which of the fractures bone “breaks diagonally”?
  - a. Green Stick
  - b. Comminuted
  - c. Transverse
  - d. **Oblique**

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# UNIT VIII BIOMECHANICS & SPORTS

## Overview

- ◆ Newton's Law of Motion & its application in sports.
- ◆ Types of Levers and their application in Sports.
- ◆ Equilibrium - Dynamic and Static and Centre of Gravity and its application in sports
- ◆ Friction and Sports
- ◆ Projectile in Sports

## LEARNING OUTCOMES

*Students will able to*

- ◆ Understand Newton's Law of Motion and its application in sports
- ◆ recognize the concept of Equilibrium and its application in sports.
- ◆ Classify lever and its application in sports.
- ◆ know about the Centre of Gravity and will be able to apply it in sports
- ◆ define Friction and application in sports.
- ◆ understand the concept of Projectile in sports.

## THE IMPOSSIBLE KICK

Roberto Carlos' goal in 1997 defied physics and still impresses scientists today. When the famous free-kick happened, physicists from all around the world were baffled by the images. That goal was the catalyst for many studies and analyses about aerodynamics and the ball's curve that day at the Stade de Gerland in Lyon.

One of the most famous studies was conducted by four French scientists -- Guillaume Dupeux, Anne Le Goff, David Quere, and Christophe Clanet -- and published in the New Journal of Physics in September 2010. In this study, the physicists conduct a







series of experiments and analysis, resulting in an equation that explains the ball's trajectory and all the forces in action at that precise moment.

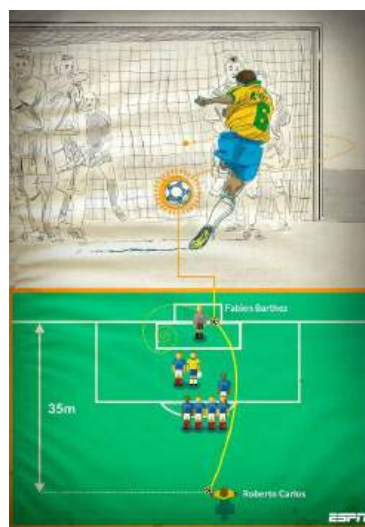
***This is what they wrote.***

*“The case of soccer, where is twice as small as  $L$ , is worth commenting on. The ball trajectory can deviate significantly from a circle, provided the shot is long enough. Then the trajectory becomes surprising and somehow unpredictable for a goalkeeper,”*

“This is the way we interpret a famous goal by the Brazilian player Roberto Carlos against France in 1997. This free kick was shot from a distance of approximately 35 metres, that is, comparable to the distance for which we expect this kind of unexpected trajectory. Provided that the shot is powerful enough, another characteristic of Roberto Carlos' abilities, the ball trajectory brutally bends towards the net, at a velocity still large enough to surprise the keeper.”

Dupeux, Le Goff, Quere, and Clanet conclude that if the correct calculations were made, and the distances and forces were repeated, the famous goal could be replicated by another player. This, however, is impossible, in the opinion of one of Brazil's most influential physicists. He describes Roberto Carlos' masterpiece as a “*football miracle.*”

“Although physics explains perfectly the ball's trajectory, the conditions at that moment, such as the power of the kick, the point of impact of Roberto Carlos' foot on the ball, and the distance to the goal, were so rare that we can call that a miracle,” says professor Luis Fernando Fontanari of Sao Roberto Carlos Physics Institute, a branch of the University of Sao Paulo -- the most respected university in the country.



Fontanari is one of the editors of “Physics of Life Reviews” and “Theory in Biosciences,” two of the most important scientific journals in the world. He adds that if the ball hadn’t stopped in the net, it would have continued in the air, drawing an incredible spiral trajectory, as the image above shows.

*“I don’t believe we will see something like that happening again,” Fontanari said.*

Israeli scientist Erez Garty also theorized about Roberto Carlos’ kick. In a YouTube video, he gave a lesson for “physics dummies,” which explains the magic. The transcript is as follows<sup>1</sup>:

In 1997, in a game between France and Brazil, a young Brazilian player named ‘Roberto Carlos set up a 35-meter free-kick. Carlos attempted the seemingly impossible with no direct line to the goal. His kick sent the ball flying wide of the players, but before going out of bounds, it hooked to the left and soared into the goal. According to Newton’s first law of motion, an object will move in the same direction and velocity until a force is applied. When Carlos kicked the ball, he gave it direction and velocity, but what force made the ball swerve and score one of the most magnificent goals in its history?

The trick was in the spin. Carlos placed his kick at the lower right corner of the ball, sending it high and to the right and rotating around its axis. The ball started its flight in a direct route, with air flowing on both sides and slowing it down. On one side, the air moved in the opposite direction to the ball’s spin, causing increased pressure, while on the other, the air moved in the same direction as the spin, creating an area of lower pressure.

That difference made the ball curve towards the lower pressure zone. This phenomenon is called the Magnus effect. This type of kick, often referred to as a banana kick, is attempted regularly, and it is one of the elements that makes the beautiful game beautiful. But curving the ball with the precision needed to bend around the wall and back into the goal is difficult. Too high, and it soars over the goal. Too low, and it hits the ground before curving. Too wide, and it never reaches the goal.

Not wide enough, and the defenders intercept it. Too slow, and it hooks too early, or not at all. Too fast, and it hooks too late. The same physics make it possible to score another impossible goal, an unassisted corner kick.

The Magnus effect was first documented by Sir Isaac Newton after noticing it while playing a game of tennis back in 1670. It also applies to golf balls, frisbees, and





baseballs. In every case, the same thing happens. The ball's spin creates a pressure differential in the surrounding airflow that curves it in the direction of the spin.

And here's a question. Could you theoretically kick a ball hard enough to make it boomerang all the way around back to you? Sadly, no. Even if the ball didn't disintegrate on impact, or hit any obstacles, as the air slowed it, the angle of its deflection would increase, causing it to spiral into smaller and smaller circles until finally stopping. And to get that spiral, you'd have to make the ball spin over 15 times faster than Carlos's immortal kick.

So, think again<sup>2</sup>

## Introduction

Biomechanics is the science of movement of a living body, including how muscles, bones, tendons, and ligaments work together to produce movement. Biomechanics is part of the larger field of kinesiology, explicitly focusing on movement mechanics. It is both a primary and applied science, encompassing research and practical use of its findings.

Biomechanics includes the structure of bones and muscles and the movement they can produce, as well as the mechanics of blood circulation, renal function, and other body functions. The American Society of Biomechanics says biomechanics represents the broad interplay between mechanics and biological systems.

Biomechanics studies not only the human body but also animals and even extends to plants and the mechanical workings of cells. ***For example, the biomechanics of the squat includes considering the position and/or movement of the feet, hips, knees, back, shoulders, and arms.***

The biomechanical principle of motion relates to linear motion, velocity, speed, acceleration, and momentum. Motion is a movement that results from a force. In any physical activity, there are multiple forces and motions occurring. This could include angular motion around a joint or the motion of the whole body in various directions. The motion or movements of the body are often caused by forces produced by our muscles, but this is not always the case. For example, if an opposition player pushes you to the ground, the force has come from them and not your muscles.

Motion can be linear, angular, or general. The type of motion is determined by the direction of movement. The only type of motion you are asked to understand is linear motion. However, to properly apply velocity, speed, acceleration, and



momentum, the other types of motion should also be defined. Angular motion is motion in a circular movement around a central point. Essentially every movement of your body at a joint is angular. The general motion is a combination of linear and angular motion, such as completing the 400m sprint. It, therefore, becomes important to know about the laws of motion for a better understanding of motion and its application in physical education and Sports.

## 8.1 Newton's Laws of Motion and their Application in Sports



Sir Isaac Newton (1642-1727) was one of the greatest scientists and mathematicians that ever lived. Newton came up with three general rules about the movement of objects, which are now known as Newton's Three Laws of Motion.

### 8.1.1 NEWTON'S FIRST LAW OF MOTION (LAW OF INERTIA)

According to the first law, a body will remain at rest or continue to move at a constant velocity unless acted upon by an external (resultant) force. Inertia is the resistance of any object to any change in its motion, including a change in direction—objectives to keep moving in a straight line at a constant speed.

#### Application in Sports

- If you slide a hockey puck on ice, eventually, it will stop because of friction on the ice. It will also stop if it meets something like a player's stick or a goalpost.<sup>3</sup>



A skater gliding on ice will continue gliding with the same speed and in the same direction unless an external force acts upon the skater.<sup>4</sup>





That unbalanced force is the player's foot, head, friction, gravity, and the net during a soccer game. A soccer player uses the body's muscles to create a force to move the leg and kick the ball from rest to motion until another player or the net stops or changes the ball's motion. <sup>5</sup>



When a ball is thrown and is in mid-air, the only force acting upon it is the force of gravity. If the force of gravity did not exist, the ball would keep traveling at a constant speed until it was affected by an object or another person touched it. If this ball were thrown upwards, it would end up traveling into space!



### 8.1.2 NEWTON'S SECOND LAW OF MOTION (LAW OF MOMENTUM)

As per the law, the rate of change of momentum is proportional to the resultant force and takes place in the direction of the resultant force. When a net force acts on an object, the acceleration of the object it produces is directly proportional





to the magnitude of the net force, is in the same direction as the net force and inversely proportional to the mass of the object. The more mass the thing has, the more net force has to be used to move it.

In general, if you use the same force to push a truck and push a car, the car will have more acceleration than the truck because the car has less mass.

### Application in Sports

As in Shot-put, a player who applies more force and tosses the shot-put at the correct angle has a greater displacement of shot-put, whereas a player who exerts less force has a lesser displacement of shot put.<sup>6</sup>



In a Discus throw, if we want to determine the force acting on a discuss (2kg), if it is accelerated at 20 m/ second sq.



$$F = m \cdot a$$

$$F = 2 \cdot 20$$

$$F = 40 \text{ Newton}^7$$

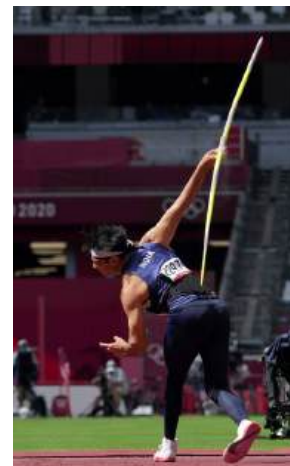
When a ball is thrown, kicked, or struck with an implement, it tends to travel in the direction of the line of action of the applied force. The greater the amount of force applied, the greater the speed the ball has. If a player improves leg strength through training while maintaining the same body mass, they will have an increased ability to accelerate the body using the legs, resulting in better agility and speed.<sup>8</sup>







- In soccer, a team will require more force to kick the ball high and faster. This law of motion is fundamental in soccer, so you can calculate the force needed to give a pass or kick the ball to the net without missing.<sup>9</sup>



### 8.1.3 NEWTON'S THIRD LAW (LAW OF REACTION)

According to this law, there is an equal and opposite reaction for every action, and this reaction acts with the same Momentum and the opposite velocity for every action. It states that whenever one object exerts a force on a second object, the second object exerts an equal and opposite force on the first object. When you walk on a floor, the floor pushes you along. No force can act alone.

#### Application in Sports

- In Swimming, a diver needs to push down on the springboard when he/she dives off a diving board. The springboard pushes back the force on you for proper projecting into the air during the performance.<sup>10</sup>





- When you jump off a small rowing boat into the water, you will push yourself forward towards the water. The same force used to go ahead will make the boat move backward.<sup>11</sup>



- During a soccer match, we need to kick the ball for passing, shooting, or clearing the ball. While kicking the soccer ball, we will feel the force of the kickback on our leg. we won't feel the force as much because our legs have more mass than the soccer ball.<sup>12</sup>



- During any type of motion, if we need to jump, our legs apply force to the ground, and the ground applies equal and opposite reaction force (ground reaction force) that propels us into the air.<sup>13</sup>







### Do you know?

When we take a vertical jump, the knee experiences mean peak loadings of  $2.4 - 4.6 \times$  body weight at the patellofemoral joint,  $6.9 - 9.0 \times$  body weight at the tibiofemoral joint,  $0.3 - 1.4 \times$  body weight at anterior tibial shear and  $1.0 - 3.1 \times$  body weight at posterior tibial shear. The hip experiences a mean peak loading of  $5.5 - 8.4 \times$  body weight and the ankle  $8.9 - 10.0 \times$  body weight.<sup>5</sup>

### Extension Activity

During your physical education period under the guidance of a physical education teacher, perform motor actions like running, jumping, and throwing. Try to identify, which law of motion defines the activity you performed and give remarks.

Motor action	Law	Remarks

- I. Tick the correct options.
  1. According to Newton's Second Law of Motion, the greater the movement of an object, the
    - a. The longer distance will it travel
    - b. Stronger will it resist the external forces
    - c. Speedier it will cover the given distance
    - d. More stable will it remain in its motion.
  2. Newton's First Law of Motion is known as the





- a. Law of Reaction
  - b. Law of Inertia
  - c. Law of Effect
  - d. Law of Momentum
3. Newton's Second Law of Motion is also known as
- a. Law of Reaction
  - b. Law of Inertia
  - c. Resultant Force
  - d. Law of Effect
4. Acceleration due to an external force acting on a moving object is technically defined as the change in that object's
- a. Location
  - b. Direction
  - c. Velocity
  - d. Movement

**II. Answer the following questions briefly.**

1. List Newton's Laws of Motion.
2. Elucidate Newton's Law of Inertia.

**III. Answer the following questions in 150-200 words.**

1. With the help of suitable examples, discuss the application of Newton's Laws of Motion in sports.
2. How can Newton's second law and third law of motion be applied in sports?

## 8.2 Levers

The lever is a type of machine. It is the human body's mechanism for movement, and although it may be viewed as a part of the skeletal system, the role of the muscles in supplying the necessary force for lever action should be kept in mind. The bony levers will be less stationary until they are moved by the muscles, which are motionless until the nervous system stimulates them.

All lever systems are made up of four components:






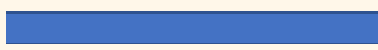


- the load
- the fulcrum
- the effort
- the lever.

*The load is the object requiring moving, the effort is the muscular force we use to move the object, the fulcrum is the joint around which the movement occurs, and the bones of the skeleton are the levers. If asked to sketch a diagram of a lever system, you would need to include all four parts.*

Lever systems have standard symbols that are used to represent each part.

You will need to know these standard symbols.

◆ Load	
◆ Fulcrum	
◆ Effort	
◆ Lever	

### Definition of a Lever

*A lever is “a rigid bar used to overcome resistance when a force is applied.*

*“A rigid piece transmits and modifies force or motion when forces are applied at two points, and it turns about a third.”*

### The Fulcrum

- It is the point at which the lever rotates or turns and identifies the lever class by its position in relation to the other two parts. In human movement, the fulcrum is the joint that dictates the kind of action.

### The Force/Effort Arm

- It is the point at which the force is applied.

### The Load/Resistance Arm

- It is the point where the load or resistance is located.



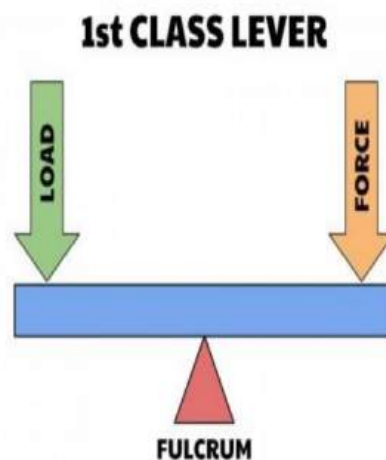


## 8.2.1 TYPES OF LEVERS

There are three types/classes of levers:

- First-Class Lever
- Second Class Lever
- Third Class Lever

**First-Class Lever:** A first lever has the fulcrum between the force and the resistance. This class fulcrum may be moved about along the lever, thereby changing the relative lengths of the force arm and the resistance arm. If the fulcrum is placed close to the resistance, the force arm is length, and hand and less force need to be applied to move the resistance, but force must be applied through a long distance to lift the resistance a short distance. Conversely, a shortened force arm requires more excellent force application, but there is a gain in speed and range of motion at the resistance end.

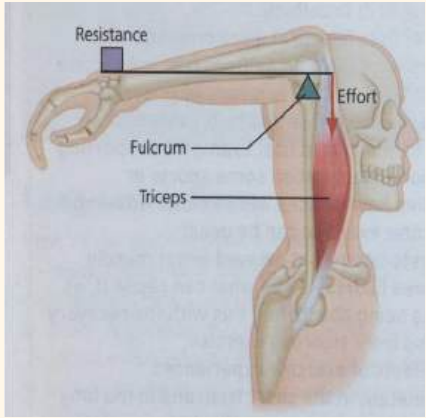



First-Class Lever

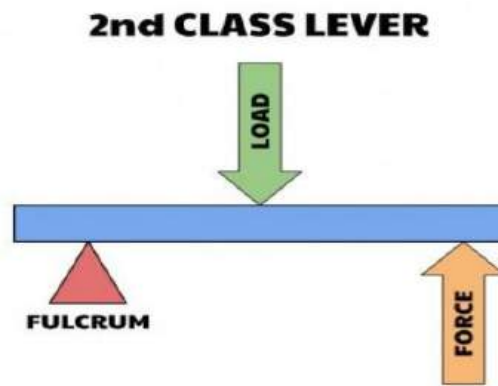
*Examples of 1st class lever*





	
<p><b>Triceps causing Extension at the elbow</b></p> <p>Example: When throwing a ball:</p> <ul style="list-style-type: none"> <li>◆ Fulcrum = Elbow</li> <li>◆ Effort = Triceps</li> <li>◆ Load = Arm/ball</li> </ul>	<p>V- sit-up position.</p> <p>Example: When doing V-sit-up -</p> <p>Fulcrum = Hip joint</p> <p>Effort = Abdomen</p> <p>Load = Leg/Lower body</p>

- **Second Class Lever:** A second class lever has the load resistance between the fulcrum and the force. In this class of levers, movement of the fulcrum will increase or decrease both the force arm and the resistance arm. The force arm is always the longer of the two, and therefore the force needed to lift resisting weight will always be less than the weight.


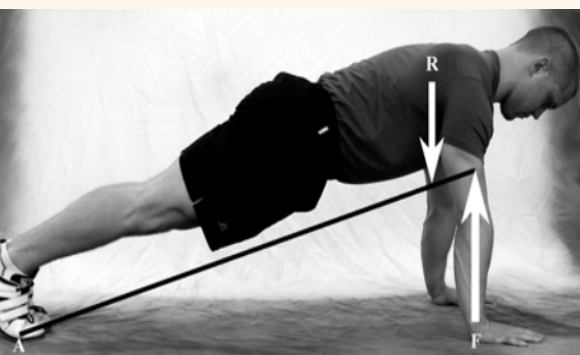


Second Class Lever

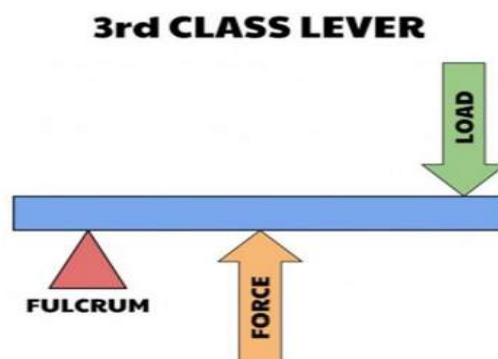
*Examples of 2<sup>nd</sup> class lever*





	
<p><i>The foot acting as a whole is a second-class lever when the fulcrum is the ball of the foot, and the body weight is lifted to the toes by force at the heel.</i></p> <p>Example: When throwing a ball:          Fulcrum = Ankle joint          Effort = Gastrocnemius          Load = Ankle joint</p>	<p><i>Straight Push-ups.</i></p> <p>Example: When doing V-sit-up -          Fulcrum = Ball of the foot          Effort = Arm Muscle contraction.          Load = Body weight</p>

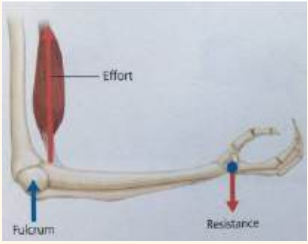

- **Third Class Lever:** A third-class lever has the force between the fulcrum and the resistance. In this class of lever, the force arm is always shorter than the resistance arm, and so a large amount of force must be applied, but the resistance is moved through a much longer range of motion than the force application. In the human body, the most common class of lever is the third class. This is particularly important in the movements of the limbs because the desired results are often those of speed or range of motion, albeit at the expense of force.



Third Class Lever



*Examples of 3rd class lever*

	
<p><b>Bicep causing flexion at the elbow</b>            Example: When throwing a ball:            Fulcrum = Elbow joint            Effort = Biceps            Load = Arm/Weight</p>	<p><b>Sit-ups</b>            Example: When doing Sit-ups            Fulcrum = Hip joint            Effort = Abdomen            Load = Upper body</p>

**8.2.3 APPLICATION IN SPORTS**

The human leverage system is built for speed & range of movement at the expense of force. Short force arms & long resistance arms require great muscular strength to move like biceps & triceps attachments biceps force arm is 1 to 2 inches triceps force arm less than 1 inch. Human leverage for sports skills requires several levers; throwing a ball involves levers at the shoulder, elbow & wrist joints. The longer the lever, the more effective it is in imparting velocity. A tennis player can hit a tennis ball harder with a straight-arm drive than with a bent elbow because the lever is longer & moves at a faster speed. Long levers produce more linear force and thus better performance in some sports such as baseball, hockey, golf, field hockey, etc. For quickness, it is desirable to have a short lever arm baseball catcher brings his hand back to his ear to secure a quick throw sprinter shortens his knee lever through flexion that almost catches his spikes in his gluteal muscles. A few examples of lever application in sports are:

1. **Cricket bat (2nd class)** - *The fulcrum is the top of the handle, the load is the bat's body, and the force is closer to the neck of the handle.*
2. **Kicking - Lower limb (3rd class)** - *The fulcrum at the knee joint, force at tibial tuberosity, (attachment of the quadriceps) load is the foot.*
3. **Jumping - Plantar flexion of the foot (2nd class)** - *The load is at the toes, the fulcrum is at the heel, and force is your weight which is anterior to your heel.*
4. **Looking up/down or side-to-side (1st class)** - *Your head is balanced on your atlantooccipital joint, which pivots, similarly to a see-saw.*





### Do you know?

Levers can be found either internally in the form of extremity bones (limbs) or externally in the form of sports implements such as rackets, bats, hockey sticks, and so on. It should be clear that the bar referred to in the definition can be of any shape.

### Extension Activity

#### Classification of Levers

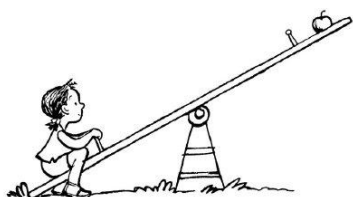
Use the information we have just gone through to complete your table

Class	Middle Component	Line drawing	Sporting example/ movement in the body
First			
Second			
Third			

#### I. Tick the correct options.

1. The three basic components of a lever are
  - a. Mass, weight & velocity.
  - b. Force, Fulcrum & Load
  - c. Fulcrum, Resistance & Effort
  - d. Both b and c.

2.



What type of lever is depicted in the picture?







- a. 1st Class lever
  - b. 2nd Class lever
  - c. 3rd Class lever
  - d. None of the above
3. Push up is an example of which lever?
- a. Law of Reaction
  - b. Law of Inertia
  - c. Resultant Force
  - d. Law of Effect
4. In the human body, the most common class of lever.....
- a. 1<sup>st</sup> Class lever
  - b. 2<sup>nd</sup> Class lever
  - c. 3<sup>rd</sup> Class lever
  - d. None of the above

**II. Answer the following questions briefly.**

1. Define Lever.
2. Draw 3 types of levers used in sports.

**III. Answer the following questions in 150-200 words.**

1. With the help of suitable examples, discuss the application of 1st class lever in sports.
2. What do you mean by lever? Explain with the help of diagrams.

### 8.3 Equilibrium (Stability/ Balance)

When we say something is stable or balanced, we generally mean that it is not easily upset; that is to say, it takes some effort to topple it. By contrast, of course, an unstable object is easily upset.

Equilibrium or stability is necessary for performing skills. Naturally, the centre of gravity (CG) shifts with each change in posture. In the standing posture, the centre of gravity, while somewhat different for males than females, is located near the centre of the upper pelvic region. It shifts with each new posture assumed by the body. A significant part of any skill is the continual adjustment of body segments to



counteract this change in position and control the centre of gravity.

