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Effects of hydrotherapy in static and dynamic balance among elderly men

Yaser Alikhajeh [a*], Seyyed Reza Attarzadeh Hosseini [b], Amir Moghaddam [c]

[a,c] *Department of Physical Education and Sport Sciences, Mashhad Branch, Islamic Azad University, Mashhad, Iran*
[b] *Faculty of Physical Education and Sport Sciences, Ferdowsi University of Mashhad ,Mashhad-Iran*

Abstract

Background: Hydrotherapy is used to treat rheumatic, orthopedic and neurological disorders. It has been the subject of investigations regarding balance recovery in elderly people. ***Objective***: To evaluate the effect of a hydrotherapy program for static and dynamic balance in elderly men. ***Methods***: This was a quasi-experimental before/after study. The participants were 28 healthy sedentary elderly men aged between 64 and 79 years (14 in the experimental group and 14 in the control group) were evaluated using two tests: the Sharpened Romberg test (static balance with eyes open and close) and Timed Up & Go. The subjects underwent, subsequently, a low to moderate intensity hydrotherapy program for balance, which consisted of three phases: a phase of adaptation to the aquatic environment, a stretching phase and a phase of static and dynamic balance exercises. The program was applied for 8 weeks, with three sessions per week, each session lasting one-hour. The elderly men were reassessed after the eight weeks of the hydrotherapy program. The data were analyzed statistically by means of Student's ***t*** test for paired samples. ***Results:*** Hydrotherapy promoted significant increases in the elderly men's balance, as assessed using the Sharpened Romberg test ($p< 0.001$) and the Timed Up & Go test ($p< 0.001$). ***Conclusions***: It can be suggested that this hydrotherapy program for balance gave rise to an increase in balance and a possible reduction in the risk of falls among these aged men.

Key words: hydrotherapy; static balance; dynamic balance; elderly men.

1. Introduction

Nowadays, falls are one of the largest public health problems among elderly people due to the high morbidity, mortality and costs for the family and society (Stevens & Olson 2000). The main risk factors for falls in this population are related to functional limitations, history of falls, increasing age (Stevens &Olson 2000;Newton 1995), muscle weakness, use of psychotropic drugs, environmental risks (Stevens & Olson 2000 ;Newton1995 ;Gregg et al 2000), and visual deficits (Perracini & Ramos 2002). Researchers have reported that elderly women have a higher propensity for falls because of less lean body mass and muscle strength, a higher prevalence of chronic-degenerative diseases and exposure to domestic activities.

Every year in the United States (Fuller 2000), 30% of non-institutionalized elderly people suffer falls. Approximately 5% of these cause fractures, especially in the hips (Perracini&Ramos2002). In the United States, the annual cost of treating hip fractures among elderly people caused by falls is 10 billion dollars (Carter et al 2001).

* Mashhad-Iran Tel.: +989155283362; fax:+ 985294224351.
E-mail address: yaser.alikhajeh@yahoo.com (y.alikhajeh)

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Thus, it is recognized in the literature that physical activity practiced throughout life can diminish bone and muscle loss, and reduce the risk of fractures by up to 60% (Stevens&Olson2000;Gregg et al 2000), In addition, physical activity promotes increased muscle strength, aerobic conditioning, flexibility and balance, and reduces the risk of falls and improves quality of life (Barnett et al 2003;Gregg et al 2000).

Since long ago, hydrotherapy has been used as a resource for treating rheumatic, orthopedic and neurological diseases; however, it has only recently become the target of scientific studies. The physical proprieties of water, together with the exercises, can fulfill most of the physical objectives that are proposed in a rehabilitation program. The aquatic environment is considered safe and efficient for the rehabilitation of elderly people, because water acts simultaneously on musculoskeletal disorders and balance improvements (Booth 2004;Caromano&Candeloro2007).

The multiplicity of symptoms such as pain, muscle weakness, balance deficits, obesity, arthritic diseases and gait disorders, among others, make it difficult for elderly people to perform exercises on the ground. The situation is different with exercises in an aquatic environment, where there is a reduction in joint overload and less risk of falls and lesions. In addition, floating allows individuals to perform exercises and movements that cannot be done on the ground (Geigle et al 1997;Booth2004;Simmons&Hansen1996).

Although few studies have reported the effects of hydrotherapy on balance and the reduction of falls, all of them have shown benefits, for example, of reduced postural oscillations (Lord et al 1993), increased functional reach (Simmons&Hansen1996) and greater independence in activities of daily living (ADLs)(Rissel1987). Given the relevance of this subject, the objective of the present study was to evaluate the effects of hydrotherapy in static and dynamic balance among elderly men.