*Equilibrium is defined as a state of balance or a stable situation, where opposite forces cancel each other out and where no changes are occurring.*

### 8.3.1 TYPES OF EQUILIBRIUM

With respect to the state of a body, equilibrium may be divided into two categories:

1. Static equilibrium.
2. Dynamic equilibrium.

#### Static Equilibrium

For a body or an object to be in static equilibrium it must not be moving or rotating. All the force and torques acting on the body or object must add up to zero.

For an object or body to be in a static or static equilibrium, where it is completely motionless it must meet 3 conditions:

1. The sum of all the vertical forces acting on the body must be zero
2. The sum of all the horizontal forces acting on the body must be zero.
3. The sum of all torques must be zero.

*Static equilibrium can be defined as a state when a body is at rest or completely motionless.*

Static equilibrium is the balance of the body during rest or stationary position.

### 8.3.2 FACTORS INCREASING EQUILIBRIUM

- The centre of gravity falls within the base of support
  - ◆ Decrease instability when the centre of gravity becomes near the edge of the base
- Larger base
- Greater weight
- Lower centre of gravity
- When anticipating an oncoming force
  - ◆ Place centre of gravity near the side of the base of support expected to receive force





- ◆ Extending the base of support in direction of expected force
- Greater friction between body and surfaces it contacts
- Rotation about an axis
- ◆ Moving cycle is easier to balance than a stationary cycle
- Kinaesthetic physiological functions
- ◆ Vestibular system, vision, touch, and kinaesthetic awareness

**Examples:** Stance maintained by the batsmen in cricket, on the starting block by the sprinter, wide stance maintained by the wrestler, etc.



### Dynamic equilibrium

Dynamic Equilibrium can be defined as a state when all the applied and inertial forces applied to a moving body are in balance, resulting in movement with unchanging speed or direction. To control the equilibrium and achieve balance, stability needs to be maximized.

When the body or an object is moving with a constant velocity - that is with no change in speed or direction it is said to be in dynamic equilibrium.

Dynamic equilibrium or dynamic stability is a balance of the body during movement.

Example: Body position maintained by a sprinter while running on the track, Cyclist while cycling, dribbling of the football by a soccer player etc.





## Guiding Principles to Determine the Degree of Stability

1. **Broader the base, the greater the stability:** Broadening the base of support helps an athlete to achieve greater stability. *eg., while standing spreading the feet in the direction of movement provide stability. Where a stance is required, using both hands and feet creates the widest base.*
2. **Body weight is directly proportional to stability:** The athlete or an object which weighs more will have greater stability. *eg., it is difficult to move a heavier person than a lighter one, Combative sports like, judo, wrestling, taekwondo, and boxing are played according to the bodyweight principle.*
3. **Lower the Centre of gravity, higher the stability:** When a player does an activity that needs stability, the player usually lowers their centre of gravity by bending. *eg., when a player bends his knees while running, he can stop sooner and more efficiently. Similarly, a wrestler half sits to maintain his stability. Even a shot-put thrower bends his knees in the end so that he may avoid a foul.*
4. **The nearer the centre of gravity to the centre of the base of support the more will be the stability:** If the centre of gravity extends beyond the base of support, balance is lost. Keeping the body's weight centred over the base will support and help maintain stability. *eg., when a gymnast walks on a balance beam one requires a small base of support. During the performance, if the balance is lost the gymnast raises the arm or legs on the opposite sides to shift the centre of gravity back towards the base of support.*
5. **Direction of acting force:** During a competition, if the direction of an acting/ applied force is known, stability can be increased by moving the line of gravity as close as possible to the edge of the base where the force is expected. *eg., when in a judo match the judoka shifts his foot in the line of direction of the force applied by the opponent to use the force of the opponent as a counterforce to throw him down.*

### 8.3.3 CENTRE OF GRAVITY

The Centre of gravity is the point at which all the weight or mass of a body may be considered to be concentrated.

The centre of gravity of an individual standing in the anatomic position marks the intersection of three primary planes and axes.

The human body's flexibility and its fluidity creates problems in accurately locating





the centre of gravity because, while the mass centre can be determined for any given, momentarily fixed stance, any significant movement is accompanied by a shift in the location of the centre of gravity. It means that the mass centre is constantly moving in many sports skills.

*Locating the centre of mass of a rigid object is not difficult and is even easier if the object is of uniform density and asymmetrical shape; in this case, the centre of gravity is at the exact centre of the object. An object suspended from this point is in rotational equilibrium.*

The ability to balance, whether stationary or moving, is key to success in most sports and physical activities. The stability of an athlete depends on her/his COG. It is exactly in the middle of the body around which it can rotate freely in any direction and where the weight of the body is centred.

### Examples:

- For wrestlers in snatch and jerk, the widening of legs and lowering of body to maintain the stability, makes COG come down.
- During running, the runner's centre of gravity is in the lower region of the pelvis and in front of his body, because his upper body is leaning forwards. Having the centre of gravity lower and in front of his lower body is advantageous for acceleration.



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### Importance and Application of centre of gravity in Sports

- Helps the athlete to move
- Stops the moving object
- Helps the athlete to accelerate
- Helps the athlete in throwing objects.
- Helps the athlete to lift the object.
- Helps the athlete to pull the object





## Example of Centre of Gravity

To get better results and to be strong, the position of the centre of gravity is quite important in many sports, few examples are given below:

- In the game of basketball and volleyball, high defence players spread their legs to lower the centre of gravity towards the base to occupy a better position against the offensive player.
- Starting in short sprints in track events is another example of the use the of centre of gravity. As we need to take an instant start in sprints, we take our body weight on our hands in the “Set” position. So, that we can start immediately while balancing our weight. *(Initially, the centre of gravity of the body falls on the edge of the baseline of hands. If the centre of gravity falls behind the line, then there will be delay in starting because it will require a greater force to go ahead).*
- In combative sports like wrestling, a wrestler falls on the mat with arms, knees, and legs spread on the mat to get a proper balanced position, (This position, makes it difficult for the opposite player to move him).



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### Do you know?

In our daily routine, we maintain different body positions and movements. Balance, equilibrium, and stability are the major factors that help us to do all these activities. Normally in an adult man the COG in a standing position will be at 56.18 % of the height from the ground, and it will be at 55.14 % in adult women.



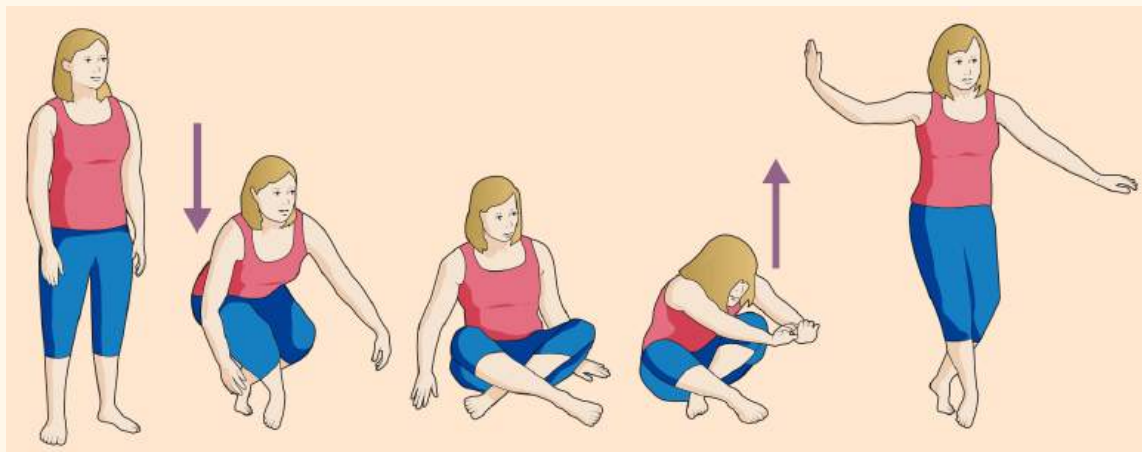




### Extension Activity

Try this simple sitting test for yourself:

1. Stand in comfortable clothes on your bare feet, with clear space around you.
2. Without using any type of support, lower yourself to a sitting position on the floor. This should be a controlled movement; you should not be concerned about the speed of the movement.
3. Now stand back up, without using your hands, knees, forearms, or the sides of your legs for support, and without loss of balance.



### Scoring

4. The two basic movements in the sitting-rising test - lowering to the floor and standing back up - are each scored on a scale of 1 to 5, with one point subtracted each time a hand or knee is used for support and 0.5 points subtracted for loss of balance. The maximum score achievable is 1. 26

#### I. Tick the correct options.

1. When the sum of force acting upon the object and sum of the movement acting upon the body is both equal to zero then the body is said to be in
  - a. Equilibrium
  - b. Static equilibrium
  - c. Dynamic equilibrium
  - d. Zero force
2. The position of the centre of gravity changes depending upon the
  - a. position of force



- b. position of the body
  - c. position of the intersection of force
  - d. position of stability
3. Centre of gravity is the average location of an object's
- a. weight
  - b. force
  - c. balance
  - d. velocity

**II. Answer the following questions briefly.**

1. What do you understand by equilibrium? What are the types of equilibrium?
2. Give suitable examples of the type of equilibrium applied to sports / games.
3. Define the centre of gravity.

**III. Answer the following questions in 150-200 words.**

1. Why do wrestlers spread their arms, knees, and legs on the mat when they fall?
2. Discuss the importance of the centre of gravity in sports with suitable examples.

## 8.4 Friction & Sports

Friction is a force that opposes the motion between two surfaces that are in touch. Friction always works in the direction opposite from the direction the object is moving or trying to move. Friction also produces heat. For example, if you rub your hands together quickly, they get warmer. We can also say that frictional force is a contact force that acts in the opposite direction to the motion of an object. This force can cause objects in motion to come to rest, as they act in the opposite direction to their motion. For example, if you roll a ball on a surface, it would come to rest after a short while.

### 8.4.1 TYPES OF FRICTION

**Static friction:**







It occurs when the force applied to an object does not cause the thing to move. Because of static friction, you must use extra force to start the motion of stationary objects. eg., if you try to push a heavy object with less force than the force of static friction between the object and the floor, the object will not move. To make the object move, you need to exert more force than the force of static friction. Once the object is moving, there is no longer any static friction.



### Kinetic friction

It occurs when force is applied to an object and the object moves. It includes three different types of friction:

- (a) **Sliding friction:** Pushing an object across a surface. This is when two bodies are in contact and one body moves on the surface of the other body by sliding on it or rubbing over the surface. Example - skating on ice, planting a pole in the pole vault event and skiing or sliding weight.



- (b) **Rolling friction:** It occurs between wheels and a surface. When two bodies are in contact and one body rolls over the other, it is referred to as rolling friction. eg., when a hockey or cricket ball is hit it begins to move ahead and roll on the ground. After sometimes it stops rolling due to the friction force, this type of friction is often seen in sports. eg., Roller skates and skateboards



## Fluid friction

It opposes the motion of objects traveling through the fluid (gas, air, and water).

*For example:*

- When you ride a bike, fluid friction occurs between you and the air.
- Cyclist often wears streamlined helmets and specially designed clothing to reduce fluid friction.
- Paragliding vs hang gliding when an athlete glides on air.



## Things that affect friction

- Applying a lubricant between two surfaces. (Motor oil, grease, and wax)
- Friction can be reduced by rolling rather than pushing an object
- Friction increases as surfaces are made rougher.
- Friction increases when the force between two objects is increased
- In general, smooth surfaces produce less friction than uneven surfaces.

### 8.4.2 METHODS OF REDUCING FRICTION

- **Polishing:** If we polish and rub the surface to reduce its unevenness and make it smooth, the force of friction can be reduced. eg., shining a cricket ball increase the swing of the ball.
- **Lubricating:** A common way to reduce the force of friction is by applying a lubricate such as Motor oil, grease, wax etc. eg., the most widely used lubricants in practical mechanical systems like bearings or gears.
- **Wheels and Ball bearing use:** It is easier to roll an object than to slide it by using wheels and ball bearings as we convert sliding friction into rolling friction. This reduces friction between the two contact surfaces and helps us to save energy and time. eg., in roller skates, both wheels and balls contribute to reducing friction.





- **Streamlining:** Friction due to air is reduced by streamlining the shape of the body. eg., the Javelin, boats, ships, and vehicles, are made with a sharp point to reduce friction.

### 8.4.3 ADVANTAGES AND DISADVANTAGES OF FRICTION IN THE FIELD OF SPORTS

#### Advantages

Friction is essential in the field of sports. Without appropriate friction, we will not be able to grip any sports equipment effectively. The advantages of friction in various sports can be explained as follows:

- **Athletics:** In Athletics, the shoes (spikes) are designed to increase friction so that better speed can be generated. The shoes used for short-distance running events have spikes in the front portion only. Whereas the long-distance runner uses completely different shoes.
- **Badminton:** The grip in badminton plays a major role in performing a shot perfectly during a match. That is why a good grip in rackets, will increase the friction with the hand, helping the shot to count and preventing the racket from slipping.
- **Basketball:** Friction between the shoes and the court helps players to maintain control of movement. They wipe their shoes often to get more friction for better movement control.
- **Cricket:** The cricket players, essentially the fielders wear shoes that have spikes. This helps them increase the friction with the ground and hence, helps the cricketer during the run-up for balling, running between the wickets, and preventing from slipping.
- **Cycling:** The friction between the tires and the surface prevents cyclists from slipping and skidding. The friction between the brakes and the wheel help cyclists slow down their bikes.
- **Football:** In Football, a footballer kicks and catches the ball. Friction helps him/her to run, change and maintain his/her position on the ground. Better friction helps him/her to tackle the opponent correctly.
- **Gymnastics:** It is due to friction that a gymnast is able to perform actions on the Horizontal bar. In fact, he uses lime powder on his hands to increase the friction between his palm and the bar.



- **Javelin:** Friction between the hand and javelin allows the thrower to grip the javelin and friction between shoes and track helps them to generate a perfect ground reaction force for throwing the javelin in the right direction. Without friction, the javelin would just fall out of their hands.
- **Running:** Friction between the shoes and the track enables an athlete to run fast, deaccelerate, stop and change direction. If friction is low, the athlete would slip and even fall.
- **Soccer:** In soccer also number and size of spikes between a striker to a defensive player are different, this technical difference is based on the type of friction required by the players.
- **Weightlifting:** In weightlifting, the weightlifters needs more friction between their feet and the floor to prevent slipping while lifting heavy weights, for which they use specially designed shoes.

The friction force is also required for pulling and pushing which is common in all sports activities. Hence, we can say that friction is necessary to give the best performance all forms of games and sports.

### Disadvantages

The disadvantages of friction are as follows:

- **Bicycling:** During cycle racing the tires get heated up due to friction. Due to more heat, tires may burst and it may lead to serious accidents.
- **Weightlifting and Gymnastics:** In weightlifting and gymnastics, the skin in the palm gets damaged due to friction and the athlete even may slip while performing the lift. Hence, gymnasts and weight lifters are advised to use powder on their palms and wear special shoes to maintain appropriate friction
- **Pole-Vault:** During Pole-Vault, a vaulter may lose grip on the pole if less friction is there between palms and pole. Hence, pole vaulters are advised to use adhesive on the palm to increase friction and perform correctly.
- **Friction makes movements difficult:** Any time you want to move an object, friction can make the job more difficult, as movement is directly affected by mass and force applied and also on the surface condition.
- **Excess friction means extra energy:** in other words, more friction means more force to overcome it and more force means more energy. Thus, energy is wasted due to friction.



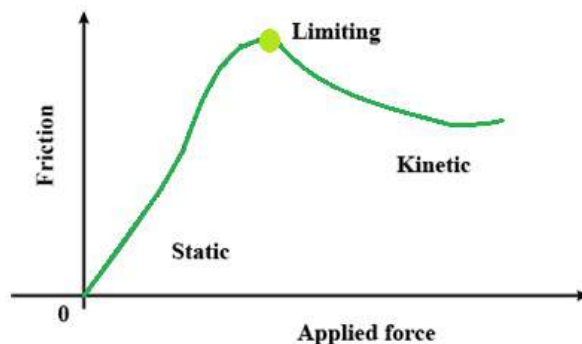


- **Friction can cause injuries:** if a player slides/falls across the ground. In fact, friction can lead to critical injuries.
- **Wear and tear:** sporting equipment occurs with time because of friction. If, there were no friction, they would last forever.

Consequently, it can be said that it is friction can be is advantageous or disadvantageous depending on the use, time, and place of using it. To some extent, some force of friction is required in various sports. The requirement may differ or vary from sport to sport.

### Do you know?


Do you know? Recently one more friction type has been recognized which is known as Limiting Friction. Limiting friction is the force that comes into play when one body is just on the verge of moving over the surface of another body. (Limiting friction occurs when the moving force and the force opposing the motion are equal; any addition to the moving force will cause slipping. The limiting frictional force is proportional to the normal reaction between the contacting surfaces and is independent of the area of contact.)



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### Extension Activity

Below are images of four sports where you find friction is prominent. Using the image provided and your knowledge to identify the type of friction in each image and complete the table below:

Sport/activity	Equipment	Type of Friction	Effect on performance
Golf - shoes			





Bobsleigh skeleton - sled			
Gymnastics - mag chalk			
Mountain bike riding - tyres			

**I. Tick the correct option.**

1. The Friction force acts in a/an \_\_\_\_\_ direction to the direction of motion of an object.
  - a. opposite
  - b. same
  - c. downwards
  - d. diagonal
  
2. Among the following sports, in which does friction plays the least important role?
  - a. Car Race
  - b. Football
  - c. Hockey
  - d. Ice Skating
  
3. Friction is a -
  - a. Magnetic Force
  - b. Non-contact Force





- c. Contact Force
- d. Couple Force
- 4. Cyclist often wears streamlined helmets and specially designed clothing to reduce Calibration
  - a. Fluid Friction
  - b. Rolling Friction
  - c. Sliding Friction
  - d. None of the above

**II. Answer the following questions briefly.**

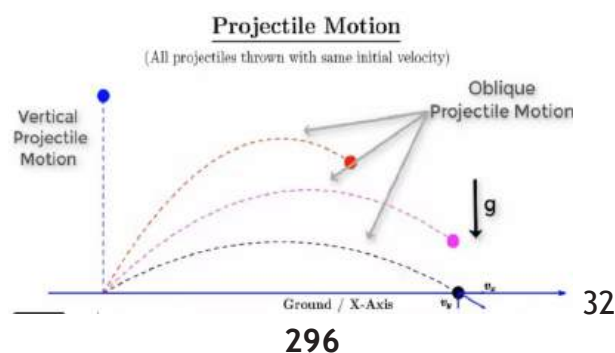
- 1. Define Friction.
- 2. What is Air Resistance?
- 3. What do you mean by 'Friction is a necessary evil'?

**III. Answer the following questions in 150-200 words.**

- 1. Discuss various types of friction.
- 2. Is friction advantageous or disadvantageous in games and sports?
- 3. Write down the methods of reducing friction and explain any two with suitable example.

## 8.5 Projectile in Sports

A projectile is a force that acts under the influence of gravity and air resistance. A projectile would travel in a continuous straight line if gravity were not present. A projectile is any object which once projected or dropped continuously in motion by its inertia and is influenced only by the downward force of gravity. A projectile is an object upon which the only force acting is gravity. Projectiles travel with a parabolic trajectory due to the influence of gravity.





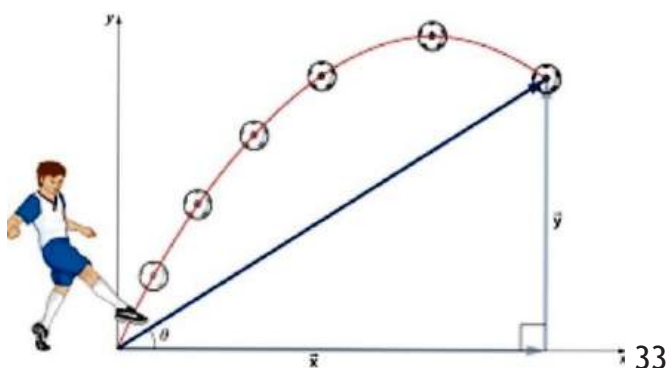
## Defining Projectiles

A projectile is an object upon which the only force acting is gravity. There are a variety of examples of projectiles. An object dropped from rest is a projectile (provided that the influence of air resistance is negligible). An object that is thrown vertically upward is also a projectile (provided that the influence of air resistance is negligible). And an object which is thrown upward at an angle to the horizontal is also a projectile (provided that the influence of air resistance is negligible). A projectile is any object that once projected or dropped continues in motion by its own inertia and is influenced only by the downward force of gravity.

In simple words, an object in flight after being thrown a project is called projectile motion.

Examples from sports involve projectile motion:

- *Objects acting as projectiles: basketball, football, shot-put, hammer, discus, javelin, golf ball, volleyball, tennis ball, etc*
- *The body acts as a projectile in high jump, long jump, gymnastics, diving, figure skating, ski jumping etc.*



The motion of a projectile is due to two separates simultaneously occurring components of motion

- One along the horizontal direction
- Other along the vertical direction

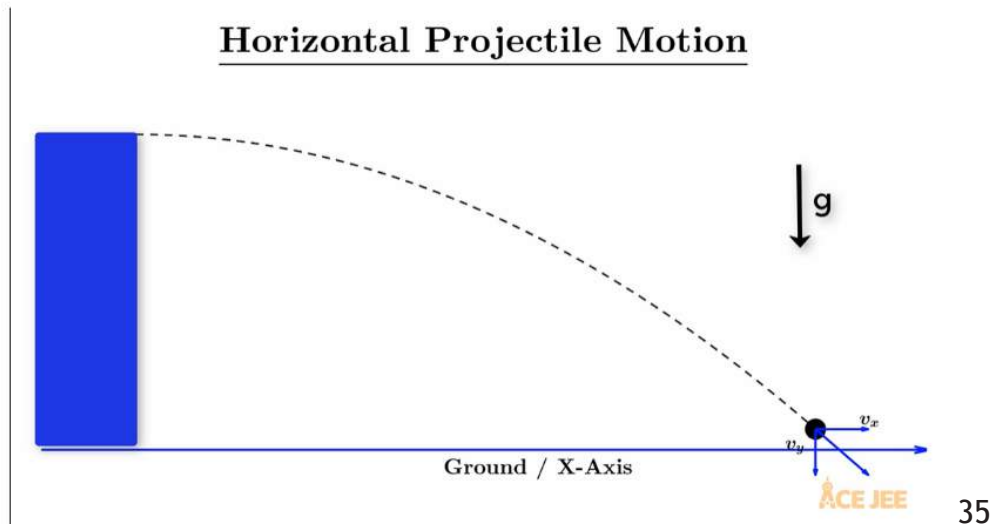
- With constant acceleration due to force of gravity







Horizontal Projectile Motion



### 8.5.1 FACTORS AFFECTING PROJECTILE TRAJECTORY/ FLIGHT PATH

- a. Gravity
  - b. Air resistance
  - c. Speed of release
  - d. Angle of release
  - e. Height of release
  - f. Spin
- (a) **Gravity-** Gravity is the force exerted by the earth on any object towards the centre of the body, and it is directly proportional to the mass of the body. Without gravity, the body will travel in a straight line after being thrown.
- (b) **Air Resistance-** Several vital factors bring air resistance into play
- ◆ **Surface area:** The larger the surface area, the more air resistance will affect the object. Example: Basketball compared to a golf ball.
  - ◆ **Speed:** As speed increases, so does air resistance. Example: The Space shuttle.
  - ◆ **Surface of the object:** If the surface is rough, then air resistance will be greater.



**Example:** Swinging ball in cricket.

- ◆ **Mass:** The smaller the mass (lighter the object), the more air resistance will affect it. Example: Movement of the shuttle in badminton.
- (c) **Speed of release:** This refers to how fast the object is released (thrown or hit). The muscle force largely determines a projectile speed of release. Generally, the greater the release rate, the greater the distance gained. Example: Speed of release in throwing events like javelin, discus, etc.
- (d) **Angle of release/ projection angle:** This refers to the pitch at which the object is thrown or hit into the air. In sporting situations, the angle of release varies according to the activity. A basketball angle above 45 degrees is required in activities such as shooting. In activities such as tennis, a lower, around 3-to-15-degree grade is required.
- (e) **Height of release:** This refers to how high above the ground an object is released. Increasing the height of release improves the horizontal distance an object can be projected. For a given speed and angle of release, the greater the height of release, the greater the distance gained. Example: Height of release in throwing events like javelin, Hammer throw, etc.
- (f) **Spin:** Spin happens as a ball moving through the air will move in the direction of at least air pressure. This helps the projectile maintain its course and can cause it to change height or direction. When applying force to a projectile below, above, or the side of the centre of gravity, you will impart spin to the projectile. Example: principle of spin in basketball shooting.

### 8.5.2 APPLICATION OF PROJECTILE IN SPORTS

There are many instances where projectile motion is applicable, whether it is in daily life, sports, or technological advancements. Here are some of the applications of projectile motion given below:

#### Sports

Projectile motion is very common in sports since most sports involve the motion of a projectile (usually a ball). By using physics, we are able to determine the optimal angle of a ball's flight in order to maximize speed or distance.





## Baseball

### *Pitching analysis*

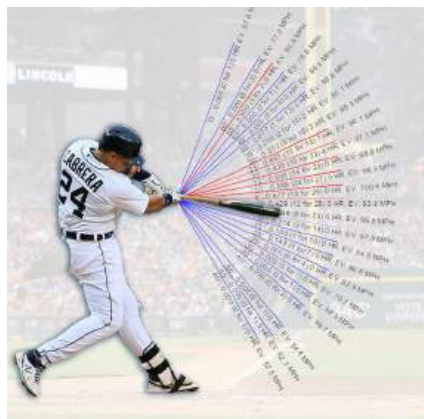
Projectile motion is applicable in both throwing and hitting. A thrown ball undergoes projectile motion when it is mid-air since the only force that affects the ball is the acceleration due to gravity. A variety of factors will go into the trajectory of a pitch, including a pitcher's height, arm angle, and the spin being applied to the ball.



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### *Hitting analysis*

In terms of hitting, advanced analytics like to use “launch angle” as a good indicator of the optimal angle that a ball should be hit. Launch angle is the angle at which a ball exits the bat as soon as they connect with each other. The best launch angles, which allow for line drives and home runs, are calculated to be around 10-30 degrees North of East, relative to the bat. This allows for the most optimal ball flight, usually necessary to hit the ball over 325 to 400 feet over the fence.



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## Basketball

Another example of projectile motion in sports is basketball. For a basketball shot to enter the hoop, the basketball must be shot at a certain angle with a certain amount of force. The optimal angle of a shot will vary depending on the height from which the ball is shot and the player's distance from the hoop. According to Professor John





Fontanella, the ideal angles from the free-throw line will vary from 48.7 degrees to 52.2 degrees, with shorter players.



### Did you Know

There are four main types of spin used in sports, Top Spin- is where you hit over the ball. Topspin creates a downward force on the ball, causing the ball to drop, Back Spin- this is where you hit under the ball, Backspin creates an upward force that lifts the ball, causing the ball to rise, Clockwise Spin- this is where you hit the ball on the left side of the centre of gravity. It causes the ball to swing to the right and Anticlockwise- this is where you hit the ball on the right side to the centre of gravity. It causes the ball to swing to the left.

### Extension Activity

Identify Projectile in Sports: Make groups in your class and during your physical education period select 5 sports and try to apply the projectile principal in them and write down your observation in the table below:

S.No.	Sports	Activity/Skill	Observation





**I. Tick the correct option.**

1. Factors that bring air resistance into play
  - a. Larger the surface area
  - b. Rough surface
  - c. Smaller the mass
  - d. All of the above
  
2. The motion of a projectile is due to two separates simultaneously occurring components of motion and they are
  - a. One along the vertical
  - b. One along the horizontal
  - c. both a and b
  - d. none of above
  
3. According to Professor John Fontanella, the ideal angles from the free-throw line will vary from \_\_\_\_ to \_\_\_\_with shorter players.
  - a. 48.7 degrees to 52.2 degrees,
  - b. 45.6 degrees and 50.2 degrees,
  - c. No specific degree
  - d. Any degree

**II. Answer the following questions briefly.**

1. Define Projectile.
2. What is Air Resistance? list any four factors.

**III. Answer the following questions in 150-200 words.**

1. With suitable example explain different types of projectiles in sports.
2. Discuss various Factors affecting projectile motion.
3. Is projectile advantageous in games and sports? Justify.

**IV. Read the given situations and write which of Newton's Laws of Motion applies to it.**





S.no.	Sports situation	Law of motion
1.	When a ball is thrown, kicked, or struck with an implement, it tends to travel in the direction of the line of action of the applied force. The greater the amount of force applied, the greater the speed the ball has.	
2.	A skater gliding on ice will continue gliding with the same speed and in the same direction unless an external force acts upon the skater.	
3.	The force applied to the ball is matched with an equal and opposite force applied to the racket.	
4.	When a white ball (the cue ball) hit a yellow or green ball in billiards.	
5.	The force applied to the arrow in archery to hit the target.	

#### V. ART INTEGRATION - IDENTIFY, PERFORM AND MAKE CARDS

We do different types of activities in our daily life routine; in the same way, newton's law of motion applies to those activities. In your classroom, make groups and select different games for different groups. Identify three fundamental skills from those games, perform them and identify which newton's law of motion relates to that skill. Make activity cum learning cards and write the following details in the table given below:

S.No.	Game	fundament skill	Name the Law of Motion	Remarks

#### VI. SPORTS INTEGRATED



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Sports science is a fascinating topic on its own, and most physical sports require





having a basic understanding of scientific concepts. Consider the amount of physics involved with a sport like a golf - a golfer must understand the concept of a trajectory and how this can be affected by a multitude of factors (wind speed and direction, for instance). From tennis to basketball, angles, arches, mass, the center of gravity, angle of contact/release, etc, are all involved with these types of sports!

Based on this students can make a project individually or in a group on different sports and games where these laws and principle is applied with practical example and presented in their classes.

### VII. Case Study

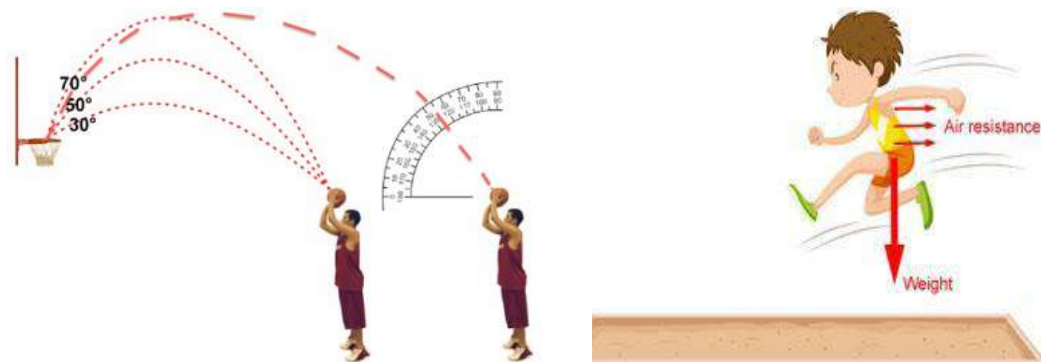


During her gymnastics practice, Zoya was finding it difficult to maintain her balance on the balancing beam. Her coach tried to explain to her about basic principles of equilibrium.

According to the principles of equilibrium Centre of gravity plays a very important role.

- (a) \_\_\_\_\_ C.G helps in increasing stability.
- (b) \_\_\_\_\_ base more stability.
- (c) There are two types of equilibrium namely \_\_\_\_\_ and \_\_\_\_\_.

2.





While explaining how to release basketball at a correct angle to successfully score points the basketball coach showed students this picture.

Basketball players wanted to know more about projectiles therefore the coach explained to them the factors affecting flight of an object.

- (a) An object covers less distance when the projected path is at \_\_\_\_\_ degrees.
- (b) If the initial velocity is low the object will cover \_\_\_\_\_ distance.
- (c) If the weight of the object is more the impact of gravity will be \_\_\_\_\_.

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# UNIT IX PSYCHOLOGY AND SPORTS

## Overview

- ◆ Personality; its definition & types (Jung Classification & Big Five Theory);
- ◆ Motivation, its type & techniques;
- ◆ Exercise Adherence: Reasons, Benefits & Strategies for Enhancing it;
- ◆ Meaning, Concept & Types of Aggressions in Sports;
- ◆ Psychological Attributes in Sports - Self Esteem, Mental Imagery, Self Talk, Goal Setting
- ◆

## LEARNING OUTCOMES

*At the end of the unit, students will be able to:*

- ◆ Classify different types of personality and its relationship with sport performance.
- ◆ Recognise concept of motivation and identify various types of motivation.
- ◆ Identify various reasons to exercise, its associated benefits and strategies to promote exercise adherence.
- ◆ Differentiate between different types of aggression in sports.
- ◆ Explain various psychological attribute in sports.

## Discussion

Read an excerpt from a leading newspaper regarding news for requirement of sports psychology in Indian Sports.

BCCI for hiring psychologists to arrest stress





TNN | Mar 11 NEW DELHI: The Indian Cricket Board has discussed plans to ask its state units to hire good sports psychologists who can help young players handle pressure better and ensure lesser drop-outs from the game. With India losing several talented Under-14 and Under-16 level players every year due to family and academics pressures, BCCI also wants to make the hiring of psychologists compulsory at state academies for age group players.

According to a board official, "India is losing a lot of talent at the age-group levels, The stake-holders of the game are all concerned and they want a system in place to tackle this problem. It is common these days to see talented players leaving the game after one or two bad seasons. As you go higher, the talent pool is reduced. "This shouldn't happen," thus the idea of hiring psychologist was discussed. adding that the cricket drop outs should stop at all levels.

<https://timesofindia.indiatimes.com/sports/cricket/news/bcci-for-hiring-psychologists-to-arrest-stress/articleshowprint/57587522.cms> 1/1

### Discuss in your group

- ◆ What causes a person to persist or to give up?
- ◆ What is the person thinking and feeling while engaged in the activity?
- ◆ What can be the reasons for drop-out of talented athletes from sports?
- ◆ How can a Sports Psychologist help young players handle pressure better?
- ◆ Can different motivation techniques help athletes towards continued sports participation?

Present your ideas to the class

## 9.1 Personality: Concept and Definitions

Reading the news clipping, did you wonder why a psychologist would be required to prevent athletes from dropping out, even though they have achieved success? Are we able to identify athletes who have the talent or skill to continue with sports participation but still lack the determination to continue in sports? If we were asked to analyse reasons why some sportspeople succeed despite all odds, surely, we will come up with adjectives like determined, persistent, courageous, dynamic, robust, etc. Is there something more which can be added to describe these athletes - eg., consistent or possessing a stable pattern of behaviour? Sports psychologists have tried to answer these by relating them with various theories of personality. Understanding personality has been an area of interest which is as old as our civilization. Even





before the present day scientific and systematic research to explain personality developed, philosophers across the globe tried to analyse characteristics which were unique to an individual and why people differed in various ways. However, the concept of personality is still evolving and covers such a large range of phenomenon, that it is very difficult to include all the aspects of personality in one definition.

The word **personality** is derived from the Latin word *persona*, the mask used by actors in the Roman theatre for changing their appearance for performing in front of their audience according to the given role. The actor performed as per the script or story wearing a particular mask. The audience also expected them to act in a particular manner on seeing the mask. However, it didn't mean that the actors possessed the desired qualities of the character in themselves. Therefore, the concept of personality came to refer to an individual's characteristic way of responding to other individuals and situations. When we observe people around us, we are able to describe their actions and responses to different situations based on the combination of their individual thoughts, characteristics, behaviour, attitude, ideas and habits. We may represent them as shy, happy, courageous, aggressive etc. These characteristics are a representation of different components of personalities. Therefore, we can view personality as the relatively stable and unique characteristics of an individual across different situations and varied period of time.

Personality, thus, can be defined as the characteristic set of behaviours, cognitions and emotional patterns that evolve from biological and environmental factors. It is the integration of those systems and habits that represent an individual's characteristic adjustment to his environment. According to Robert A Baron, "Personality is an individual's unique and relatively stable pattern of behaviour, thoughts and feelings." Matt Jarvis (2006) in his book presented a general definition of personality offered by Pewin (1993) "Personality represents those structural and dynamic properties of an individual or individuals as they reflect themselves in characteristic responses to situations". It is the integration of those systems and habits that represent an individual's characteristic adjustment to his environment."

**Carl Jung (1933)<sup>1</sup>:** Personality as an attitude refers to a predisposition to behave in a certain manner.

**William Herbert Sheldon (1942)<sup>2</sup>:** offered a topology of personality based on three major morphologies or body types (Endomorph, Ectomorph, Mesomorph), each associated with a different temperament of an individual.

**Cattell (1950)<sup>3</sup>:** Personality is "that which permits a prediction of what a person will do in a given situation."





**Guildford (1959)<sup>4</sup>:** Personality is an 'individual's unique pattern of traits.'

**Allport (1961)<sup>5</sup>:** Personality is the dynamic organization within the individual of those psychological systems that determine his unique adjustment to his environment.

**Eysenck (1953)<sup>6</sup>:** Personality is defined as more or less stable and enduring organization or a person's character, temperament, intellect and physique which determine his unique adjustment to the environment.

**Robert A Baron (2008)<sup>7</sup>:** Personality is defined as individual's unique and relatively stable pattern of behaviour, thoughts and feelings.

In sports also, it is important to understand athletes and their unique and relatively stable characteristics in different situations and conditions. It is essential to know how a particular athlete responds to the situational demands of the training as well as competitions. No two athletes behave in a similar manner; they may behave differently in a common situation. Some athletes may not like to take a command from a coach but may respond positively towards acceptable alternatives like cooperative learning from coaches. Sports psychologist may also be interested to learn which type of people opt for a particular type of sports or exercise program. To understand this, let us overview personality from various approaches and theories propounded by eminent psychologists from across the world. These theories represent various contrasting views and perspectives on the origin and nature of human uniqueness. Each theory may have vast differences but offers wide range of insight that can add towards effective understanding of personality of an individual.

### 9.1.1 PERSONALITY TYPES

Over the years, with the progress of research and development of literature in the field of personality by various psychologists, it is essential to understand the various approaches for getting a better perspective and understanding of personality.

Personality type refers to the psychological classification of different types of people. Personality types are distinguished from personality traits, which come in different degrees. There are many theories regarding personality types, and each theory contains several and sometimes many sub theories. For example, according to type theories, there are two types of people, introverts and extroverts. According to trait theories, introversion and extroversion are part of a continuous dimension with many people in the middle. The major theories include dispositional (trait) perspective, psychodynamic, humanistic, biological, behaviourist, evolutionary, and social learning perspective. However, many researchers and psychologists





do not clearly subscribe to any one particular perspective, but instead take an heterogeneous approach. There is also a substantial emphasis on the applied field of personality testing. In psychological education and training, the study of the nature of personality and its psychological development is usually reviewed as a prerequisite.

Since no one particular theory or approach covers the complete aspects of personality, the approach for explaining 'personality' includes mainly, the 'Type' approach which consists of classification or comprehending of personality type based on a set of behaviour characteristics with similarities as done by Myers and Briggs type indicator, Friedman and Rosenman Type A personality behaviour etc., as well as on the basis of body type classification by Kretschmar, or somatotype by William Sheldon, and the fluid type classification as explained by Hypocrites.

Trait approach, on the other hand, focusses on specific psychological attributes based on the concept of individuals differing in 'unique' and 'stable' characteristics. Trait refers to a characteristic that is unchanging and predictable. For example, shyness is a trait that is usually stable in an individual's personality. Some traits are innate - the infant possesses a basis for developing the trait at birth, while others are acquired through learning, such as the tendencies toward tidiness or untidiness. Some researchers like Eysenck, Cattell as well as Allport and others support inherent traits as "cardinal" and proposed a theory of personality based on biological factors, arguing that individuals inherit a type of nervous system that affects their ability to learn and adapt to the environment. Sigmund Freud and Neo-Freudians like Jung, who described the structure of personality in three part-id, ego, super ego, put forward the psycho-dynamic theory of personality that assumes there is an interaction between nature (innate instincts) and nurture (parental influences).

In modern sports, inter-action perspective regarding personality is an extremely popular and widely adopted approach towards understanding of behaviour. It defines behaviour as function of personality and situational factors acting together. According to the interaction theory behaviour in any situation is a function of both personality and external factors. For example, an player with high hostility trait may not indulge in aggressive behaviour if he or his team is winning with a large margin, or an athlete with composed traits may reflect neurotic tendencies of anxiety if faced with the challenge of scoring the winning run of the last ball of a knockout round match.

### 9.1.2 JUNG'S CLASSIFICATION OF PERSONALITY TYPES

Carl Gustav Jung, a Swiss psychiatrist and a disciple of Sigmund Freud, was once





a great admirer of Freud's view on psychoanalysis and worked with him for five years. However, he started developing contradictory views on some of the major assumptions or findings of Sigmund Freud and later followed a separate professional path. Therefore, many times, Carl Jung is referred to as a Neo-Freudian also.

Characteristics of Introverts & Extroverts	
Introvert	Extrovert
Interested in their own self Reserved	Highly socialized Broad-minded
Self-aware and introspective Take pleasure in reading, writing Tend to shy away from public	Expressive and enjoy centre of attention Meet unknown people easily
Think before acting	Bold, outgoing and optimistic person Action oriented

Later he published a book Psychology Typen (Psychology Types) in 1921 and presented his own theory of personality by classifying personality based on two important aspects.

First is personality attitude (introvert and extrovert) and second is personality functions (Sensing, Intuitive, Thinking, Feeling). He can be credited for being the first to introduce the concept of introversion and extroversion to the world of psychology. It was not a designed to label type of people, instead the purpose was to demonstrate the complexity of human typology and its consequences. Let us understand Jung's topology based on personality attitude and personality functions:

1. Personality Attitude: which is distinguished as Extrovert or Introvert.
2. Personality Functions: which can be classified as four distinct function namely; Feeling, Intuiting; Judging or Sensing. The four functions are divided into what Jung called rational (or judging) and irrational (or perceiving) functions. Thinking and sensations are rational, according to Jung, while intuition and feeling are irrational.



**Introvert:** In Jung's theory, introverts are people who are predominantly interested in their own mental self. They are typically seen as more reserved or reflective and prefer to be withdrawn from external reality. They opt to live in their own inner





world of feelings and thoughts and often take pleasure in solitary activities such as reading, writing, or meditating. They prefer to create their own virtual and imagery world, due to which they tend to shy away from in public interactions and social connects and are less vocal with people around them, due to this, they like to be reserved and within themselves. They are more analytical before speaking.

**Extrovert:** In Jung's theory people with an extrovert personality are the total opposite of those with an introvert personality. They prefer the outer world of things, hence are found to be more broad-minded, are highly socialized, hence can meet unknown people easily. They are very bold, outgoing and optimistic person.

The Eight Preferences				
<i>Where you prefer to focus your attention</i>	<b>E</b>	<b>EXTRAVERSION</b> People who prefer extraversion tend to focus their attention on the outer world of people and thin	<b>I</b>	<b>INTROVERSION</b> People who prefer introversion tend to focus their attention on the inner world of ideas and impressions.
<i>The way you prefer to take in information.</i>	<b>S</b>	<b>SENSING</b> People who prefer sensing tend to take in information through the five senses and	<b>N</b>	<b>INTUITION</b> People who prefer intuition tend to take in information from pattern and the big picture and focus on future possibilities.
<i>The way you prefer to make decisions</i>	<b>T</b>	<b>THINKING</b> People who prefer thinking tend to make decision based primarily on logic and on objective analysis of cause and effect.	<b>F</b>	<b>FEELING</b> People who prefer feeling tend to make decision based primarily on values and on subjective evaluation of person-centered concern.
<i>How you prefer to deal with the outer world</i>	<b>J</b>	<b>JUDGING</b> People who prefer Judging tend to like a planning and organized approach to life and prefer to have things settled.	<b>P</b>	<b>PERCEIVING</b> People who prefer perceiving tend to like a flexible and spontaneous approach to life and prefer to keep their options open





Extroverts tend to enjoy human interactions and to be enthusiastic, talkative, assertive, and gregarious. They take pleasure in activities that involve large social gatherings, such as parties, community activities, public demonstrations, and business or political groups. They also tend to work well in groups.

**Personality Functions:** Whether a person is an introvert or extrovert, she/he has a preferred pattern to deal with the situations. There can be four basic way or function used by people:

1. **Feeling:** Feeling is a preference for making decisions based on values and effects on people rather than logic. People use their emotional aspects to understand the situation and deal according to it.
2. **Thinking:** The capacity to decide objectively based on the evidence and applicable principles is defined as thinking. People evaluate the information received with logic and rationale for dealing with outer world.
3. **Sensing:** Sensing refers to a preference for perceiving the world through facts, evidence, data and details. People use their senses to seek information. They are good at looking and listening to understand the world around them.
4. **Intuitive:** Intuition refers to a preference for perceiving the world through concepts, theories and abstractions. People use their perception and intuitions to understand the situation, people around them, sometime its referred as sixth sense of an individual.

According to Jung, the two attitudes of extraversion and introversion cannot be demonstrated in isolation. It need to be associated with one of the four functions. When the two attitudes (Extrovert and Introvert) combine with four functions (Sensing, Intuition, Thinking, Feeling), they form eight mental functions-in-attitude or personality types. Let us briefly view each of the eight combinations of personality types.

Extroverted Thinking	<p>Extroverted thinking involves segmenting; organizing for efficiency; systematizing; applying logic; structuring; checking for consequences; monitoring for standards or specifications being met; setting boundaries, guidelines, and parameters; deciding if something is working or not.</p> <p>Sorting out different colours and styles; thinking about the consequences. Extroverts who are thinkers are able to see the world through complex and solid ideas but these complex ideas are often handed down or moved on by others. These people often work in fields related to Math and Science.</p>
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Introverted Thinking	<p>Introverted thinking involves analysing; categorizing; evaluating according to principles and whether something fits the framework or model; figuring out the principles on which something works; checking for inconsistencies; clarifying definitions to get more precision; analysing options for using principles.</p> <p>Introverts who think see how the world works in a subjective and creative way. This analysis is based on internal knowledge. These people often work in science fields as well.</p>
Extroverted Feeling	<p>Extroverted feeling refers to connecting; considering others and the group- organizing to meet their needs and honor their values and feelings; maintaining societal, organizational, or group values; adjusting to and accommodating others; deciding if something is appropriate or acceptable to others.</p> <p>These people base their judgements on factual, known information. They form their assessments on social values and beliefs. These people often work in business fields and politics.</p>
Introverted Feeling	<p>Introverted feeling means valuing; considering importance and worth; reviewing for incongruity; evaluating something based on the truths on which it is based; clarifying values to achieve accord; deciding if something is of significance and worth standing up for.</p> <p>They base their feelings on emotions, feelings and beliefs. These people often work in the art field.</p>
Extroverted Sensing	<p>Extroverted Sensing refers to experiencing the immediate context; taking action in the physical world; noticing changes and opportunities for action; accumulating experiences; scanning for visible reactions and relevant data.</p> <p>These individuals look at the world and interpret reality. They see what is going and go with it. They are not influenced by other opinions. These people often work as taste-testers or proof-readers.</p>
Introverted Sensing	<p>Introverted Sensing involves reviewing past experiences; “what is” evoking “what was”; seeking detailed information and links to what is known; recalling stored impressions; accumulating data; recognizing the way things have always been.</p> <p>Introverts at times look for a hidden message or meaning to something. They do not just look at something and see it being there without a reason. These meanings are based on internal reflection. These people often work in the art field as well.</p>





Extroverted Intuitive	<p>Extroverted Intuition refers to interpreting situations and relationships; picking up meanings and interconnections; being drawn to change “what is” for “what could possibly be”; noticing what is not said and threads of meaning emerging across multiple contexts.</p> <p>These people base their meanings of things on facts rather than feelings. They are usually inventors.</p>
Introverted Intuitive	<p>Introverted Intuition leads people to foreseeing implications and likely effects without external data; realizing “what will be”; conceptualizing new ways of seeing things; envisioning transformations; getting an image of profound meaning or far-reaching symbols.</p> <p>Introverted Intuitives usually base their decisions on their inner desires. They find warmth through subjective ideas. These people usually work as artists or religious figures.</p>

### Ambivert

While explaining personality through the term Introvert and Extrovert, there is reference of a third term called Ambivert which is a relatively new term. Jung did not use the word to explain that there is no such thing as a pure introvert or extrovert. This concept was supported by many other later psychologists. Ambiverts reflect a blend of traits from the introvert as well as the extrovert along with having some specific strengths. Thus, an ambivert can be defined as someone who falls in the middle of the introvert/extrovert continuum.

#### 9.1.3 BIG FIVE THEORY OF PERSONALITY



Another important trait approach which can provide essential insights into the key elements of personality is of the Big Five Factor personality model offered by Paul Costa and Robert McCrae. The five personality traits also known as the Five Factor Model of Personality and sometimes referred as OCEAN. The five domains or traits represented by the acronym OCEAN, are Openness, Conscientiousness, Extraversion, Agreeableness, and Neuroticism.



Let us try to understand the attributes of each of the five personality factors on a continuum leading from high reflected characteristics at one end to low reflected characteristics at the other .

### **Openness to Experience (Imaginative vs Narrow Interest):**

Openness refers to dimension of personality which ranges from being imaginative, humorous, intellectual, creative, curious, having broad interests, open to ideas at one end to being closed to experience, suspicious and rigid at the other. In sports, athletes or Individuals scoring high on Openness are characterized by reflection of demonstrating new ideas and skill execution initiatives along with wide variety in ideas.

### **EXTRAVERSION (Enthusiastic vs Reserved)**

Extraversion refers to dimension of personality which ranges from having enthusiasm, energy, positive emotions, talkativeness, assertiveness at one end to being reserved, sober and cautious at the other. An individual who scored high on extraversion is characterized by high sociability, is outgoing and has a tendency to seek stimulation in the company of others. Those who score low on extraversion prefer solitude or smaller groups, prefer activities alone, and avoid large social situations. Not surprisingly people who score high on both extraversion and openness are more likely to participate in adventure and risky sports due to their curious and excitement seeking nature.





### CONSCIENTIOUSNESS (Organized vs Easy-going)

Conscientiousness refers to well-organised, careful, responsible, hardworking and dependable individuals at one end to being relaxed and easy going, spontaneous, disorganized and careless. Numerous studies have found to have a positive correlation between conscientiousness and cognition, individuals high on conscientiousness have been found to perform better in academics as well as in the sports arena wherever planning, organising skills and decision-making abilities are essential to the task.

### AGREEABLENESS (Friendly vs Un-Cooperative)

Agreeableness refers to compassionate behaviour of an individual. Dimensions of agreeableness range from being good-natured, cooperative, trusting at one end to being suspicious, irritable and uncooperative at the other. It is also a measure of a person's helpful and friendly behaviour nature and reflects whether that person is generally friendly and nurturing or not. People who score low on agreeableness tend to be antagonistic towards others and are described as rude and unkind.

### NEUROTICISM (Composed vs Nervous)

Neuroticism focusses on the emotional stability on an individual. This trait refers to dimensions of personality which range from being poised, calm and composed at one end to nervous, anxious and excitable at the other. Individuals reflecting high neuroticism are characterized by the tendency to experience unpleasant emotions, and are often found to demonstrate impulsive and hostile behaviour. In contrast, people who score low in neuroticism tend to be calm and even-tempered. Athletes' sports performances are highly influenced by neurotic characteristics and modern findings supports exercise and physical activity as an alternate therapy to manage neurotic behaviours.

BIG 5 Traits	Behaviour for High Score	Behaviour for low score
<b>OPENNESS</b>	Curious, Imaginative, Intellectual, Creative, Open to trying new things, Focused on tackling new challenges, Thinks about abstract concepts	Dislikes change, Does not enjoy new things, Resists new ideas Not very imaginative, Dislikes abstract or theoretical concepts
<b>CONSCIENTIOUSNESS</b>	Well-Organised, careful, responsible, self-disciplined	Disorganised, careless, relaxed, easy going







<b>EXTRAVERSION</b>	Active, optimistic, sociable, interactive , affectionate	Sober; reserved , cautious
<b>AGGREEABLENESS</b>	GoodNatured, friendly, helpful, trusting, cooperative	Irritable, suspicious, rude, uncooperative
<b>NEUROTICISM</b>	Insecure, nervous, anxious, excitable	Calm, composed, poised, Hardy, Secure

### I. Tick the correct answers

1. Personality is derived from a latin word 'persona' meaning
  - a. Shape
  - b. Mask
  - c. Stage
  - d. Philosophy
2. Which can be a suitable concept related to personality in sports?
  - a. Stable but not unique characteristics
  - b. Stable and Unique characteristics
  - c. Unstable characteristics
  - d. Dynamic behaviour pattern
3. A person who is bold and outgoing is an
  - a. Introvert
  - b. Extrovert
  - c. Ambivert
  - d. Somatotype

### II. Answer the following questions briefly.

1. Define Personality?
2. What does OCEAN represent according to Big Five Theory of Personality?
3. Comment upon Allport's Theory of Personality.

### III. Answer the following questions in 150-200 words.

1. Differentiate between Introvert and Extrovert personality?





2. What are the types of personality traits according to the Big Five Theory? Explain with their importance in physical education and sports.

## 9.2 Motivation

Let us re-visit our initial discussion once again. Why did some athlete keep playing without worrying about pain, discomfort of training, injury or even academic pressure? On the other hand, why did many talented athletes stop participating after initial failures?

Let us consider the two important questions.

1. What motivates a player to behave in a certain way?
2. How to motivate an athlete to perform better?

To answer the questions above, let us start from understanding of the concept 'motivation'. The term 'Motivation' is derived from Latin word *Movere* meaning 'to move'. The basic reason for any human activity is nothing else but motivation. Motivation is the driving force that spurs a person to action It can be explained as a process to initiate, guide and maintain behaviour over time as defined by Robert Baron (2008). Motivation can also be defined simply as the direction and intensity of effort. Truly, motivation is a process of inspiring, guiding the organism to move in a particular direction.

From the above definitions, we can understand motivation is influenced by two factors: Objective and Direction. The first factor 'objective' explains the 'why' of an action or behaviour, whereas the second factor 'Direction' explain 'what' of an action or behaviour. The 'why' or objective for a behaviour helps to find the reason for initiating a behaviour. The direction is about 'what' an individual wants to do, 'what' they plan to achieve. If either objective or direction is lacking for an action or behaviour, ultimately the quality of action or achievement suffers. It means, to achieve the desired goal you need to have a purpose or desire which activates you towards initiating a task in a particular direction and seeking behaviours to be persistent with enough fuel and energy till the goal is achieved. When one of the random activities leads to a goal, it reduces the drive, and the organism stops being active.

What is it, then, that arouses the organism to action? How does one get this drive? The answer can be found in the two terms 'Intrinsic' and 'Extrinsic' motivation. Intrinsic motivation involves doing something because it's personally rewarding to you. It emerges from within and is directly linked with the natural instincts based







on feelings of joy and satisfaction. Extrinsic motivation, on the other hand, involves doing something because you want to earn a reward or avoid punishment. Thus, extrinsic motives involve outside forces. Let us find out more about the type of motivation and see how motivation is an important aspect in sports and exercise psychology.

### Do you know?

**A motivation** A state of lacking any motivation to engage in an activity, characterized by a lack of perceived competence and/or a failure to value the activity or its outcomes.

**Intrinsic Motivation** When you pursue an activity for the pure enjoyment of it, you are doing so because you are intrinsically motivated.

**Extrinsic Motivation** refers to behaviour that is driven by external rewards such as money, fame, grades, and praise.

## 9.2.1 INTRINSIC AND EXTRINSIC MOTIVATION

**Intrinsic Motivation:** The word intrinsic is derived from the French word 'intrinseque' which means inward. Intrinsic is also referred as internal motivation which drives an individual from within to naturally pursue actions that provide fun, pleasure, fulfilment or challenge. If an individual's behaviour reflects a desire to pursue an action for enjoyment, or the individual continues the activity in a consistent manner because it provides a feeling of satisfaction, these can be identified as intrinsic motivation factors towards the directed behaviour. Intrinsic motivation includes satisfaction of needs felt by the individual which comes from inside or within and is directly linked to the individual's instincts or urges.

**Extrinsic Motivation:** The word extrinsic is derived from the Latin word 'extrinsecus' which means outward. Just as its meaning suggests, extrinsic motivation is that in which the source of satisfaction does not come from within and the behaviour is not due to natural urges or impulses. Instead, the behaviour or action is influenced by external forces or drives. The reasons for action are not part of an individual's character, but are due to urges from outside such as prize, money, praise, or even punishment.





### Extension Activity

Talk to a friend who is an athlete and try to find what motivated him to participate in sports. Read the below mentioned responses and identify the statements which most closely suit your friend's reason to participate:

1. Doesn't know why he plays and that he doesn't see any particular benefit associated with it.
2. To learn new skill of the sports.
3. To gain skill mastery and perfection.
4. Find joy and happiness in participation.
5. Perform to obtain a reward or trophy in the championship.
6. To make the coach happy for getting the best athlete ward in school.
7. Participate to avoid pressure from the family.

The response of your friend reflects the following about his motivation.

If YES to:

Item 1: Reflects Amotivation

Item 2, 3, 4: he/ she is Intrinsically motivation  
Item 5,6,7: he/ she is Extrinsically motivation

### Difference between Intrinsic and Extrinsic Motivation

	Intrinsic Motivation	Extrinsic Motivation
<b>Definition</b>	Driving force to pursue an action for fun, joy or any other inner satisfaction	Driving force to pursue an action due to reward, trophy, money, promotions or praise
<b>Factors</b>	Internal factors like joy, enjoyment	External factors like reward, promotion, praise
<b>Method</b>	Goal Setting strategies, Family and Community support	Associating success with future benefits, awards, promotions and avenues.
<b>Benefits</b>	Long term benefit of maintaining a behaviour	Helpful to initiate or create a drive towards a desired behaviour when internal factors are missing.

### 9.2.2 MOTIVATION TECHNIQUES

Motivation is the process in which the learner's internal energies or needs are directed towards various goal objects in his environment. In other words, it is the driving



force which increases the desire to perform better. Every individual has certain basic motives or needs that she/he tries to satisfy. As long as one is satisfied with one's present behaviour and knowledge and finds it adequate to satisfy all her/his needs, she/he will not try to change his behaviour or acquire new knowledge. Let us try to understand some of the techniques used in sports to motivate athletes by helping them to maintain their inner urges to continue training as well by utilizing external factors to supplement their drive to prolong with the desired athlete behaviours essential for sports performance.

The motivational techniques are based on the following mentioned approaches. Understanding of each approach will help in developing unique strategies to motivate athletes towards desired behaviours.



1. **Cognitive Approach:** The active processing and interpretation of information influences the persistent and purposive drive for action by an individual. It is based on the notion that desired motivation can be achieved by an individual through active processing and interpretation of information. Expectancy theory and Goal Setting theory is widely used as a cognitive approach for motivation. Expectancy theory explains that people are motivated for the task where the probability of success is higher in comparison to failure. Whereas the goal-setting concept maintains that a stronger drive for actions and behaviour is fuelled by quality of information on time set for task attainment along with task difficulty level and specificity of the task.
  - (a) **Time Bound:** The task should be time bound
  - (b) **Set Complexity level of task:** Task should be neither too difficult nor too easy
  - (c) **Make task Specific:** Task instructions should be precise about what is to be done
  - (d) **Define Purpose of task:** Outcome of the task should be clear and defined.





2. **Pedagogical Approach:** Teaching coaching pedagogies used in sports training for planned outcome is largely responsible in guiding and maintaining the desired behaviour of athletes. Adequate communication and maintenance of positive relationship during training is an essential component influencing the motivation of athletes towards a consistent action or behaviour. Making training enjoyable, engaging athletes in decision making and providing valuable feedback to athletes are essential components to motivation. Let us discuss few techniques of motivation using a pedagogical approach.
  - (a) **Guided Discovery Method:** Athletes are highly motivated if allowed to find solutions to the problems by themselves rather than if they are just made to do things as per instruction. Lack of independence in decision making and non- promotion of cohesive training environment for athletes are major reasons affecting motivation. Cooperative learning with opportunities for athletes to engage in decision making is an effective strategy towards motivation.
  - (b) **Valuable Feedback System:** To persuade athletes to push harder for a longer period of time, they must be provided with a strong support system. Assisting athletes with feedback which can provide them with specific direction to move in is an effective means towards effective motivation.
  - (c) **Fun-based Training:** Training should be challenging and task-oriented for optimal performance. However, for providing athletes with enough drive and energy to sustain them, training methods should involve fun and enjoyment for athletes. Adding creativity and innovation to training and the teaching-learning system helps in adding motivation for athletes to persist with continuous demands of training load.
  - (d) **Individualized Training Program (ITP/IEP):** All athletes are unique and respond differently to the vast variety of training demands. Each athlete is a unique individual and should have a training programme designed for their abilities and capabilities and which is within attainable limits of the athletes. Individualized training programmes or individualized education programmes are very essential in sports to help athletes to set their own targets, challenges and difficulty levels which will not only help them to avoid burnout, but also keep them motivated.
3. **Social Support Strategy:** Participation in sports and taking up exercise is greatly influenced by an understanding of the social networking and perception of people around them. Conducive exercise environment, creating drive among people to initiate and maintain sporting behaviour is deeply affected by the societal pressure or support provided to the individual. Positive social support



from peer group, family members, and friends helps in developing healthy habits and enough drive to maintain the act of exercising. Initiating group activities and engagement of family and peers in sports participation helps in increased participation in sports and exercise.

#### 4. Facilitation Approach:

- (a) **Incentives and Rewards:** Drive towards an action to maintain it for a long term may sometimes need external support. Awards and rewards work effectively as a motivation force for athletes to pursue sports with consistency and continuity.
- (b) **Valance of Reward:** Many time prizes and awards are used extrinsic sources of motivation to maintain a desired action or behaviour. But, at times, even these may prove to be ineffective. It is essential to understand that external factors like prize money or medals do motivate athletes, but the most important aspect is to understand the need and expectation of the individual athlete, this is known as 'valance' of the reward or valuing the award. To be motivated, athletes must be awarded by considering what is desired or expected by an individual so that he or she can value that reward. An athlete may like to be rewarded by being made the captain of the team and may value it more than being rewarded with a pay hike.
- (c) **Performance appraisals:** Motivation or the driving force for any desired behaviour to last over a long period of time may need support of being recognised and praised for the current and past endeavours. It creates the drive for future action and pursuit of excellence with confidence among athletes. It encourages them to plan their directions and actions. Regular appraisal of performance should be provided to athletes and appropriate rewards given.
- (d) **Quality Support and Facilitation:** Motivation for an action is influenced by the amount of facilitation made available for athletes, but the impact is larger only if the quality of support is of a high standard. Factors influencing or impacting the desired behaviour of athletes need to be studied, diagnosed and appropriate support needs to be provided to ensure maintenance of behaviour of highest standards.

### 9.2.3 MOTIVATION AND SPORTS

Motivation as a guiding force to initiate, guide and maintain a behaviour desired for sports participation and performance is well understood but still motivation remains as a challenging task in sports.





Researchers around the world have discussed the methods to maintain or increase motivation of athletes, but little has been done to understand the reasons about why we participate in an exercise or indulge in s activities. Summarizing the conclusions of different research, four motives towards sports and exercise behaviour can be identified.

1. Physical wellbeing;
2. Psychological wellbeing;
3. Performance achievement;
4. Status and Power (assertive achievements).

All the motives mentioned above are intrinsic in nature and point towards the reason for sports participation and exercise as being largely intrinsic in nature. People participate in sports and exercise for various intrinsic motives but external motives can be added wherever or whenever intrinsic motive is reduced.

**I. Tick the correct answers.**

1. Motivation that drives individuals to naturally pursue actions that provide fun, joy, pleasure or challenge is called
  - a. Extrinsic Motivation
  - b. Amotivation
  - c. Intrinsic Motivation
  - d. Cognitive Motivation
2. Motivation through reward or praise is known as
  - a. Intrinsic Motivation
  - b. Extrinsic Motivation
  - c. Pedagogical Motivation
  - d. Facilitation Motivation
3. Which of the following is NOT a feature of Intrinsic Motivation?
  - a. goals
  - b. feedback
  - c. needs
  - d. attitudes



## II. Answer the following questions briefly.

1. Define Motivation.
2. Differentiate between Intrinsic and Extrinsic Motivation.
3. Write a short note on any two techniques of motivation.

## III. Answer the following questions in 150-200 words.

1. How can a coach strategize in motivating an athlete to keep performing?
2. How does motivating a sports person affect games and sports and how do games and sports influence a player's motivation?

### 9.3 Exercise Adherence

"If exercise could be packed into a pill, it would be the single most widely prescribed and beneficial medicine in the nation" - Dr Rober Butler, Former Director, National Institute of Ageing.

In the simplest term exercise adherence refers to *the extent to which the individual maintains an active involvement in physical exercise and acts in accordance with the advised interval, exercise dose, and exercise dosing regimen despite opportunities and pressures to withdraw*. Exercise adherence, therefore, refers not just initiation but also maintenance of physical activity and exercise behaviour according to individualized need and requirement. It is associated to the 'stickability' factor which is related with quality of any athlete or participants to continue with sports, exercise or any other physical activity without losing the motivation to pursue it further. So, exercise adherence can also be referred as *a self-regulated, voluntary behaviour directed towards maintaining an exercise routine for a prolonged period of time after initial phase of adoption*. It is important as well as interesting to understand the reasons why people adhere to exercise and the forces that push athletes towards initiating sports participation.

#### 9.3.1 REASON TO EXERCISE

Reason to exercise or exercise determinants point towards the importance of motives of an individual towards initiating and adopting exercise as a part of her/his lifestyle. We find many people around us with different behaviours towards exercise and physical activity and each behaviour can be associated with its own reason for adherence or non-adherence. We may find many people who have not initiated exercise or even thought of exercise and physical activity in near future, or those







who think of starting exercise in the near future but are not able to initiate the programme, and still others who started or initiated an exercise programme but were not able to continue or adhere to it for long and dropped out. Why people find a reason to exercise, participate in fitness and engage in recreation sports can be understood by the following aspects:

1. **Overcoming Social Physique Anxiety:** People in the society are influenced by how other perceive them in-term of their looks, fitness or body shape, weight and size. This leads to adoption of various means and methods to make them lean and fitter. Exercise combined with proper diet can help people attain their goal to be lean and fit thus helping overcoming social physique anxiety with the means of exercise, fitness and recreation sports program engagement.
2. **Reduced risk of disease:** Lifestyle factors does play an important role toward rise of various contemporary health issues. Hypertension, obesity are major health concerns in the modern day due to increase in facilities and urbanization leading to limited physical engagements, lack of physical activity and promotion of sedentary lifestyle. To overcome the sedentary lifestyle, adoption of exercise and fitness are considered to be essential and important.
3. **Recreation :** With change in lifestyle and devotion of more hours on table chair task, engagement in serious academics, focus on professional pathways, individuals are facing with the challenge of finding time and activity for recreation, fun and enjoyment. Recreation sports, fitness and exercise provide fun, enjoyment, recreation along with the physical benefits, thus recreation being considered as an essential reason to exercise.
4. **Mental Relaxation:** There are various means and methods adopted for stress reduction and mental relaxation by people of all segments, demography, age groups. Exercise is one of the most effective ways to cope with stress and depression more economically and with tremendous benefits to the society. Therefore, people participation in exercise for mental relaxation as a reason is relevant.
5. **Socialization:** Often people look for opportunities to engage with community and socialize with friends, peer groups, colleagues etc from their busy life. The engagement with society members are essential to overcome social isolation, tackle loneliness which can affect their mental health and prevent camaraderie spirit among peoples of the society. Especially in the modern lifestyle and with urbanization leading to less time available for social connect, the most effective way to connect socially is through participation in team sports, group exercises program and various other fitness programs. Thus socialization qualifies as a reason for people to engage and experience exercise and sports programs.



### 9.3.2 BENEFITS OF EXERCISE

1. **Health Benefits:** There has been evidence of humans working hard and putting in physical effort for their survival and better life since early times. Even today people across the world desire to lead a healthy life and consider health as the most essential aspect of life. With the change in living conditions and transformation in contemporary lifestyle, engaging in physical activity, exercise and sports has a prominence as a chosen activity or preferred behaviour among people to keep themselves healthy. Regular exercise can provide the following benefits:
  - (a) ***Reduces risk of Cardiovascular Disease:*** Exercise and a regular cardio-fitness regime has a significant role in preventing various cardiovascular diseases like hypertension and coronary heart disease. Exercise strengthens the heart and improves circulation. The increased blood flow raises oxygen levels in the body. This helps lower risk of heart diseases such as high cholesterol, coronary artery disease, and heart attack.
  - (b) ***Weight Management:*** Living in a society where physical appearance is important, individuals take to exercise from a desire to keep themselves in shape. Though they may experiment with other methods for losing weight like dieting and calorie control etc., but these methods alone not found to be effective for weight reduction unless regular exercise is not combined with diet control.
  - (c) ***Strengthens Bones and Muscles:*** Regular exercise helps build strong bones. Later in life, it can also slow the loss of bone density that comes with age. Doing muscle- strengthening activities can help you increase or maintain your muscle mass and strength.
  - (d) ***Reduces risk of some Cancers:*** Exercise reduces risk of cancers like cancers of the colon, breast, uterus, and lungs.
  - (e) ***Reduces risk of Falls:*** For older adults, research shows that doing balance and muscle- strengthening activities in addition to moderate-intensity aerobic activity can help reduce your risk of falling.
2. **Provides Stress Relief:** Modern lifestyle with its work pressure and competitive lifestyle leads to a lot of stress. The physical effects of prolonged stress are numerous, including a greater susceptibility to illness, a lack of energy, problems with sleep, headaches, poor judgment, weight gain, depression, anxiety, and a host of other ills.





3. **Increases Happiness:** It has been evident to find people engaged in physical activity for various extrinsic goals like weight loss, improving physical appearance etc. but there are people who prefer to exercise and engage in physical activities like recreation sports or adventure sports due to their innate nature to experience joy, happiness and satisfaction. During exercise, the body increases the production of endorphins which are known to help produce positive feelings and can improve the mood and make the individual feel relaxed and happy.
4. **Promotes Self-Efficacy:** Self-efficacy is the belief that one is capable of achieving a specific goal. Regular exercise and participation in sports is largely associated with an individual's belief in her/his abilities to complete physical tasks, achieve determined goals and produce challenging outcomes.
5. **Promotes Social Cohesion:** Human beings are social animals who prefer to engage in group activities because it given them opportunity to socialize and interact with other people. As a result, many people engage in exercise behaviour and sports participation. Sports and group exercise programmes also prevent boredom and social isolation by helping participants feel connected with the society and community around them as team mates, opponents or even as spectators. Group cohesion developed among participants of exercise group and sporting members acts as one of the important reasons for exercise.
6. **Enhances Value Orientation:** Knowledge and understanding about a healthy lifestyle and importance of regular physical activity creates a value orientation among individuals to initiate exercise and later continue with exercise behaviour. Value orientations represent philosophical beliefs. Values inculcated by physical activity and exercise include discipline, enhanced learning process, self-actualization, social responsibility and ecological integration.
7. **Cognitive Benefits:** Regular aerobic activities lead to a positive improvement in attention control and information processing speed. Exercise can improve brain function and protect memory and thinking skills. Exercise increases heart rate, promoting the flow of blood and oxygen to the brain. It can also stimulate the production of hormones that can enhance the growth of brain cells. This serves to increase the following mental function.
  - (a) **Attention Control:** Regular physical activity and exercise help improve attention and concentration among people of all ages. Physical exercise at a moderate level also revealed positive effects and benefits among the participants.



- (b) **Improves Memory:** Physical activities have been known to enhance intelligence especially among children. Even among the elderly, even a small amount of physical activity delays memory loss. Exercise has been shown to reduce changes in the brain that can cause Alzheimer's disease.
8. **Mental Health Benefits:** A session of jogging or any physical activity has the possibility of mood enhancement and increasing the feel-good factor. Issues associated with depressions, anxiety etc. can be resolved with regular physical activity and exercise.
- (a) **Exercise as therapy for emotional disorder:** Physical activity is an effective intervention for various mental disorders like depression and anxiety. Exercise therapy has been able to produce improved mood, enhanced self-esteem and thereby, increase productivity.
- (a) **Fitness as moderator of life stress:** Regular physical activity helps in creating a positive attitude towards work by developing higher ability to cope with stress and tension.
- (a) **Runners High:** Participating in regular physical activity promotes a high sense of mental alertness, mood upliftment, a feeling of liberation, suppressed discomfort and heightened well-being.
9. **Psychological Well-being:** Participation in regular physical activity, sports and exercise brings positive changes in the mental and physical well-being of an individual. Exercise leads to changes in blood flow to brain, increase in oxygen consumption, reduction in muscular tension, improved metabolism, creating a feeling of wellbeing.
10. **Personality Enhancement:** Participation in physical activity and exercise has revealed significant influence on personality. Regular participation and long-term engagement in physical activities especially at young age (before maturity) reflects greater extraversion and stability among participants, which are very important characteristics or traits of personality.
11. **Develops Leadership Qualities:** Engagement in an exercise programme and participation in sports provides opportunity for individuals to experience adversities and opportunities to learn from compensating various deficiencies like lack of space, inadequate logistics, adverse conditions and still persist with prolonged activities, so developing qualities of leadership.
12. **Special Population:**
- (a) **Clinical Population:** People with intellectual disabilities of all age groups and have found to derive significant benefits from regular participation in





physical activity. Psychomotor activities help them in enhancement their skills in activities related to daily living too.

- (b) **Elderly Population:** Ageing is a process which is observed to be delayed among the people who are regular participants of physical activity even of an acute nature. Even low intensity bouts of exercise prove to be helpful in slowing down of the ageing process among the elderly.

#### 9.4 Strategies for Enhancing Adherence to Exercise

Psychologists and therapists around the world have widely professed the benefits of exercise. Although most people do understand the importance of physical activity and regular exercise, yet a large percentage of them have either not initiated exercise behaviour, or, if a few opted for exercise, they couldn't continue it and dropped out. Therefore, its essential to discuss the strategies for enhancing adherence to exercise.

1. **Goal setting:** A moderate bout of acute exercise (20-30 min) is considered to be beneficial for improving positive psychological effects of exercise. Exercise performed above lactate threshold (LT) is perceived as unpleasant and the participant may like to discontinue it due to overexertion and discomfort. Therefore, along with setting of SMART - Specific, Measurable, Attainable, Realistic, Time based - goals.
2. **Adding variety to exercise:** Lack of new variety of exercise may lead to boredom and dropping out. Boredom can be tackled with the addition of a variety of exercises and moves that address the same body issues, without loss of therapeutic benefits. Adding variety to the exercise program through adoption of new strategies, changing methods, using new equipment, re-inventing logistics and adding new members can induce fresh energy to the exercising activity, thus enhance adherence to exercise.
3. **Social support enhancement:** Increasing social support refers to engagement of friends or other members who can contribute towards positive participation in physical activity, exercise and sports because social interaction may help fuel goal achievement and thus produce good results. Creating of a system of buddy partner, youth leader, mentor where members of family, a classmate or a friend or relative can be engaged as a motivator and flag bearer for exercise.
4. **Contract:** While acute bout of exercise has been associated with positive effects, chronic exercise habits or regular exercise behaviour are important for maintaining these benefits. Therefore, promoting participants for signing an



intent to comply through a written contract which has specified expectations, responsibilities and contingencies for behavioural changes have found to be more effective in exercise adherence among the participants.

5. **Reinforcement Interventions:** Positive as well as negative reinforcement approaches have found to be effective in exercise adherence. Use of incentives and rewards for appreciating attendance and participation or awarding with badges have been proved effective in maintaining exercise behaviour among participants as well as motivation from many to initiate and engage in physical activity.
6. **Feedback:** Providing feedback to the participants in physical activity provides much needed direction and energy for prolonging and continuing exercise behaviour. Individualized feedback to the participants on the quality of progress and other positive aspects about them can create higher levels of motivation and prove effective towards exercise adherence.
7. **Process Orientation:** Exercise programmes based on outcome goals or product goals like weight loss, physique and appearance etc. are found to be effective in the initial stages of exercise adoption, but it is difficult to maintain the drive with prolonged exercise behaviour. Helping people to shift from process goals to product goals which are more intrinsic in nature will be more helpful towards becoming lifelong exercisers.
8. **Problem Solving:** This intervention is based around identifying the obstacles and barriers that stand between the participant and her/his physical activity goals. It is important to generate and implement solutions, evaluate the outcomes and choose different solutions if needed.
9. **Health Risk Appraisals:** Health risk appraisals of participants provide them with relevant information about their current health, risk factors and level of fitness. This helps to enhance motivation and can be used to monitor changes over time. It can also help with regards to the goal setting process as areas they need to improve are identified.
10. **Health Education:** It is important that participants seek information from experts on the benefits of exercise, proper exercise techniques and the results that should be expected during exercise. This will ensure that they truly understand why and what they are doing and it will give them the confidence and motivation required to participate in long-term physical activity as well as to prevent injury or discouragement. Research has also expressed the importance of health-care provider's and influence they have over participant's physical activity and the implementation of the aforementioned interventions.





**I. Tick the correct answers.**

1. Which of the following is effective for prevention of Coronary Heart Disease?
  - a. Regular exercise
  - b. Sedentary lifestyle
  - c. Medicine
  - d. Dieting
2. Which one of the following is NOT a result of regular exercise?
  - a. Increased bone density
  - b. Increased cholesterol level.
  - c. Strong immune system.
  - d. Increased longevity.
3. Normally people do not adhere to a regular exercising programme due to
  - a. lack of proper goals
  - b. adding a variety of exercises
  - c. social support enhancement
  - d. feedback from instructor

**II. Answer the following questions briefly.**

1. Briefly list the benefits of exercise.
2. Mention the strategies to enhance exercise adherence.
3. What are the psychological benefits of exercise? Explain.

**III. Answer the following questions in 150-200 words.**

1. Explain the various reasons to exercise.

### 9.5 Aggression

Players convicted of on-field violence

British boxer disqualified after biting opponent during heavyweight bout





We have to delve back to 1988 to find the first example in the English game of a footballer being convicted in a court of law over on-field violence. In this case, Sky Sports' excitable pundit Chris Kamara was the culprit; 'Kammy', then of Swindon Town, caught Shrewsbury Town's Jim Melrose with his elbow, breaking Melrose's cheekbone in the process.

A British heavyweight boxing match ended in chaos after a fighter bit his opponent and was disqualified on Saturday. The 10-round bout between David Price and Kash Ali at Liverpool's MandS Bank Arena came to its abrupt conclusion the 27-year-old Ali grabbed hold of his opponent before falling on top of him. He then bit Price near his rib cage.

Do try to remember any sports match where players have been highlighted in media, newspapers or by commentators for hitting the opponents or abusing the officials, spectators or their own team members and being referred to as displaying unsporting and aggressive behaviour. Surely, we can recollect various occasions when athletes' behaviour on the field has been aggressive. Why do athletes become aggressive on or off the field? What are the different behaviour outcomes associated with aggressive behaviour? How can these be reduced? These are the few important questions which most of the teachers, coaches and even parents, who deal with athletes of different age groups are worried about. Let us try to understand the concept of aggression as accepted by the world of psychology and used by sports professionals in the past several years.

### Do you know?

**Aggression** - Aggression is behaviour that is hostile and violates other people's rights.

**Reactive aggressive behaviour** is unplanned and impulsive, and is usually a response to feelings of anger, fear, or a need to retaliate against someone.

**Proactive aggressive behaviour** is calculated and planned action that has some motive other than harming someone.

According to the American Psychological Association, aggression is a type of behaviour aimed at causing physical or psychological harm to another. Most psychologists refer to aggression as any behaviour intended to harm or injure any living being who is trying to avoid it. This definition includes three important features. First, aggression is a behaviour that can be seen. It is not an emotion that occurs inside a person,





such as anger. Second, aggression is intentional. Aggression is not accidental. It is a deliberate behaviour to harm or injure and can be either physical or psychological, ie., hitting, pushing or abusing someone purposely, with an intent to hurt. Third, the victim wants to avoid the harm.

Sport psychologist Gill (2000) produced a four-part criterion which aimed to help us interpret whether an action is aggressive in sport. His criteria were:

- There must be physical or verbal behaviour.
- It must involve causing harm or injury whether it is physical or psychological.
- It must be directed toward another living thing.
- There must be the intention to cause harm or injury.

*Few more definitions of aggression:*

Behaviour that results in personal injury or destruction of property. (Bandura, 1973)<sup>8</sup>

Behaviour directed towards the goal of harming or injuring another living being who is motivated to avoid such treatment. (Baron and Richardson, 1994)<sup>9</sup>

The intentional infliction of some form of harm on others. (Baron and Byrne, 2000)<sup>10</sup>

During last many years much debate and deliberations have been made in the field of sports and exercise psychology as well as sports sciences towards an acceptable definition of aggression. An acceptable concept of aggression along with its two types of aggression has been cited by Husman and Silva in 1984 as 'hostile' and 'instrumental' aggression to differentiate between two types of aggression.

### 9.5.1 TYPES OF AGGRESSION

1. **Hostile Aggression:** The term 'hostile' refers to being 'opposed', therefore hostile aggression refers to violent and angry behaviour where the intent and primary goal is to harm the other. A boxer who punches the opponent below the belt with the primary aim of injuring him because he is losing or an athlete who uses abusive words to mentally harm another player who has angered him with better skills are examples of hostile aggression. *Hostile aggression is a type of aggression that is committed in response to a perceived threat or insult. It is unplanned, reactionary, impulsive, and fuelled by intense emotion as opposed to desire to achieve a goal. Aggressors typically*



*have a sense of a loss of control during outbursts, and characteristically experience physiological hyperarousal.* Thus, it is also sometimes known as *reactive aggression*. In the examples given above, the intent of action is to physically or mentally harm the other person due to dislike, enmity or due to the person being on the opposing team or side. Along with the intent, the goal is also to harm the other, therefore non-legitimate measures or illegal methods to physically or mentally harm the other person are employed.

### Prospect of Losing Makes Me Aggressive, says Viswanathan Anand

India Today | 21 June 2012

*Speaking at a function for young chess players, the world chess champion Vishanathan Anand said, “The insecurity of loosing made me aggressive. I don’t show it openly but the prospect of losing to some player is so horrifying your might want an extra bit.” “Against Topalov (in 2010 world championship) I was able to channel that feeling into a willingness to play long games. I was able to feel motivated.”*

*“The hunger is still there to go for the next one,” says Anand. “I am often asked how I maintain my motivation even after five world titles. Frankly, I never took to chess because it was on some kind o f a checklist. I will keep playing till I enjoy it. The desire is still there,” he said.*

*(<https://www.indiatoday.in/sports/other-sports/story/viswanathan-anand-chess-world-champion-niit-delhi-110525-2012-07-21>)*

- Instrumental Aggression:** The term ‘instrumental’ refers to ‘serve as a means’ ie., aggression is being used just as an instrument to gain advantage or win and not because of anger or enmity. Therefore, instrumental aggression refers to aggressive behaviour meant or used to attain some non-aggressive goals like winning, getting money, prestige or gaining any other advantage. ***Instrumental aggression is harmful behaviour engaged in without provocation to obtain an outcome or coerce others.*** An instrumental aggression does consist of an aggressive intent to harm an opponent physically or psychologically without necessarily being angry. Instrumental aggression is a behaviour directed at the target as a means to an end. For example, elbowing and injuring a player to gain a competitive advantage, or late tackling to stop an opponent from scoring a goal.





### Development of Relational Aggression

A science brief published in Psychological Science Agenda in August 2013 by APA deals with development of relational aggression associated with young children due to media exposure. The research work after examining different types of aggressive behaviour discussed the two types of aggression. Along with physical aggression like kicking, pushing, it mentions about second type of aggression known as Relational Aggression. According to the study, relational aggressive behaviour has an intent to hurt, harm and injure others using the relationship. It also uses threat of relationship against other individuals through social exclusion, friendship withdrawal, spreading rumours, false news etc. are used as goals for the intent of harming.

<https://www.apa.org/science/about/psa/2013/07-08/relational-aggression>

An important distinction between hostile and instrumental aggression is that instrumental aggression is learned behaviour, where hostile aggression is impulsive. In the majority of situations, neither is an ideal response or solution to your problem.

From the above concept of aggression, we reach a consensus that from the perspective of a sports psychologist, there is no 'good' aggression or 'bad' aggression. Any behaviour with an intent to physically or mentally harm another individual is aggression and is not acceptable on the sports field. An important concept mentioned by the sports psychologists is assertive behaviour. Most athletic events involve interaction between people. There is some interchange of words, feelings and behaviours. While confrontation is often manifest through assertion and aggression, these two approaches have distinguishing factors and lead to very different outcomes. Assertive behaviour is generally seen as a positive form of expression, whereas aggression is a negative form of expression. Assertive behaviour has its roots in respect for the other individual, while aggression does not; for example, if you voice your opinion through aggressive acts, you are conveying that your feelings are more important. Aggression also is often counter-productive, while assertive behaviour leads to a more positive resolution. Finally, assertive behaviour is all about standing up for yourself and your values in an unthreatening manner, while aggression puts others down.



	Hostile	Instrumental	Assertive
<b>Intent</b>	Harm or Suffering	Harm or Suffering	No harm
<b>Primary Goal</b>	Harm or injure	Win or advantage	Win or Advantage
<b>Process</b>	Non-Legitimate	Non-Legitimate	Legitimate
<b>Emotion</b>	Anger	No Anger	Unusual effort and energy expenditure
<b>Explanation</b>	Self-justification instead of apology	Offer apologies	

### Aggression Management : A Challenge in Sports

Behaviour of aggression by players is an area of concern for coaches, parents across the society which need to be minimized if not stopped or curtailed completely. Few of the strategies which could be effective in managing aggression among athletes have been mentioned below:

1. *Social acceptable discharge medium*: Aggression is an inborn drive, according to the drive theory people have the innate instinct to be aggressive and it builds up till it is discharged (catharsis). There need to be opportunities and space for people to displace or express aggression through a socially acceptable means, for example bout of aerobics, swimming, martial arts kicking pads or punching bags.
2. *Positive Reinforcement*: Aggression has a circular effect, one act lead to another because the people especially athletes learn the way to release it. The circle need to be broken by positive reinforcement and not letting it continue. Providing space for players to speak and express their opinion is an effective example.
3. *Negative Reinforcement*: During competitions, any act of violence should not be tolerated or exempted and must have strict rules of punishment for offending players and the team, whereas fair play point can be awarded for players and teams showing restrains during aggressive situations.
4. *Modelling*: People emulate their heros and seniors, young players grow up watching them receive awards, prizes and recognitions, therefore try to copy their behaviour to a large extent. Hence aggressive behaviour should not be promoted or appreciated at the top level and by the seniors as it will help in reducing the trickle effect.





5. *Training and role playing:* Athletes can learn to control their hostile feeling along with anger through role play and training with experts. Training is effective in regulating the emotion of anger that leads to hostile behaviour.
6. *External Cues:* Stimulus which puts preference of winning over participation can lead to various hostile as well as instrumental aggression. Coaches, parents must focus and promote participation over performance, appreciate fair play than winning, discuss fun over results.

**I. Tick the correct answers**

1. Which of the following is a legitimate behaviour?
  - a. Hostile Aggression
  - b. Instrumental Aggression
  - c. Assertiveness
  - d. Proactive Aggression
2. In instrumental aggression, the main aim is to using aggression.
  - a. cause harm to the opponent
  - b. achieve a positive goal
  - c. express your feeling of jealousy
  - d. show your hostility to an opponent
3. Aggression is displayed in sports through .....

  - a. assertion of views
  - b. use of abusive words
  - c. walking away from the opponent
  - d. strictly following the rules

**II. Answer the following questions briefly.**

1. What do you understand by aggression in sports?
2. Define hostile aggression.
3. Define instrumental aggression.



### III. Answer the following questions in 150-200 words.

1. Differentiate between Hostile aggression, Instrumental aggression and Assertiveness?
2. Describe various reactions of athletes which can be classified as aggression and assertive behaviours?

### Answers to Personality Quiz

1. Extraversion (Q1, Q6R); Agreeableness (Q2R, Q7); Conscientiousness (Q3, Q8R); Emotional Stability (Q4R, Q9); Openness to Experiences (Q5, Q10R).
2. 'R' denote reverse-scored item, recode the reverse-scored items (i.e., recode a 7 with a 1, a 6 with a 2, a 5 with a 3, etc.). The reverse scored items are 2, 4, 6, 8, and 10.
3. Take the AVERAGE of the two items (the standard item and the recoded reverse-scored item) that make up each scale.
4. The maximal score can be 14 and minimum score 1.

Example using the Agreeableness scale: A participant has scores of 5 on item 1 (Extraverted, enthusiastic) and 2 on item 6 (Reserved, quiet). Start with recoding the reverse-score items (ie. Item 2 score was 5) replacing the 5 with 3. Second, take the average of the score for item 7 (eg.6) and the recoded score for item 2. So the Agreeableness score would be:  $(6 + 3)/2 = 4.5$ .

## 9.5 Psychological Attributes in Sports

Sports scientist from around the world have researched about unique attributes of successful athletes and elite sportsmen to understand factors enabling athletes to perform successfully and reach optimal level of performance in their athletic career. In sport psychology, much attention has been given to exploring and understanding the psychological attributes of elite athletes with the aim of influencing athlete talent and development. It is widely acknowledged that psychological attributes have an important role in athletes' lives and can influence athletes' performance, behaviour, and psychological well-being.

Attributes are perceived to be essential for performance effectiveness and athlete development, where athletes' abilities to perform, understand and manage training and competition environment and other important factors have many positive effects. From several attributes which are considered to be essential, self-esteem, mental imagery, self talk and goal setting is being discussed in this chapter.







### 9.5.1 SELF-ESTEEM

The concept of self-esteem generally refers to a person's evaluation of, or attitude toward, him- or herself. Self-esteem is centered around a belief in the self, respect for the self, and confidence in the self. An equally important component of self-esteem is esteem from others. That is, the respect and admiration others bestow on a performer is equally motivational. Because pursuit of excellence is a comparative process, esteem by others is reflective of one's performance. Hence, it is critical that the performer seeks esteem from others. According to American Psychological Association (APA), Self-esteem refers to the degree to which the qualities and characteristics contained in one's self-concept are perceived to be positive. It reflects a person's physical self-image, view of his or her accomplishments and capabilities, and values and perceived success in living up to them, as well as the ways in which others view and respond to that person. The more positive the cumulative perception of these qualities and characteristics, the higher one's self-esteem. A reasonably high degree of self-esteem is considered an important ingredient of mental health, whereas low self-esteem and feelings of worthlessness are common depressive symptoms.

The coach needs to instill in the performers the desire for esteem from others. "athletic participation is associated with increases in self-esteem and positive feelings about the body." William Russell's work suggests that this probably relates to one "dimension" or aspect of self-esteem—the physical (that is, how we judge our own bodies compared with others' bodies). Other dimensions of self-esteem might be intellectual, competitive, congenial (whether others like you, for instance), all, in some way, rating how we value aspects of ourselves. Research revealed that the pursuit of self-esteem is a powerful motive behind marathon runners, cyclists, and other exercisers. A great many studies have documented self-esteem's positive association with EXERCISE BEHAVIOR, while others have noted the RELATIONSHIP between low self-esteem and EATING DISORDERS, SELF-ESTEEM, OBESITY, and several forms of DEPENDENCE. Self-esteem is popularly used interchangeably with self-evaluation and high self-esteem with, among other terms, self-respect, self-assurance, and dignity, though its closest neighbor conceptually is PHYSICAL SELF-WORTH; for many scholars. Regular exercise has been shown to be related to increased self-esteem.



### 9.5.2 MENTAL IMAGERY

Mental Imagery is a psychological skill used widely in sports for enhancing performance of wide variety of motor skills. Mental Imagery may be defined as using one's senses to create or recreate an experience or visual image in the mind that at times may seem to be as real as seeing the image with our physical eyes. An expansion of this brief definition clarifies that:

- (a) an image can be created in the mind in the absence of any external stimuli,
- (b) an image may involve one or more physical senses, and
- (c) an image is created from information stored in the sensory store, working memory, or long-term memory.

The use of the 'mind's eye', or imagery, is considered important both in stress management and in focusing athletes on their task. Imagery, or the mental creation or re-creation of sensory experiences in the mind, is the most popular mental training technique used by athletes. Imagery can be used in various ways to aid relaxation and focusing. Sport psychologists distinguish between external imagery, in which athletes picture themselves from outside performing, and internal imagery, in which they view themselves performing from inside their own body. A good example of internal imagery is in the mental rehearsal of sporting techniques. When we imagine carrying out a sporting technique, the nervous system and muscles react in a similar manner to that expected if we were actually carrying out the technique. This means that imagery helps us to learn and practise techniques. Another reason mental imagery works is that it de-sensitises us to the anxiety of competitive situations. The more we are exposed to things that cause us anxiety - whether in real life or in our imagination - the less anxiety they cause. Coaches from around the world have also indicated that they use imagery more than any other mental training technique and felt that imagery was the most useful technique that they used with their athletes. All athletes have the potential to increase their imagery abilities through systematic practice, with increases in imagery ability enhancing the effectiveness of imagery training.

#### How to practice Imagery:

Mental imagery techniques have been implemented with various different models and strategies. One of the very popular model is PETTLEP framework. PETTLEP model for mental imagery intervention framework is an acronym representing a seven point





checklist of guidelines to be followed when devising an imagery intervention that can provide an effective execution of imagery interventions for athletes. These are Physical, Environment, Task, Timing, Learning, Emotion, and Perspective. Mental Imagery intervention and training can be effective in enhancing performance.

### Benefits of imagery

Athletes use imagery for many different reasons, including skill learning and practice, strategy development and rehearsal, competition preparation, including familiarization with venues and mental warm-ups, mental skill development and refinement, and coping with various sport stressors or obstacles, such as injuries, heavy training, and distractions

- Acquisition and improved performance of skills and strategies
- Modification of attention focus and other cognitions.
- Regulation of arousal and anxiety.
- Effective in enhancing self-confidence, motivation and self-control

### 9.5.3 SELF TALK

Self-talk is defined as overt or covert personal dialogue in which the athlete interprets feelings, perceptions, and convictions and gives himself instructions and reinforcement. Self-talk is an effective technique to control thoughts and to influence feelings. Thoughts and feelings can influence self-confidence as well as performance. Sports scientists support for the use of self-talk strategies to improve performance in exercise and sport tasks. Every athlete during any action or performance may have thoughts that come into their mind, especially during competition it can be either positive or negative, these thoughts are a form of self-talk. The athlete must learn to control his thoughts and to structure them to his advantage. This is effectively accomplished through self-talk, the athlete must carefully pre-select the actual words and phrases used during self-talk and consider them for maximum effectiveness. The coach or sport psychologist can assist the athlete in this regard.

For self-talk to be effective, it is suggested that self-talk statements be :

- (a) brief and phonetically simple,
- (b) logically associated with the skill involved, and
- (c) compatible with the sequential timing of the task being performed.



## Types of self talk

Three primary categories of self-talk include task-specific statements, encouragement and effort, and mood words. These three categories are further clarified below:

1. **Task-specific statements relating to technique** category of self-talk refers to words or statements that reinforce technique. For example, in the tennis volley, the word “turn” might be used in association with preparation for stepping into the volley.
2. **Encouragement and effort** category of self-talk refers to words or statements that provide self-encouragement to persevere or to try harder. For example, the phrase “You can do it” might be used in preparation for an anticipated play at home plate in softball.
3. **Mood words** category of self-talk refers to words that precipitate an increase in mood or arousal. For example, the mood words “hard” or “blast” might be used in conjunction with a play in football or soccer.

## Benefits of Self -Talk

1. **Building and developing self-efficacy** : Self- talk is effective in stimulating thoughts and feelings that lead to the belief that a person is competent and able to perform a task efficiently and effectively.
2. **Skill acquisition** : Learning a new skill requires persistence, effort, and dedication. Self-talk can be effective in helping the athlete to continue to work hard in order to achieve a worthwhile goal. In becoming proficient in a new skill, the athlete changes bad habits and learns new good habits.
3. **Creating and changing mood** : Effective use of mood words can either create a desired mood or change an undesirable one. Words are powerful motivators because of the meaning that they convey. In an effort to increase power needed to get out of a sprinter’s block quickly, the athlete might say the words “go” or “explode” as she powers forward.
4. **Controlling effort** : Athletes need to be able to sustain effort throughout long practices or competitions. Self-talk can suggest to the athlete the need to increase effort when it is needed or to sustain effort when it is deemed beneficial for performance learning or enhancement. During long practices, boredom can be a challenge that must be overcome. Self-talk words and phrases such as “pick it up,” “stay with it,” or “pace” can be effective in controlling effort.





5. **Focusing attention or concentration** : As with maintaining effort, it is often necessary to remind yourself to stay focused or to concentrate on the task at hand. Athletes often get tired, and when this happens, their concentration can easily wander. If the mind wanders when the coach is teaching an important concept relating to the athlete's role.

#### 9.5.4 GOAL SETTING

Goal setting is a mental training technique that can be used to increase an individual's commitment towards achieving a specific standard of proficiency on a task within a specified time. It is a process of establishing a level of performance proficiency which should be reached within a prescribed time period is known as goal setting. It has proven effectiveness in enhancing performance and productivity in several contexts, including employee exercise programs, competitive sport, and industrial organizations, and provides a basis for both increasing a person's SELF-EFFICACY and for instilling a task with intrinsic worth. An aspiring athlete may set goals intuitively at the outset of a career, for example, to execute a decent pass, sustain a rally, or just finish a race. As a career progresses, athletes typically define specific goals, sometimes establishing a long-term GOAL SETTING. GOAL that can be broken into less ambitious short-term goals, setting up a kind of hierarchy of goals to be achieved one by one. An office worker might enroll in a company FITNESS program, setting goals related to a broad class of health-related behaviors, so exercise goals are related to complementary dietary aims and objectives such as walking instead of driving to work four times a week and taking the stairs every morning.

Goal setting works because it focuses attention on specific task demands, increases effort and intensity, encourages persistence when adversity is encountered, and promotes the development of strategies and problem solving to move toward goal achievement. When compared to 'no goals' or 'do-your-best goals', specific goal setting enhances athletes' performance. There are different types of goals and over-all effectiveness of goal setting depends on type of goal being selected by the athlete in different situation, and coaches can surely help them identify suitable goal types and persevere toward it. In sports, athletes focus majorly on three types of goals, Performance goal, Process goal and Outcome goals. The important distinction between outcome, performance, and process goals indicates that mental skills are enhanced when athletes focus on the right goals at the right time. Let's try to understand these different types of goals:





1. **Outcome Goal:** give priority and importance to the final outcome of a sporting event. They are uncontrollable, yet attractive and exciting, they are useful in enhancing motivation for the exhausting physical and mental preparation needed to achieve typical outcome goals, such as winning championships or medals. Outcome goals are the successful implementations of process and performance goals. They keep us in perspective and help to stay focused on the bigger picture. Examples of outcome goals may include winning a sport, losing the desired amount of weight, or scoring a top rank in school.
2. **Performance Goal:** focus on achievements of athletes relatively independent of other competitors or teammates. Therefore, they are more flexible and controllable for athletes, which allows them to continually raise and lower goal difficulty levels to remain challenged and successful in their pursuit of exciting outcome goals. These goals help in tracking progress and give us a reason for continuing the hard work. For example, focus on striking a score of 100 in an innings or making 50 passes in a match rather giving importance on winning or losing is an example of performance goal. Performance goals may help us in quantifying our efforts and measuring the progress and also achieve outcome goals in the process.
3. **Process Goal:** focus on specific behaviour or task throughout a competition, training or specific task demands in productive ways, such as occupying their minds with key verbal cues that lock in optimal performance images and plans. These behaviours reflect proper and effective techniques for executing a specific athletic task and plans. For example, to focus on the defender rather than ball or focus on position of arm toward target while shooting, or focusing on toe positioning while jogging to avoid inward movement are process goals, when repeated for a period of time, it should help in attaining performance goal and outcome goals.

### Principles of Goal Setting

1. Make goals specific, measurable, and observable.
2. Clearly identify time constraints.
3. Use moderately difficult goals; they are superior to either easy or very difficult goals.
4. Write goals down and regularly monitor progress.
5. Use a mix of process, performance, and outcome goals.
6. Use short-range goals to achieve long-range goals.





7. Set team as well as individual performance goals.
8. Set practice as well as competition goals.
9. Make sure goals are internalized by the athlete.
10. Consider personality and individual differences in goal setting.

### Characteristic of effective goal:

The acronym SMART has been used by sport psychologists to help athletes remember five important characteristics of well-stated goals

**Specific** goal is one that focuses exactly on the goal to be achieved. For example, “shooting 80 percent accuracy in free-throw shooting” is specific, but “becoming a better basketball player” is not.

**Measurable** goal is one that you can quantify, in the sense that you know exactly how close you are to achieving the goal. The general goal “to become a better server in tennis” is not measurable, because you don’t know when you have achieved the goal.

**Action-Oriented** Goals are these things that we can do to make this happen. Action-oriented goals have action steps and action plans with detailing of what, when and how to do. Making clear the key actions required to achieve a goal helps everyone see how their part of the work is connected to other parts of the work and to a larger purpose. This information through action-oriented goals helps athletes stay focused and energized rather than become fragmented and uncertain.

**Realistic** goals focus on setting the target which are attainable and within the capability and capacity of the athlete. The goal set should be able to stretch athlete toward improvement, but it should not be out of reach or it will be not motivating enough for an athlete to strive for. Setting of goals that are too high are discouraging while setting goals too low leaves the athlete dissatisfied with the task.

**Timely** : A well-stated goal should be timely in the sense that it specifies time constraints associated with the goal, but also timely in the sense that it reflects an appropriate amount of time to accomplish the goal. We make the goals of athletes timely by creating deadline for the specific task and try to meet the deadline well on time.







## Benefits of Goal Setting

It is important for the athletes and the coaches to understand how Goal Setting can be beneficial for performance enhancement process. Let's try to read few important benefits of Goal Setting.

1. Improved focus attention
2. Develop persistence
3. Mobilisation of efforts
4. Developing new learning techniques
5. Increased motivation

## Answer the following questions

1. Which one of the goals focus on technique for executing a task?
  - i. Process Goal
  - ii. Product Goal
  - iii. Outcome Goal
2. Which type of goal focus on final result of an event ?
  - i. Outcome Goal
  - ii. Process Goal
  - iii. Product Goal
3. Process of recreating images in mind to improve performance in sports is referred as ?
  - i. Mental imagery
  - ii. Self-talk
  - iii. Self-esteem
  - iv. Goal setting
4. Define Self-Esteem?
5. Describe important of self-talk by athletes in sports ?





## Case Study

Read the following Case Study carefully.

*A state sports team was winning all the tournaments and was highly praised for its efforts. An interview with the team to find and explore the reasons for its continuous success highlighted the following reasons. As per the report, the team had many new players who were wellorganised, responsible, self-disciplined and precise in their task and contributed to the success of the team. The Captain had been selected by the team members themselves, and he was most interactive, sociable and optimistic on the field as well as off it. This made him a good leader.*

*The best part of the team was that, all its senior players were helpful and cooperative with their juniors and were always willing to listen to them. The team's coach mentioned few essential elements that had contributed to the team's success. According to him, the ability to motivate people plays a crucial role in the team's success more often than the technical skills, and this is what separates a good coach from an average one. The coach also referred to occasions when players went through the phase of lack of intrinsic motivation. The coach realised that while there are some athletes have an innate drive to constantly strive for success and enjoy their task, there are others who seem to lack internal motivation and need extrinsic factors like rewards, prize, money etc. to create the required drive or required behaviour. The team's psychologist spoke about the aggressive behaviour among the team players against the opponents. It was interesting to listen to various instances where the players had instigated opponents or charged at them violently, in anger, but had later tried to justify their actions.*

*Sometimes, players were found to be abusing opponents not in anger, but to get an advantage or for the sake of winning, though this behaviour is not acceptable and they were awarded punishments as per the code of conduct and rules of sport.*

*Read the above story of a sports team and answer the following questions?*

1. Which trait best reflected the personality of junior players?
  - (a) Introvert
  - (b) Conscientiousness
  - (c) Neuroticism





2. Which member of the team reflected most of the Extrovert traits?
  - (a) Coach
  - (b) New Members
  - (c) Captain
3. Which type of players were recommended for special training with Sports Psychologist?
  - (a) Extrovert
  - (a) Introvert
  - (a) Mesomorph
4. The team sports psychologist is referring to which type of behaviour as non-threatening but confident.
  - (a) Assertive
  - (a) Hostile
  - (a) Instrumental
5. Which are the two types of motivation discussed in the above story? Which, according to you, is the better form? Why?

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# UNIT X TRAINING IN SPORTS

## Overview

- ◆ Concept of Talent Identification and Talent Development in Sports
- ◆ Introduction to Sports Training Cycle - Micro, Meso, Macro Cycle.
- ◆ Types & Methods to Develop - Strength, Endurance, and Speed
- ◆ Types & Methods to Develop - Flexibility and Coordinative Ability

## LEARNING OUTCOMES

### *Students will*

- ◆ understand the concept of talent identification and methods used for talent development in sports
- ◆ understand sports training and the different cycle used in the training process.
- ◆ understand different types & methods to develop -strength, endurance, and speed in sports training.
- ◆ understand different types & methods to develop - flexibility and coordinative ability.

## FLYING SIKH, HIS TOUGH FITNESS ROUTINE

Milkha Singh was born in 1929 in Gobindpura village in the Muzaffargarh district of Pakistan. He spent most of his childhood in poverty. Singh lost his 14 siblings to poverty, poor health, and lack of medical attention. During the 1947 partition, he became an orphan and moved to India. He earned his living by working in a roadside restaurant before joining the army in 1951. During his military training, he realized his sprinting abilities. Hawaldar Gurudev Singh persuaded him to run a cross-country race as a part of military training. He practiced hard and came to the limelight during the National Games at Patiala in 1956. He broke the 200 m and 400 m records in the National Games at Cuttack in 1958.





Milkha Singh, the Flying Sikh, remained passionate about his fitness routine throughout his life, including playing 18 holes of golf at the 7,202-yard-long Chandigarh Golf Course and running light sprints at Sukhna Lake; the legendary athlete would also offer his insights to budding and national athletes.

‘No royal road goes till success. To reach the world level, I at least did not find any such road. Running is such a meditation that one must leave all the world’s goods to achieve success and make your body ready to take on the challenge. Concentration, strategy, and effort are long processes. I used to run 365 days a year, whether on rainy or windy day; nothing could stop me from running. I did not find any work more important than my practice, and there was a time when I would see myself running even in my dreams,” Singh writes in his memoir.

From running three miles ranging from running the first mile slowly and then increasing pace each mile before his training in the off-season schedule, Singh would run three 400m races followed by one slow-paced 200m race followed by three 400m races fast followed by another 200m race slowly in the morning.

During the season schedule, 10 sprints of 150m on Mondays, six 200m sprints on Tuesdays, four 300m sprints on Wednesdays, two 500m races on Thursdays, two 600m races on Friday, running 350m or 500m once on Saturdays followed by complete rest on Sundays. According to the memoir, Singh would alternate training days to adjust to various strategies during his Olympic training.

He is the only athlete to win a gold medal in the 400 meters race at the Commonwealth Games and the Asian Games. Milkha Singh set a national record in the 1960 Olympics by winning fourth place in the 400m race in 45.73 seconds. This record remained for almost 40 years.<sup>1</sup>

During his sports career, Padma Shree Milkha Singh achieved many medals, including the gold medal in 200 meters in 1958 Asian Games, 400 meters in 1958 Asian Games, 440 yards in 1958 Asian Games, 400 meters in 1962 Asian Games, the 4×400-meter relay in 1962 Asian Games, and silver in 400 meters 1964 Calcutta National Games.<sup>2</sup>

Apart from these achievements, in 1960, he was persuaded by then Prime Minister Pandit Jawaharlal Nehru to run against Abdul Khaliq in Pakistan, whom he defeated. He then received the title of “the Flying Sikh” by General Ayub.<sup>3</sup>



## Introduction

Talent identification and development have become increasingly relevant in sports performance (Sarmiento, Anguera, Pereira, Araújo, 2018), especially in the last 20 years. A significant body of scientific research discusses longitudinal and nonlinear talent identification and development processes, the qualities that underpin elite sports performance, and how coaches could facilitate talented athletes' development through the sports system.

### Discussion

Select anyone sports of your choice and identify four qualities required for optimum performance in those sports. Write down the advantages of the qualities in the table below. Discuss why talent identification is essential in sports and games

S.No.	Qualities	Advantage	Why this will improve your sports performance

## Concept of Talent Identification and Talent Development in Sports

Talent can be defined as adequate aptitude or ability in one direction, above the normal average. Thus, someone who has talent can do something without trying hard.

Talent identification can also be defined as "the process by which children are encouraged to participate in the sport they are most likely to succeed, based on selected parameters. These parameters are designed to predict performance capacity, considering the child's current level of fitness and maturity." As talent identification is often confused with latent development, keeping the above definition clearly in mind is necessary. Identifying is the first step in progressing from beginner to a successful international athlete; talent development follows this as the next critical phase in achieving sporting success.

The figure below illustrates the various stages comprising the long-term talent identification system in sports and games.





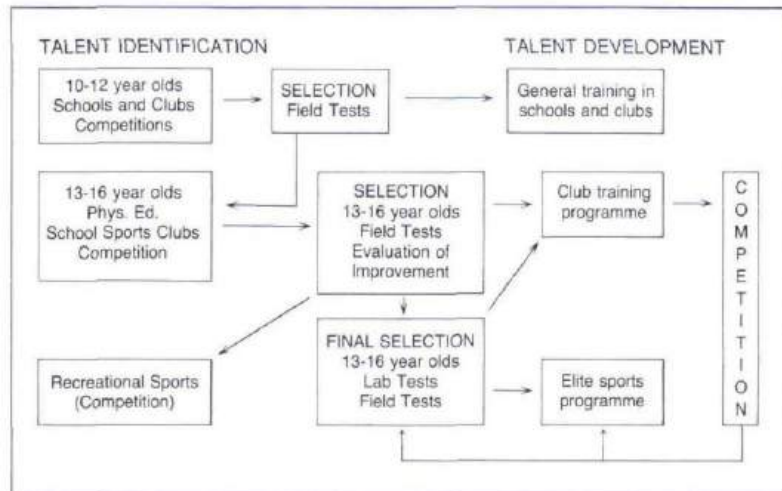


Table 10.1: Talent Identification System Related to Talent Development and Recreational Sports

The best way to ensure that a talent identification programme reaches the maximum possible number of children is to cooperate closely with schools.

The first stage of the process could occur between the ages of 10 and 12, using essential fields tests that are easy to administer. These tests should be carried out in schools and administered by the teachers if the selection is made early. Those who seem talented could then be encouraged to participate in general training in schools and clubs.

The second phase of the selection procedure could occur between 13 and 16. Again, the tests should be carried out in schools and be easy to administer. Those selected at this stage would then be invited to undergo more sophisticated tests, administered by specialists in the area or state centres, consisting of field tests and laboratory tests depending on the facilities available. The test battery should include background information, training history, competition results, anthropometric measurements, and psychological and physiological tests.

Finally, those selected should be allocated to elite junior programmes on an event-group basis. Those who show promising results in the second-stage tests but are not ultimately selected should be encouraged to participate in club training programmes. There should always be the possibility of entering the selection to produce good competition performance. All the tested youths should be encouraged to participate in recreational sports. It is essential to promote the youth competition structure in developing countries. Tests in these countries should be adapted to take into account local conditions, but should be standardized across the whole country.



Process of **Talent Identification and Development** is classified into five stages as follows:

1. **Talent Detection:** This is the discovery of potential performers who are not currently involved in the sport in question.
2. **Talent Identification:** Recognizing participants with the potential at an earlier age to become elite performers in the future.
3. **Talent Development:** Provides athletes with a suitable learning environment to accelerate or realize their potential
4. **Talent Selection:** The ongoing process of identifying individuals at various stages of development who demonstrate pre-requisite performance levels.
5. **Talent Transfer:** Focuses on transfer from one sport to another sport where there are more significant opportunities to succeed

These five steps are common across sporting in Talent Identification and Development System and are often operationalized within the everyday practice (i.e., identification or selection for the next step of a programme is influenced by performance in the previous development environment).

### Importance of Talent identification

- Discovery of the great talent
- Recognition of the hidden talent
- By recognizing the talent at the early stage, the children can show their skills at their extreme
- Talent identification helps in finding a significant asset for the country

### Components of Talent Identification

The main components of Talent Identification (TID) can be divided into the following categories:

- Physiological attributes
- Physical attributes
- Psychological attributes
- Technical/Tactical attributes
- Results
- Intangibles





### Do you Know

Steps for talent and its promotion include:

#### Step I

**Aim:** Screening of children for essential training stage Screening is done based on: -

- Health and physique
- General physical performance capacity
- Motives interest in mental capabilities
- Interests of parents etc.

#### Step-II

After 3-4 years of basic training

**Aim:** selection for a group of sports (Advance training stage). Selection based on the following

- Physique and Motor abilities
- Ability to tolerate load
- Performance
- Cognitive, emotional, and personality traits

#### Step-III

After 3-4 years of advanced training

**Aim:** selection for a sport (high-performance training stage). Selection based on the following: -

- Physique
- Performance and the potential for performance
- Talent indicators
- Cognitive, emotional, and personality traits

#### I. Tick the correct options

1. The performance enhancement in the future can be predicted based on
  - a. Physiological factor
  - b. Physical factor
  - c. Talent indicators
  - d. All of the above





2. Psychological factors contributing to talent identification is
  - a. Cognitive
  - b. Emotional
  - c. Personality traits
  - d. All of the above
3. Talent identification is a \_\_\_\_\_ process
  - a. General process
  - b. Scientific process
  - c. Specific process
  - d. None of the above

**II. Answer the following questions briefly.**

1. List the names of components of talent identification in sports.
2. Identify the importance of talent identification in sports and games?

**III. Answer the following questions in 150-200 words.**

1. Adopting Components of Talent Identification will enhance performance factors in games and sports. Discuss.
2. 'Talent identification is the first step in the progression from beginner to successful international athlete' Elaborate.
3. Classify the Process of Talent Identification and Development in detail.

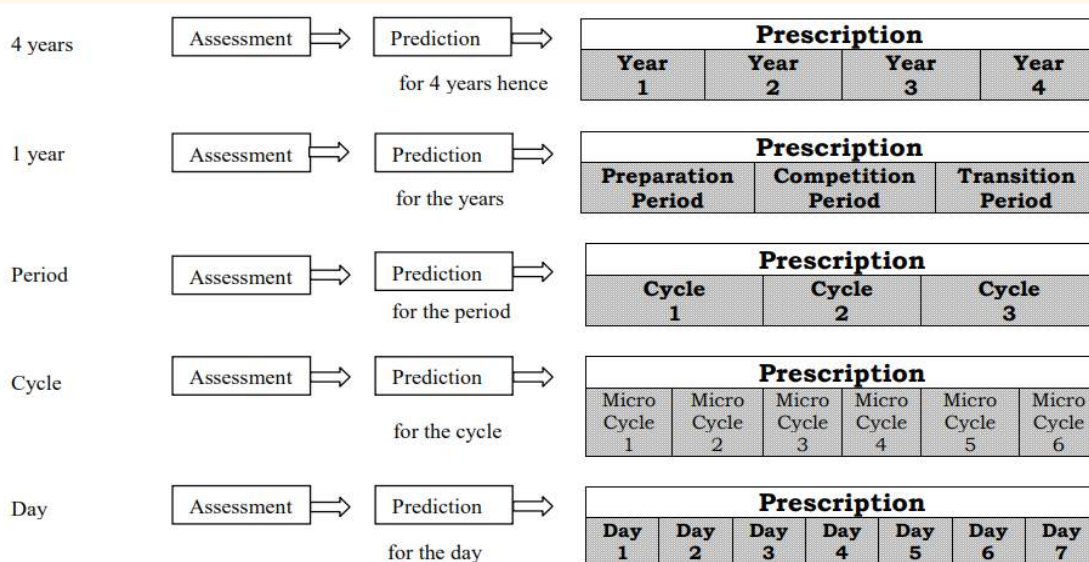
### Introduction to Sports Training Cycle - Micro, Meso, Macro Cycle

Several planning systems are available in sports training; a sportsperson has to follow all the procedures to ensure high performance in a specific sport. When we look into the sports training planning format, we will be able to find plans like a long-term plan, Olympic plan, annual plan, sectional plan, and day's plan. All the projects form a unified training basis, and the pursuit of several years indicates the main line of development. Training content is more concrete and specific in a plan of shorter duration. All the short duration sports training plans are worked according to the requirements of more extended duration plans, called long-term plans. It is the largest unit in the system of planned training. The duration of this plan is approximately 8 to 15 years. This plan begins with the basic training of the sportsperson and continues until the attainment of optimum performance standards in a specific sport.



**Do you know?**

An Olympic plan is divided into small time units.



**Fig. 2. An Olympic Plan Broken into Smaller Time Units (adapted from Kinsman, 1983)**

Another set of planning most common in sports training is a sectional plan. Sectional plans are termed as plans of phases, periods, and weeks. Different periods of the training year, namely preparatory periods, competition periods, and transitional periods; various training cycles, i.e., microcycle, mesocycle, and macrocycle, are all sectional plans. They are prepared based on the needs and recommendations of the annual plan. These plans being shorter in duration, the details regarding the training of different performance components are more specific.

The three cycles of training are:

- Micro Cycle:** The duration of this cycle is 3 to 10 days and is thus considered the shortest cycle of training. In the case of an intermediate and high-performance sportsperson, this cycle lasts 5 to 10 days. The last day of the micro cycle provides active recovery and relaxation to the sportsperson to prepare him for training in the next micro cycle. Even though 5 to 10 days is not adequate to achieve most training tasks, it forms an integral part of the entire training process. The following three proportions of high and medium or low load are adopted in the microcycle.
  - ◆ 1:1, i.e., every day of the high load is followed by a day of medium load.
  - ◆ 2:1, i.e., every two days of high load are followed by a day of medium load.





- ◆ 3:1, i.e., every three days of high load are followed by a medium or low load day.
- (b) **Meso Cycle:** The duration of this training cycle is 3 to 6 weeks and is thus termed a cycle of medium duration. The purpose of this cycle is to tackle specific training tasks. These tasks are:
- ◆ Learning and acquiring mastery of skills
  - ◆ Maintenance and stabilization of performance
  - ◆ Development of physical and motor fitness components
  - ◆ Preparation for a specific competition
  - ◆ Attainment of optimal level of performance
  - ◆ Preparation for the next mesocycle by providing recovery and relaxation.

A mesocycle of 4 weeks is considered the best because this is the minimum period within which significant change is affected in the physiological and psychological factors. The last week of the training mesocycle is considered a transitional phase that ensures recovery and relaxation.

- (c) **Macro Cycle:** The duration of this cycle is 3 to 12 months and it is, thus, considered the most extended cycle of training. The purpose of the macrocycle is to enable the sportsperson to improve the performance capacity to put up an optimal performance, at a specific time, during the competition. A macrocycle comprises several mesocycles; the last mesocycle ensures recovery and realization for a smooth transition to the following macrocycle.

### Do you Know

Anders Ericsson, a psychologist, writes that it takes 10,000 hours of practice to become an expert. In other words, an athlete training for 5 hours a day, seven days a week over 365 days a year, would take about 5.5 years to acquire expertise in their chosen sport or game.





### Extension Activity

Preparing for an Annual Zonal Competition is long-term planning,

It consists of various stages

Working in groups, interview ten sports persons from your school, or another nearby school, who have participated in CBSE's Zonal Competitions (or any equivalent Competition). Find out details of their planning process for the annual zonal competition and list any five below.

S.No.	Process of Planning
1.	
2.	
3.	
4.	
5.	
6.	

#### I. Tick the correct options

1. Meso cycle is training of
  - a. one week
  - b. 4 to 10 days
  - c. 3 to 6 weeks
  - d. Three 3 months
  
2. Transitional Phase is a
  - a. rest and recovery period
  - b. training period
  - c. competition period
  - d. fitness period
  
3. Micro cycle is
  - a. 3 to 10 weeks
  - b. 3 to 10 days
  - c. 3 to 10 hrs
  - d. None from above





## II. Answer the following questions briefly.

1. What do you understand by Macro Cyclicity?

## III. Answer the following questions in 150-200 words.

1. All players diligently follow the periodization process. Why do coaches and players follow periodization cycles during training to attain good results in a championship?
2. Identify the specific training tasks in Mesocycle?

## Strength, Endurance, and Speed

### Strength

Strength is one of the most crucial motor components of fitness and plays a significant role in sporting events as it is a direct product of muscle contraction. It is a conditional ability that depends on the energy liberation process in the muscles. The amount of force muscles can produce to complete a task is known as strength.

In simple words, strength is the ability of a group of muscles to overcome resistance.

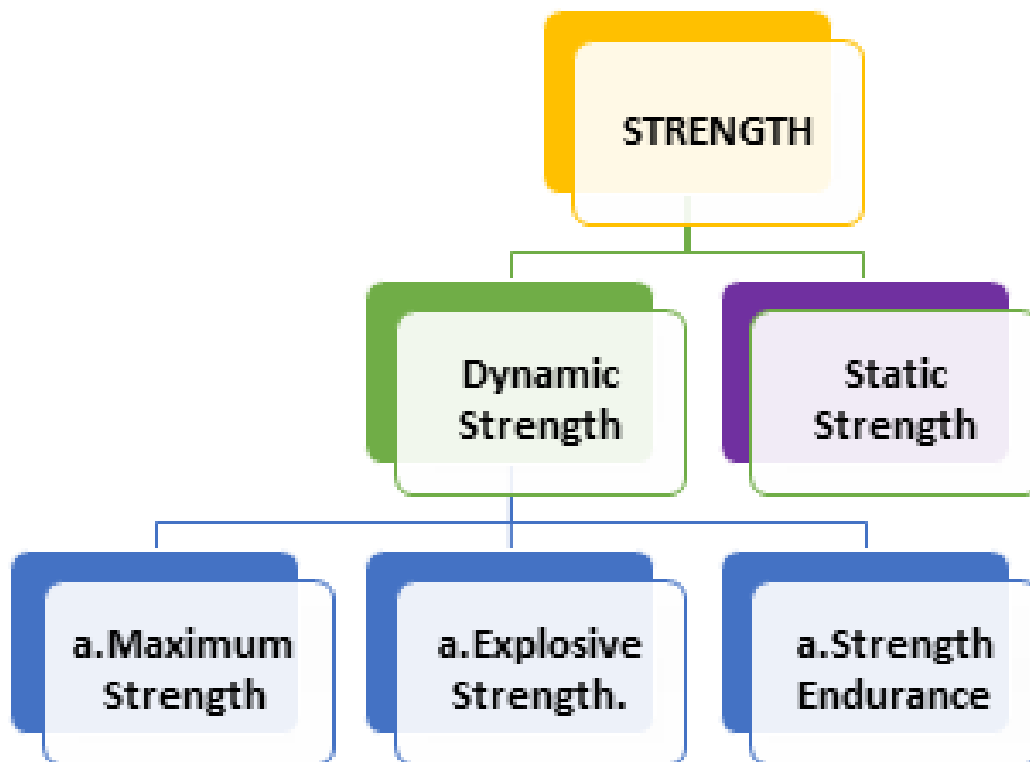
As all the movements in sports are caused by muscular contraction, it can be said that strength is part and parcel of all motor abilities, technical skills, and tactical actions.

### Definition

- According to **H. Singh**, “*strength is the ability to overcome resistance or to act against resistance.*”
- According to **Barrow and McGee**, “*strength is the capacity of the whole body or any of its parts to exert force.*”
- According to **Mathews**, “*The force that a muscle or group of muscles can exert against a resistance in one maximum effort.*”

Different sports need different types of strength, and the requirement and application of strength in sports differs according to sports-specific needs. Commonly, strength is classified and studied into two forms: static and dynamic stability.





### Static Strength

Static strength is also called isometric strength. It is the ability of the muscles to act against resistance. Static strength can be measured with a dynamometer. This type of strength is not seen directly. Some static strength is not usually applied in sports, but it is used in phases in weightlifting. Example: plank or yoga asanas.

### Dynamic Strength

Dynamic strength is also known as isotonic strength. In pull-ups and push-ups, we required dynamic strength. In performing such a workout, there is a diminishing tendency in dynamic strength, and as a result, muscles refuse to do work after some time. The man cannot do even one extra pull-up or push-up at this stage. Movements are visible when someone uses dynamic strength. It is recognized by rhythmic muscular contractions with changes in muscle length, using a relatively small force. Example: push up and full squats.

Dynamic strength can be divided into three parts.





### a. Maximum Strength

The muscle can overcome maximum resistance in a single repetition or muscular contraction. Maximum strength means exerting force against resistance in the maximal effort. A muscle can overcome the resistance of maximum stimulus intensity in a single muscular contraction.

Though maximum strength does not hold much importance in most sports but is undoubtedly required in sports like long jump, shot put, javelin throw, weightlifting, discus throw, etc. These sporting events require the tackling of heavy resistance.<sup>4</sup>



### b. Explosive Strength.

The muscles can overcome resistance as fast as possible. In other words, it can be said that it is a combination of strength and speed. Explosive strength is always used in motor movements and is a form of dynamic strength. Muscle can get over the resistance of sub-maximum intensity of stimulus as possible.

Explosive strength is particular to the nature of movement and is greatly influenced by motor coordination, i.e., inter and intramuscular coordination. This strength is mainly used in volleyball spiking, jumps in basketball, sprint events, etc.<sup>5</sup>





### c. Strength Endurance

The muscle can overcome resistance under fatigue or for as long as possible. Same as explosive strength, strength endurance is a product of two motor abilities: strength and endurance. A muscle can get over the resistance of a medium-intensity stimulus for as long as possible.

Strength endurance can be a form of static or dynamic strength depending upon whether the movement is isometric (static) or isotonic (active). This strength is mainly used in long-distance races of athletics, swimming, distance cycling, etc.<sup>6</sup>



#### Do you Know

To improve muscle strength, you should attempt to perform between 2 and 5 sets of approximately 2 to 6 repetitions at an intensity of at least 85 percent of your 1RM for that specific exercise. For individuals trying to improve muscle power, the ideal is to perform 3 to 6 sets of 3 to 6 repetitions at 30 to 60 percent of 1RM. A lighter percentage (30-45 percent of 1RM) should be used with power exercises that allow for the release of the mass being lifted (e.g., bench press throws). The proper rest period between each set for strength and power exercises is two and five minutes.



**TABLE 6.1** Adjusting Training Load to Training Goals

	Frequency (times/wk)	Intensity (% RM)	Volume	Rest
<b>Power</b>	1-2	30-60	3-6 reps 3-6 sets	2-5 min
<b>Strength</b>	3-5	>85	2-6 reps 2-5 sets	2-3 min
<b>Hypertrophy</b>	4-6	67-85	6-12 reps 3-6 sets	30-90 s
<b>Endurance</b>	5-7	<65	15-25 reps 2-3 sets	<30 s

Improving muscular endurance requires approximately 2 or 3 sets of 15 to 25 repetitions. Muscular endurance exercises are performed at an intensity below 65 percent of 1RM, with short rest periods of one to two minutes for sets with higher repetitions and less than one minute for moderate repetitions. Finally, those looking to improve muscle mass (hypertrophy) should do 3 to 6 sets of 6 to 12 repetitions at 67 to 85 percent of 1RM, with rest periods of between 30 and 90 seconds. Table 6.1 provides a summary of these numbers.

## Methods to Develop Strength

As **strength** is a highly trainable motor component, specific methods help an athlete develop or improve strength. These methods are discussed below:

1. **Isometric Exercise:** These are the exercises that are not visible as there are no direct movements. Therefore, isometric exercises cannot be observed. In these exercises, work performed cannot be seen directly, like pushing a wall. While pushing a wall, work is done, i.e., the force is being exerted, but the work done cannot be seen as the wall is still at the same place and doesn't move a bit. These exercises involve muscles carrying out tension against the other group of muscles. There is no change in the muscle length when such exercises are done, hence they are called "iso" metric. These exercises need less time and equipment and can be performed practically anywhere and everywhere. Moreover, isometric exercises can prove to be of great value for maintaining strength in case of an injury. These exercises, if performed regularly, may result in a change in muscle size and shape.<sup>7</sup>





2. **Isotonic Exercise:** These are exercises in which movements can be seen directly. Isotonic exercises result in toned muscles and increased muscle length. These exercises hold much importance when it comes to sports. This method is considered to be the best method to develop strength. Examples of isotonic exercises include running and jumping on the spot, weight training exercises, and calisthenics exercises.<sup>8</sup>



3. **Isokinetic Exercise:** this method was introduced by J.J. Perrine in 1968 and involves a particular type of muscle contraction called isokinetic contraction, generally used in sporting events like rowing and swimming. These exercises are performed on specially designed instruments. In isokinetic contraction, the muscles apply maximal force throughout the range of motion around the joint. Whereas in isotonic contraction, the pressure is applied at a particular angle. The use of isokinetic contraction is minimal. Hence, the contribution of isokinetic contraction in developing strength is yet to be scientifically proved.<sup>9</sup>







### Do You Know?

#### Preventive Measures in Strength Training

While doing strength training, appropriate supervision is a must as there is always a high risk of injury accompanying it. Therefore, it is essential to know the means for preventing such incidents. These are:

1. Strength training must be done after proper warming up.
2. Strong and stable joints are a prerequisite for strength training. Therefore, the strength and stability of the musculoskeletal system must be ensured by doing general strength training with low intensity.
3. While exercising with heavyweights, a correct technique is required. Or else it will result in serious injuries.
4. A strength training program includes a variety of exercises. These exercises must be done correctly, preferably agonists and antagonists' muscles one after the other.
5. The load must be increased gradually as per the athlete's ability and requirement.
6. Recovery or rest plays a vital role in strength training. Proper and effective use of the recovery period helps in preventing injuries.
7. Improper breathing while exercising with heavy weights leads to serious disturbance in blood circulation. Hence, as a rule, a sportsperson must breathe continuously, and if he holds his breath, it should be for a minimum duration possible.
8. Safety equipment like belts, boots, wrist bands, etc., should be used when necessary.
9. In the case of children, the load should be low until the age of 16 years as the chances of injuries are very high.

#### Extension Activity

Under the supervision of your physical education teacher, form yourselves into two groups. Tell one group to do isometric and the other to do isotonic exercises for one hour a day for 3- 5 days a week. Test their strength after two months. Prepare a table and evaluate

which method is better?

Name:

Objective:







2. An exercise in which movement is visible.
  - a. Isometric
  - b. Isotonic
  - c. Isokinetic
  - d. Isonomic
3. Under which kind of strength would you put Shotput?
  - a. Strength Endurance
  - b. Explosive Strength
  - c. Maximum strength
  - d. Speed Strength

**II. Answer the following questions briefly.**

1. Define Strength?
2. Explain Isometric exercise with suitable examples.
3. Write a short note on the different types of Strength.

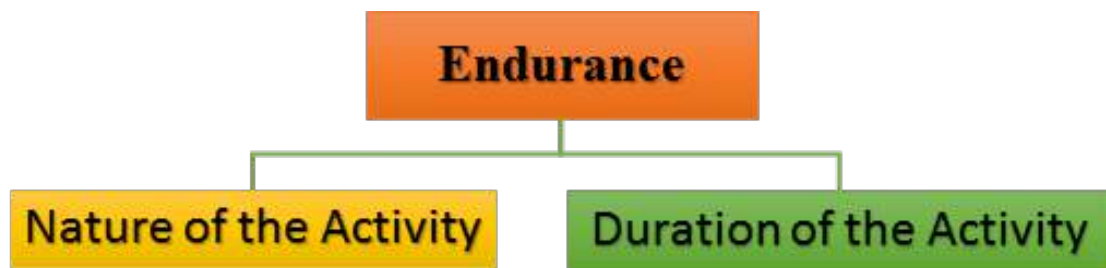
**III. Answer the following questions in 150-200 words.**

1. Explain the preventive measures to be kept in mind during strength training.
2. What is Strength? What are various methods for developing Strength? Write in detail

## Endurance

Endurance is the ability of a person to maintain a certain level of energy production for a more extended period. It is the ability to sustain an activity. Like strength, endurance is also a conditional ability. Endurance has been studied thoroughly and deeply because it holds great importance in health, training, and competition. Endurance plays a vital role in almost every activity, directly or indirectly. It is either measured by the number of repetitions or the times an action is performed.





### Definition

Harre defines endurance as *“the ability to resist fatigue.”*

Barrow and McGee defined endurance as *“the result of a physiologic capacity of an individual to sustain movement over a period of time.”*

H. Singh defines endurance as *“the ability to sustain an activity.”*

### Types of Endurance

Different games and sports require different types of endurance, which majorly can be classified into the following categories:



#### I. Classification according to the nature of the activity:

This classification is based on the kind of activity required for endurance. It can be classified into the following types:

- **Basic Endurance:** This is the ability of a person to resist fatigue in which the load is of medium intensity and involves aerobic muscular metabolism. Therefore, it can be said that it is the ability to do movements that involve a large number of muscles at a slow pace for a prolonged period. For example, jogging, cycling, and swimming for more than 30 minutes. Basic endurance forms the base for all other types of endurance.<sup>10</sup>





- **General Endurance:** it is the ability to do such sporting movements for a prolonged duration that are general. This type is not specific to any sport and can be developed by performing general exercises. Unlike essential endurance, in which the intensity of the activity is medium, general endurance activities may incorporate high-intensity practices. But the duration for general endurance is much shorter than essential endurance.<sup>11</sup>



- **Specific Endurance:** this is the ability to perform movements of a particular sport to resist fatigue. Specific endurance varies from activity to activity as it depends on the nature of fatigue. For example, the specific endurance of a hockey player is different from that of a marathon runner or a cyclist as the need for the activity is different.<sup>12</sup>



## II. Classification according to the Duration of the Activity:



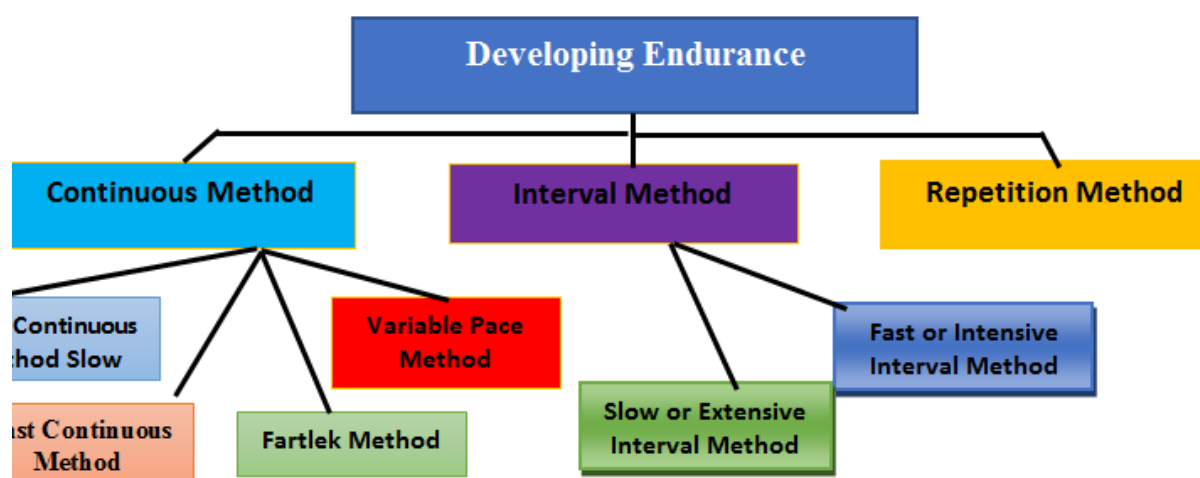


This classification considers only cyclic sports activities and is based on physiological factors. From the viewpoint of Harre (1986), this classification can be divided into the following sub-categories:

- **Speed Endurance:** This is the ability to resist fatigue in cyclic activities that last up to 45 seconds. The classic example of this endurance type is a 400m sprint in track and field. This type of endurance is majorly dependent on the power and capacity to produce energy.
- **Short Term Endurance:** This ability is needed for activities lasting 45 seconds to about 2 minutes. The most appropriate example for short-term endurance is an 800m run. This endurance depends majorly on speed endurance and strength endurance.
- **Medium Time Endurance:** Medium time endurance is needed to resist fatigue in activities lasting from 2 minutes to about 11 minutes. The most common example of this type is 1500m and 3000m run and 100m rowing. As in short-time endurance, this type of endurance also depends on speed and strength endurance, but to a limited extent.
- **Long Time Endurance:** This type of endurance is needed for activities that last for more than 11 minutes. This type of endurance is required in events like marathons, cross country, etc<sup>13</sup>



## Methods to Develop Endurance



The various methods to develop endurance are discussed below:

### 1. Continuous Method

As the name suggests, this method is about continuity. In this method, an exercise is done for a longer time without any rest. Because the duration of the activity is long and continuous, the training intensity is low. This method has the following subcategories:

- (a) **Slow Continuous Method:** In this method, the activity is performed at a certain speed without any break for a long duration. The speed of exercise is usually determined according to heart rate. A trained athlete's heart rate should be between 140-160 beats per minute during activity. The duration of the training should not be less than 30 minutes. This method is used for walking, running, cycling, etc.



**Effect:** due to relatively low intensity and long duration, the effect of this method is limited mainly to the muscles, but there are few psychic and positive effects on metabolism. Some of the most significant changes are:







- ◆ Increased muscle glycogen.
- ◆ Increased liver glycogen.
- ◆ Increased capillarization.
- ◆ Increased number and size of mitochondria.
- ◆ Improved thermal regulation.
- ◆ Quality of oxidative enzymes improves.
- ◆ Increased fat metabolism.
- ◆ Positive effect on heart and lungs.
- ◆ Psychological changes such as improved willpower, self-discipline, and self-conquest.

(b) **Fast Continuous Method:** The activity is performed comparatively fast, but the speed remains uniform throughout the training. Heart rate during the training should be between 160-180 beats per minute. Because the intensity is high and is more strenuous and exhaustive than the slow continuous method, the duration of the activity should be at least 20 minutes.



**Effects:** effects of the fast continuous method are:

- ◆ Effective for improving VO<sub>2</sub> max.
- ◆ Improved capacity of muscles to consume oxygen
- ◆ Significant increase in the size and number of mitochondria.
- ◆ Improved anaerobic capacity

(c) **Variable Pace Method:** In this method, activity is performed at a changing pace, but this change in speed is pre-planned. The heart rate usually







ranges between 140-180 beats per minute during this method. The duration of this method may range from 15 minutes to 1 hour. Due to the varied pace, this exercise is very strenuous and should be done by trained athletes.

### Effect of Variable Pace Method

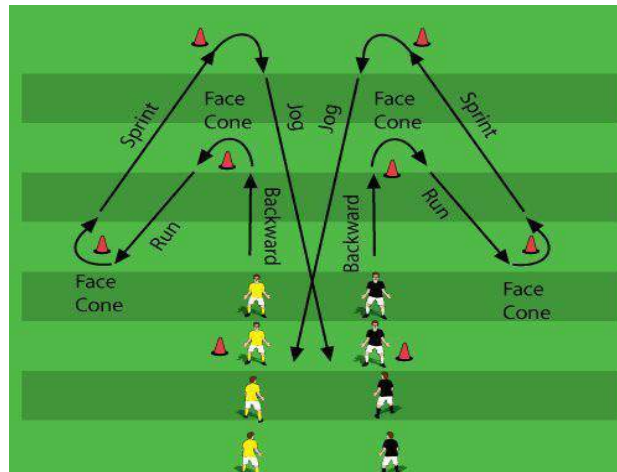
- Increases glycogen in the muscles
- Increases the number and size of mitochondria
- Increases efficiency of heart and lungs
- Improves willpower and confidence
- Improve VO2 Max

(d) **Fartlek Method:** Fartlek is a Swedish word that means 'speed play.' In other words, it is another variation of the variable pace method. The difference between the two is in the Fartlek method the speed variation is not planned. The athlete changes the speed of his own accord during the activity due to changes in terrain, surroundings, and feelings. The heart rate and duration of the training are similar to the variable pace method.

### Major effects of this method:

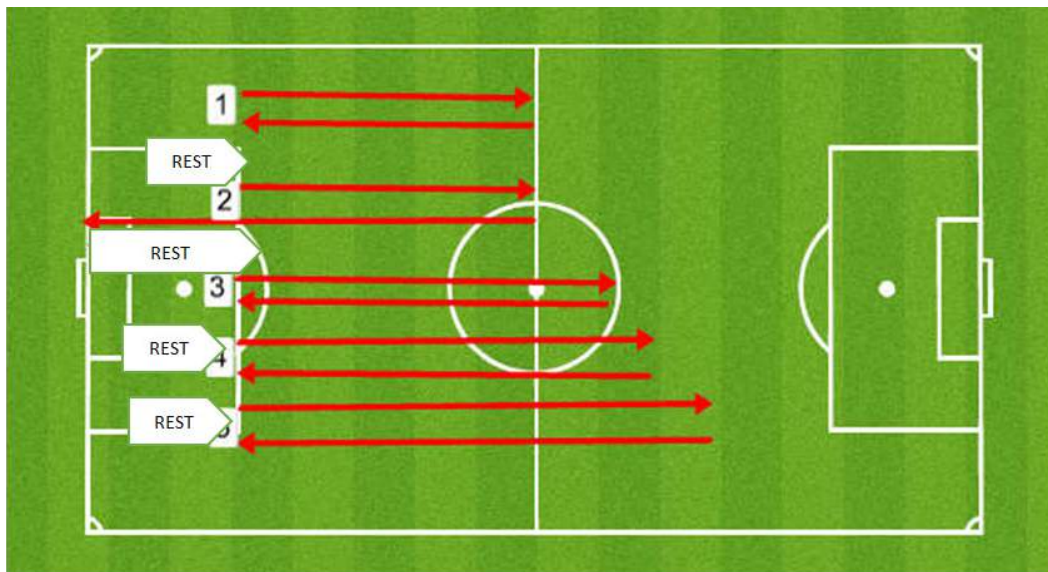
- Promotes weight loss
- It's an excellent test for strength and endurance
- It improves speed and race tactics
- It improves the mind over matter game
- It is excellent for getting into the racing mindset as a fartlek session mimics the surges of speed you may put on in a race.
- Incorporating these speed surges helps runners measure and learn how much they can push their bodies over shorter segments.
- Increases physical and mental energy
- Improves flexibility
- Improves Fast and Slow Twitch Muscle Response





## 2. Interval Method

It is the most versatile method used for improving endurance. In this method, the activity is practiced at a comparatively high intensity with intervals or breaks of incomplete recovery. It is based on the principle that “work should be done with sufficient speed and duration so that the heart rate goes up to 180 beats per minute. After this, there should be a short interval, and when the heart rate drops down to 120-130 beats per minute, the work should start again.”<sup>14</sup>



The most important effects of this method:

- Improved circulatory system
- Improved aerobic capacity
- Improved lactic acid tolerance
- Improved VO<sub>2</sub> max



### 3. Repetition Method

The repetition method is characterized by a high intensity that ranges from 90-to 100% of work with an interval of complete recovery. It is the best method to develop speed endurance.

The Essential effects of this method are:

- Improved anaerobic capacity
- Improved lactic acid tolerance
- Improved phosphagen stores<sup>16</sup>



#### Do You Know?

**Volume:** Training volume is simply the amount of training you do. The primary training component includes duration or time of training, distance covered volume load (sets in weight training), number of repetitions, or performed work in a given time. It is a quantitative component of work.

**Intensity:** Training intensity refers to the effort by which a training session is completed. It is a qualitative component of work—more work or efforts done by the athlete per time. Assessment of intensity varies from sport to sport. Speed is assessed by metres per second, resistance in kilogram, team games, or distance races may be evaluated by heart rate, etc.

**Density:** Training density is simply the volume of training completed within a given time frame. As volume and intensity have an inverse relationship, density and intensity do. The less dense a session, the more intense it can be.

#### Extension Activity

With the help of physical education, teachers design medium-intensive exercise sessions to improve endurance. Participate in groups, Record the video and upload it on YouTube under **Fit India Movement**.

#### I. Tick the correct option.

1. Which is not a type of endurance according to the nature of activities





- i. Basic Endurance
  - ii. General Endurance
  - iii. Specific Endurance
  - iv. Speed Endurance
2. 400m sprint event comes under
- i. Speed Endurance
  - ii. Short Endurance
  - iii. Medium Endurance
  - iv. Long Endurance
3. There will be no variation in the pace of inactivity in
- i. Fartlek Method
  - ii. Continuous Method
  - iii. Interval Method
  - iv. None of the Above
4. The Swedish word meaning speed play is.....
- i. Fartlek Method
  - ii. Continuous Method
  - iii. Pace Method
  - iv. None of the Above

**II. Answer the following questions briefly.**

1. Define Endurance.
2. Write about the different types of Endurance based on the duration of activity.

**III. Answer the following questions in 150-200 words.**

1. Explain types of endurance according to the duration of the activity.
2. Explain types of endurance according to the nature of the activity.
3. What do you mean by endurance? Explain methods to develop endurance in detail.



## Speed

Speed has a complex nature and depends considerably on the central nervous system. Speed ability, in sports, signifies the ability to execute motor movements as quickly as possible. These movements can be cyclic or acyclic.

**Theiss and Schnabel** defined speed as *“the prerequisite to do motor actions under given conditions (movement task, external force, individual prerequisite) in the minimum of time.”*

**Johnson and Nelson** defined speed as *“the capacity of an individual to perform successive movement of the same pattern at a fast rate.”*

Certain factors help in determining the speed of an individual, such as mobility of the nervous system, explosive strength of an individual, correct technique of performing a task, bio-chemical reserves and metabolic power of an individual, flexibility, and certain psychic factors like optimum arousal, attention, motivation, concentration, ability to relax, etc.

### Types of Speed

From a general point of view, there are five different types of speed that are discussed briefly as follows:

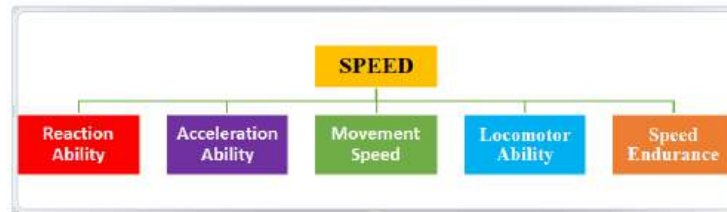
1. **Reaction Ability:** Reaction ability is the ability to react quickly to a stimulus or signal. It depends entirely on the coordinative abilities of an individual. Different games and sports have other signs like visual, auditory and tactile, to name a few. And to respond to such signals accurately and as quickly as possible is known as reaction ability. It can be further classified into simple and complex reaction abilities.
2. **Acceleration Ability:** Acceleration ability is the ability to achieve a high locomotion speed from a stationary position. It depends significantly on the explosive strength, technique, and movement frequency. This ability is essential in almost every game and sport but greatly influences sprinting events.
3. **Movement Speed:** Movement speed can be defined as the ability to perform a single movement in the minimum possible time. It is highly related to acyclic sports, but its importance in cyclic sports is limited to the initial phase. It is dependent on the technique and explosive strength.
4. **Locomotor Ability:** Locomotor ability is the ability to maintain maximum speed when in motion for the maximum possible duration or distance. It is essential in sports like 100m and 200m sprints, speed skating, and short sprints in cycling.





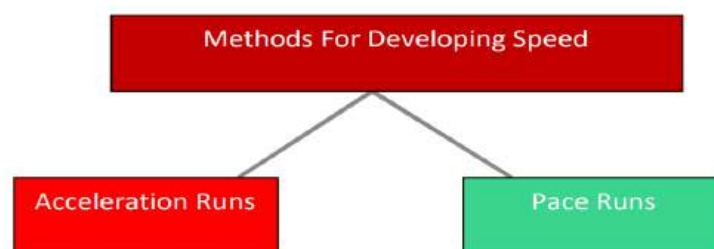
Locomotor ability depends highly on the mobility of the nervous system. The chances of improving locomotor ability are relatively low.

5. **Speed Endurance:** Speed endurance is a combination of two words, speed and endurance. It is the ability to do the movement with high speed for a longer duration, i.e., under fatigue. It depends highly on anaerobic capacity, technique, and psychic factors.



## Methods Developing Speed

Speed is a motor ability that depends on genetic and environmental factors. Genetic factors, as we all know, cannot be manipulated. An individual having fast-twitch fibres in a comparatively higher percentage than slow-twitch fibres will have more speed. At the same time, the individual with a high rate of slow-twitch fibres will have better endurance. The ratio of these muscle fibres cannot be changed. Therefore, it can be said that the genetic make-up of an individual sets the limit on the speed of an individual, but the role of environmental factors on the speed cannot be denied as well. The following are the most commonly used method to develop the speed of an individual:



1. **Acceleration Runs** are generally used to develop speed while attaining maximum speed from a static position. In an acceleration run, a sportsperson must run a specific distance. After starting, the athlete tries to gain total momentum at the earliest and finishes the specified distance. These runs are repeated with sufficient rest between the runs. It usually takes 50-60 meters for a sprinter to attain maximum speed after the start. According to the research, it is observed that even well-trained athletes can maintain their top speed for 20 meters only.





The number of acceleration runs can be set according to an athlete's age, capacity, and fitness level. It may vary from 6-12 repetitions with intervals for complete recovery. The acceleration runs must be done after proper warm-up.<sup>17</sup>



2. **Pace Runs:** unlike acceleration runs, pace runs incorporate the method of running the set distance at a uniform speed. It usually includes races of 800 meters and above. It is a fact that an athlete can run a distance of 300 meters at full speed, and in the case of longer races, he must conserve his energy by reducing speed.

Therefore, keeping the pace in mind in middle and long-distance races is essential. At the beginning of such races, the speed should not be too high, and the pace should be maintained throughout the race. For this type of training, the athlete should run at a maximum steady speed for a distance 10-20% more than the actual racing distance. Repetition for pace run training can be fixed as per the athlete's fitness level with complete recovery in between repetitions.<sup>18</sup>



### Do you Know?

Skeletal muscles are made up of individual muscle fibres, and like muscles themselves, not all muscle fibres are the same. There are two types of skeletal muscle fibres, fast-twitch, and slow-twitch, and they each have different functions that are important to understand when it comes to movement and exercise programming.







**Slow-twitch muscle fibres:** Slow-twitch muscle fibres are fatigue-resistant and focused on sustained, smaller movements and postural control. They contain more mitochondria and myoglobin and are aerobic in nature compared to fast-twitch fibres. Slow-twitch fibres are also sometimes called type I or red fibres because of their blood supply. They promote prolonged duration activity at a slow pace, also known as aerobic muscles. Examples are long-distance running, swimming, cycling, etc.

**Fast-twitch muscle fibres** execute fast movement for short distances, also known as anaerobic muscles. It helps in short distance races, weight lifting, jumping, etc.

I. Tick the correct option.

1. Which is not a type of Speed
  - i. Reaction
  - ii. Sprinting
  - iii. Acceleration
  - iv. Speed endurance
2. What type of speed is defined as the ability to maintain maximal speed for maximal distance and maximum duration?
  - i. Acceleration ability
  - ii. Locomotor ability
  - iii. **Movement ability**
  - iv. Reaction ability
3. Acceleration run and pace run can be two methods of improving
  - i. Flexibility
  - ii. Speed
  - iii. Endurance
  - iv. Strength

II. Answer the following questions briefly.

1. What are acceleration runs?
2. Define Speed.



### III. Answer the following questions in 150-200 words.

1. Explain types of Speed and methods to develop speed.

#### Flexibility

Flexibility is also known as the range of motion around a joint. It is the ability to execute a movement with greater amplitude or range. Flexibility is related to genetic factors as well as physical activity programmes. Flexibility is a motor component that is not a conditional or a coordinative ability. In general, usage flexibility often corresponds with stretchability, elasticity, litheness, mobility, pliancy, etc. Flexibility is affected by muscle strength, the structure of the joints, tendons, ligaments, and other factors. A person possessing good flexibility can perform daily tasks with greater ease and comparatively more efficiency and effectiveness. Moreover, the personality and posture of such individuals is more attractive.

Tight joints affect smooth and efficient movements, whereas flexibility ensures smooth and efficient workouts. Therefore, it can be said that flexibility is helpful in many ways, such as preventing injuries, improving posture, reducing back pain, maintaining healthy joints, improving balance during making movements, and learning various skills quickly, such as backstroke in swimming.

#### Importance of Flexibility

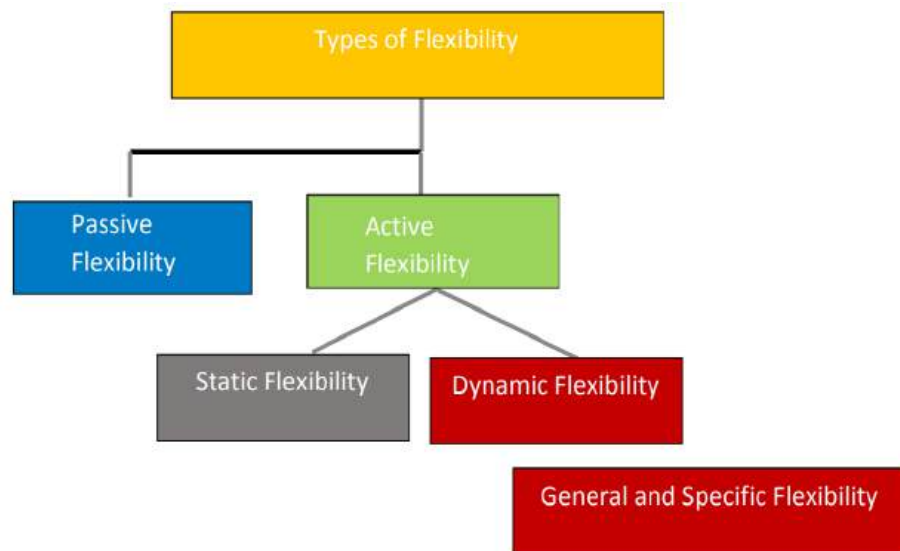
Flexibility has an important inter-relationship with other factors that improve performance. Hence, it is essential to determine different aspects to a lesser or greater extent. The importance of flexibility is briefly discussed below:

1. Greater range of motion ensures more force and speed developed by the muscles.
2. It is due to the flexibility to perform movements with minimum muscular tension and, therefore, facilitates a higher movement economy.
3. It reduces stiffness in joints.
4. It reduces the risk of injuries as muscles are more pliable.
5. It helps in maintaining appropriate posture while performing.





## Types of Flexibility



Flexibility is of the following two types:

- (A.) **Passive Flexibility:** the ability to do movements with greater amplitude and with external help is known as passive flexibility. Example, stretching with the help of a partner. Passive flexibility is always more than active flexibility and is primarily determined by the joint structure and stretchability of the muscles and ligaments. Passive flexibility is the base of operational flexibility.<sup>19</sup>



- (B.) **Active Flexibility:** the ability to perform a movement with greater amplitude without external help is called active flexibility. For example, you are performing a stretching exercise by a sportsperson himself. Active flexibility is always less than passive flexibility, and the difference between the two indicates a lack of muscular strength or coordination. Active flexibility is further classified into the following two categories:



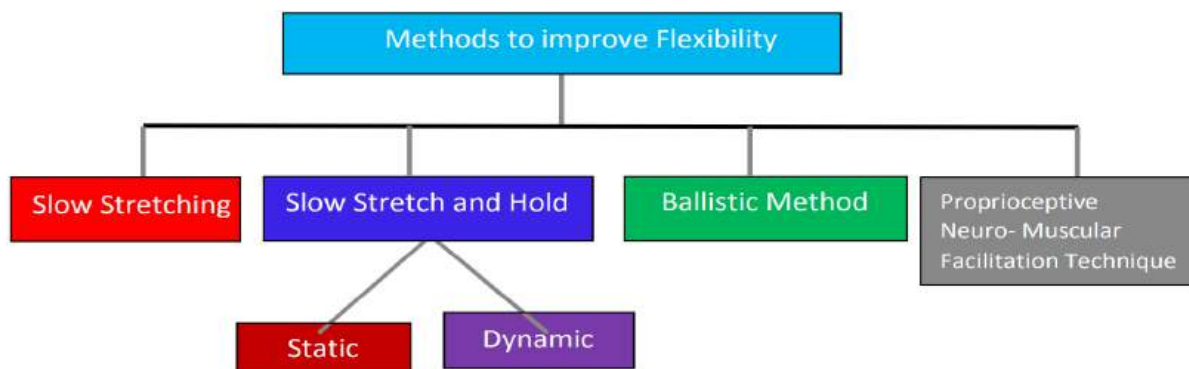


- a. **Static Flexibility:** it is required for movements done while the individual is in a static position, i.e., standing, sitting, or lying.
- b. **Dynamic Flexibility:** it is required for executing movements when an individual is moving.<sup>20</sup>



In addition, the terms General and Specific Flexibility are also used often. General flexibility refers to the flexibility of all the critical joints of the body, such as the shoulder, hip, and trunk. It is not used for any sporting event or physical activity. However, specific flexibility should be understood to be the ability to perform specific movements or movements related to specific sports.

## Methods to Improve Flexibility



The various methods that can help to improve flexibility are discussed below:

1. **Slow Stretching:** The first and foremost way to improve flexibility is slowly stretching the muscles around the joint. The critical point to note here is that stretching should be slow and without any jerky movements.
2. **Slow Stretch and Hold:** The next stage after stretching is to hold for about 6-8 seconds at the maximum stretching point. This method is considered to be the most commonly used method in the field of games and sports.





Stretching can be done either statically or dynamically.

**Static stretching** involves slowly easing into extension and holding the position. The period required for static stretch depends on the purpose. The stretch should be held for about 10 seconds if it is for a cool down. If it improves flexibility, the hold is recommended for about 30 seconds.

**Dynamic stretching** requires controlled movements, usually of legs and hands, and where the event requires dynamic movement, it is suitable for dynamic stretching exercises.

- 3. Ballistic Method:** This method performs the movement with a swing and rhythm. As the stretching is done rhythmically, it is called Ballistic Method. The ballistic method once experienced popularity but has come under the scanner by many physical therapists. This form of stretching uses the body's momentum to extend the range of motion. However, many experts believe that ballistic stretching can lead to injury.<sup>21</sup>



- 4. Proprioceptive Neuro-Muscular Facilitation (PNF) Technique:** It is also known as the post isometric stretch and is based on the principle of proprioceptive neuromuscular facilitation. This principle states that if a muscle is contracted maximally for a few seconds, the muscle gains maximum relaxation after the contraction. In this method, the muscle is first contracted for 5-7 seconds and then gradually stretched to its utmost limit and held for about 8-10 seconds. The process is repeated 4-8 times for each muscle group.<sup>22</sup>





### Do You Know?

The essential tips for developing flexibility

1. The right age for flexibility development is considered before puberty, as it is hard to develop flexibility after puberty.
2. Flexibility tends to deteriorate once improved if the stretching routine is not continued.
3. Stretching exercise performed in fatigue affects flexibility negatively. Hence, a person should perform such exercises when fresh. The ideal time to perform stretching exercises is after warm-up.
4. Flexibility exercise tends to work best after a good warming up. If the warm-up is not performed correctly, it may lead to overstretching of the muscles.
5. Flexibility training should aim for optimum flexibility and not for maximum flexibility—too much flexibility results in less joint stability and, therefore, chances of injury increase.
6. A muscle group must be stretched several times to improve flexibility effectively. Usually, 10-15 repetitions are recommended for a muscle group to gain flexibility.
7. A stretching exercise should be accompanied by a conscious effort to relax the antagonist's muscles.
8. It is essential to avoid jerky movements while performing stretching exercises.
9. Age has an inverse relationship with flexibility. Therefore, do not compete with others while working on one's level of flexibility.
10. For faster improvement in flexibility, the routine can be followed daily or twice a day, involving various exercises for each joint.





### Extension Activity

Good flexibility can improve sports performance and reduce the risk of injury. Learn static and dynamic flexibility exercises in school with the help of your physical education teacher or coach and practice them. Teach the same to your friends in your neighbourhood and increase the number of exercises and repetitions with time. Please do a small project with pictures for the same and submit it to your school as a SEWA project.

#### I. Tick the correct option.

1. Which is not a type of Flexibility?
  - i. Active
  - ii. Passive
  - iii. Ballistic
  - iv. Stretch
2. In which method is stretching done rhythmically?
  - i. Slow stretch
  - ii. Slow stretch and hold
  - iii. Ballistic method
  - iv. PNF
3. Which of the following factors does not influence flexibility?
  - i. Structure of joints
  - ii. Proper warming-up
  - iii. Body temperature
  - iv. None of these
4. What are the necessary steps in improving flexibility?
  - i. Proper warm-up
  - ii. Proper stretching
  - iii. Repetition of exercise
  - iv. All of these







## II. Answer the following questions briefly.

1. Define flexibility.
2. What do you mean by Passive Flexibility?

## III. Answer the following questions in 150-200 words.

1. Explain types of Speed and methods to develop speed.
2. Discuss methods to improve flexibility.
3. Define Flexibility. Explain its types and any two methods to develop flexibility.

## Coordinative Abilities

Coordinative abilities primarily depend on the central nervous system's motor control and regulation process. For a coordinative ability, the control regulation processes must function in a particular manner. The coordinative abilities are those abilities of an individual that enable the individual to do various activities correctly and efficiently.<sup>23</sup>



Zimmerman et al. stated that “*Coordinative abilities are understood as relatively stabilized and generalized patterns of motor control and regulation processes. These enable the sportsman to do a group of movements with better quality and effect.*”





## Types of Coordinative Ability

In sports, the following seven types of coordinative abilities are essential. The use of these abilities is, however, different in different games.

1. **Orientation Ability:** it is the ability to determine and change the position and movements of the body in the required time and available space in a definite field of action (such as a volleyball court, skating rink, a football ground) and a moving object (like a ball, opponent, partner). The use and demands on orientation ability are vast in sports. Example: body movement and position in gymnastics are essential for orientation. In team games, vision, especially peripheral vision, is decisive for orientation.
2. **Differentiation Ability:** It is the ability to attain a high fine-tuning of movement phases. It is the ability to achieve a high level of accuracy. The high level of differentiation depends on movement experience and mastery over motor action. High differentiating capacity is used in sports in sensing or implementing movement, such as movement sense.
3. **Coupling Ability:** it is the ability to coordinate body part movements with one another and about a definite goal-oriented body movement. Coupling ability is essential in sports where activities with a high degree of difficulty have to be done, such as gymnastics and team games. In a team game like football, foot movements for ball control or dribbling have to be coupled with the whole-body action of running and jumping. Coupling ability depends on the functional capacity of kinaesthetic and visual sense organs.
4. **Rhythm Ability:** Rhythm ability is the ability to perceive the rhythm of a movement and do the exercise with the required rhythm. It also denotes the ability to reproduce rhythm stored in motor memory, in motor action. In some sports like gymnastics and figure skating, the sportsperson has to perceive an external rhythm and music and express it in his movements. In sports where rhythm is not given outside, the sportsperson has to use the rhythm stored in his memory.
5. **Reaction Ability:** Reaction ability is the ability to react quickly and effectively to a stimulus. Different games and sports have different types of signals like visual, auditory, and tactile, to name a few. And to respond to such signals accurately and as quickly as possible is known as reaction ability. It can be further classified into simple and complex reaction abilities.
6. **Adaptation Ability:** Adaptation Ability is the ability to adjust or completely change the movement programme based on changes and anticipated changes.





The situational change may be expected or may take place suddenly. It depends considerably on the speed and accuracy of perception of changes in the situation.

7. **Balance Ability:** Balance Ability is the ability to maintain equilibrium or balance throughout the movement and regain balance quickly after disturbing balance movements. It is further classified into two types:

- (a) Ability to maintain balance during stationary position or slow movements. It depends on kinaesthetic, tactile, and to some extent on vestibular sense organs.
- (b) Ability to maintain or regain balance during rapidly changing positions. It depends primarily on the functional capacity of the vestibular sense organs.

I. **Tick the correct option.**

1. The ability to coordinate body part movements with one another and about a definite goal-oriented body movement is known as:
  - a. Balance Ability
  - b. Adaptation Ability
  - c. Rhythm Ability
  - d. Coupling Ability
2. The ability to attain a high level of fine-tuning of movement phases is known as:
  - a. Differentiation Ability
  - b. Orientation Ability
  - c. Adaptation Ability
  - d. Coupling Ability
3. What kind of coordinate abilities are defined as determining a body's position and its part in time and space concerning gravity and moving objects?
  - a. Differentiation Ability
  - b. Orientation Ability
  - c. Adaptation Ability
  - d. Coupling Ability





**II. Answer the following questions briefly.**

1. What do you mean by the term coordinative abilities?
2. What is coupling ability?

**III. Answer the following questions in 150-200 words.**

1. Write about coordinative abilities in detail.
2. What are coordinative abilities, and explain different types of coordinative ability?

**IV. Complete the following mind map about the factors that influence sports training.**

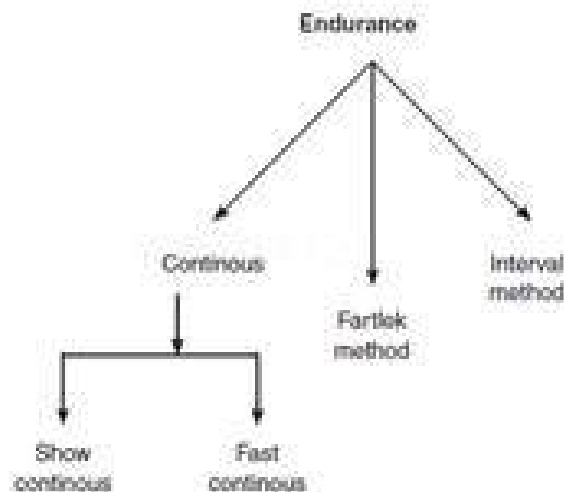


**V. ART INTEGRATION - WRITE AN ARTICLE**

Subedar Neeraj Chopra PVSM VSM is an Indian track and field athlete who is the reigning Olympic champion in the javelin throw. He is the first track and field athlete to win a gold medal for India at the Olympics. Write an article about him highlighting the factors that made him succeed, focusing on his training system.

**VI. Case Study**

**1. Training in sports**





- a. The heart rate in continuous method of training should be about \_\_\_\_\_ beats per minute and duration for the activity should be \_\_\_\_\_
- b. Interval Training Method is based on the principle of \_\_\_\_\_
- c. Fartlek is a \_\_\_\_\_ term meaning speed play.
- d. Fartlek was developed by \_\_\_\_\_ in 1930.

2.



- a. Sit-ups are examples of which kind of strength?
- b. \_\_\_\_\_ Method was developed by J J Perrine in 1960.
- c. \_\_\_\_\_ has no movement or change in size of muscles.

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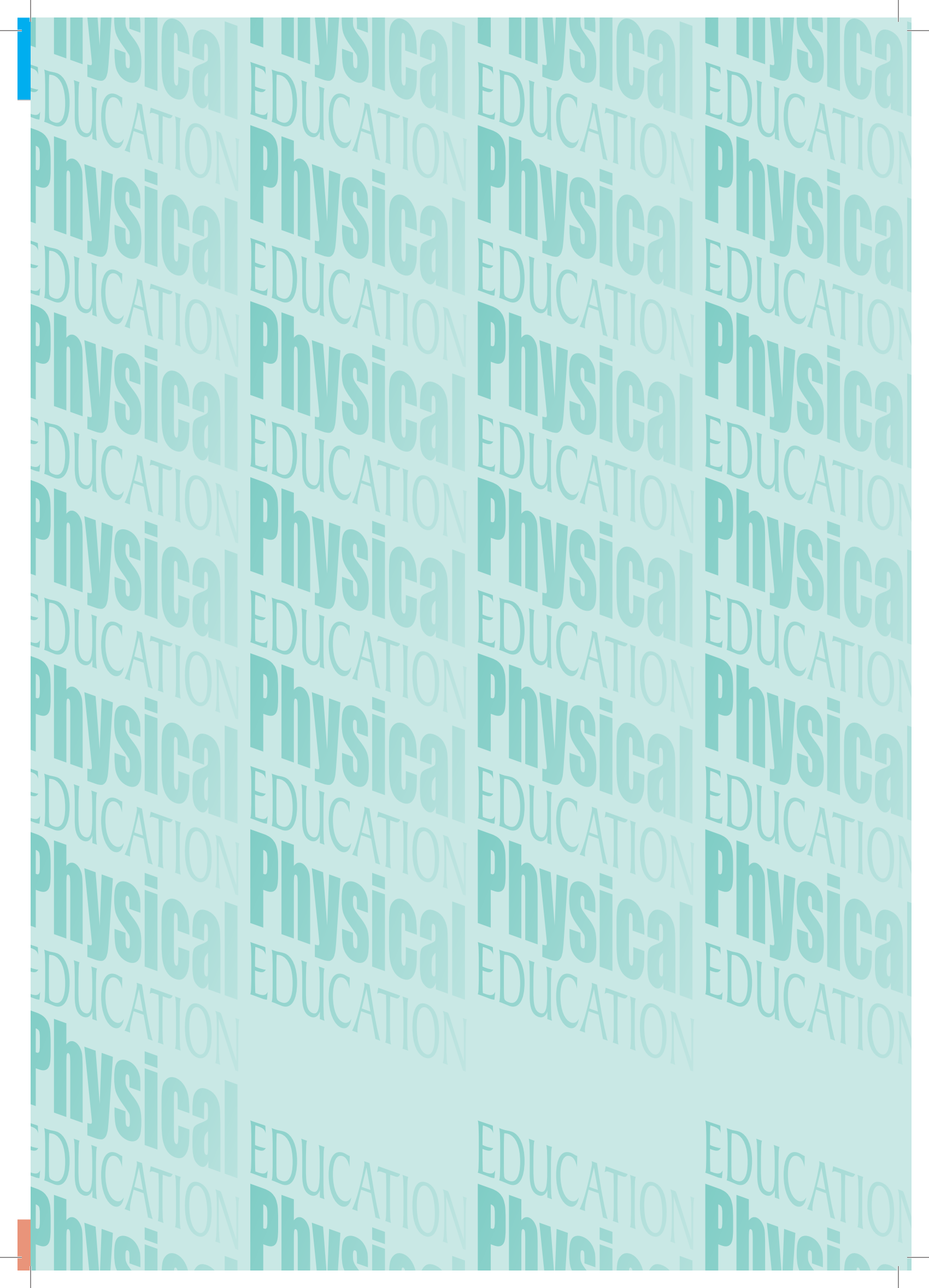


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### Foot Note

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