2. Methods

2.1, Participats

This was a quasi-experimental before/after study. The participants were 28 healthy sedentary elderly men aged between 64 and 79 years, 14 elderly men in the experimental group (*75.79 ± 4.04* years) and 14 elderly men in the control group (*70 ± 13.30* years).The volunteers were recruited by means of posters in the association itself and subsequently selected in accordance with the inclusion and exclusion criteria. The inclusion criteria were: over 64 years of age, independence in walking, independence in activities of daily living, the absence of medical contraindications for exercise, cardiological and dermatological medical certificate, 90% participation in the treatment and signature of the free and informed consent statement. The exclusion criteria were: urinary or fecal incontinence, renal insufficiency, open wounds, contagious skin diseases, infectious diseases, catheters, vascular thrombi, cardiac insufficiency, uncontrolled arterial pressure, dyspnea upon minimal effort, use of psychotropic drugs (benzodiazepi-nes) or participation in any other physical activity or physical therapy program.

2.2, Materials

The materials consisted of the following: a questionnaire for interview, the Sharpened Romberg test(Paula et al 2000), the Timed Up & Go test (Podsiadlo&Richardson1991), a chronometer (Sport Timer), two chairs of 45 cm in height (one of them with arms), swimming pool measuring 7.5 by 11.1 meters, with a sloping bottom with the depth going from 0.8 to 1.2 meters, and with a mean temperature of 30ºC.

2.3, Procedures

The evaluation started with an interview to collect information such as age, marital status, number of people living in the home, reports of diseases, use of medications and history of falls and fractures. After the interview, the elderly men underwent balance evaluation using the Sharpened Romberg test (static balance with eyes open and close) and the Timed Up & Go test. These tests were chosen because they are functional, validated, internationally accepted, easy to apply and low-cost (Miyamoto et al 2004;Podsiado&Richardson1991).

Assessment of static balance of participants was carried out as follows using the Sharpened Romberg Test. The participant was asked to stand straight with naked feet, putting one foot in front of the other and his or her arms

crossed upon the chest; the score given to each individual was the time he could maintain a stable state with open and then with closed eyes (Paula et al 2000). Because the participants were unaware of the scoring, they were asked to repeat the task three times (in order to control for the plateau effect) before the main test; next, in a separate trial, they performed the task for another three times, for which an average score was calculated and considered as an index for their ability to maintain balance.

The Time Up & Go test provides rapid monitoring to detect balance problems that affect elderly people's ADLs. The shorter the time used to complete the test, the better the balance is. The time it took for the elderly men to get up from a chair, walk a distance of 3 meters, turn around, walk back to the chair and sit down again was measured in seconds. The elderly women did the test once to become familiarized with it and, on the second attempt, the time was recorded (Shumway Cook et al 2000).

The scales were applied before the treatment (pre-test) and after 8 weeks (post-test 8) of hydrotherapy. The arterial pressure (AP) was measured before and after the treatment sessions, with the aim of checking the individuals' conditions for performing the aquatic activities, without statistical intentions.

The study lasted 8 weeks, with one-hour sessions, three a week. The hydrotherapy for balance program was carried out with six elderly men per group and included adaptation to the aquatic environment, hydrokinesiotherapy and inclusion of aquatic exercises from other studies (Simmons &Hansen 1996; Douris et al 2003; Lord et al 2006) that challenge balance. Each session was divided into three phases: aquatic environment adaptation phase, stretching phase and a phase of static and dynamic exercises for balance. The intensity was low to moderate, with constant intensity, frequency and speed, for 8 weeks. Each series was performed continuously and between each one there was a one-minute rest.

2.4, Statistical Analyses

For comparisons over the course of time for the measurable variables, the Student ***t*** test for paired data, by means of comparing scores or times after the treatment with corresponding results for the same individual from the preceding evaluation. The data have been shown as mean differences and standard deviations of the difference. Statistical significance was set at the ($p<0.05$) level of probability. All analyses were conducted using the Statistical Package for Social Sciences (ver.16).

3. Results

According to the obtained results, the hydrotherapy program promoted significant increases in the elderly mens' balance, as observed by means of the Sharpened Romberg test (static balance with eyes open ($p\leq 0.001$) and static balance with eyes open close ($p\leq 0.002$)). The increase occurred after the 8 weeks (Table 1).

Likewise, the Timed Up & Go test showed that there was a significant decrease in the elderly men's times taken to perform the tests after the hydrotherapy program, after the 8 weeks ($p\leq 0.001$) (Table 1).

No differences were noted between control group in static balance with eyes open and close and the Timed Up & Go test.

Table 1. (M±SD) of the differences in elderly men before and after the program of hydrotherapy for static/dynamic balance obtained by means of the Student ***t*** test for paired data.

Test		Control Group M± SD	Experimental Group M± SD	Paired sample t-test	df	p-value
Static balance with close eyes	Pre-Test	30.57 ± 17.39	52.36 ± 44.75	1.69	26	0.102
	Post-Test	29.86 ± 16.87	121.57 ± 110.08	3.80	26	0.005
Static balance with open eyes	Pre-Test	183.07 ± 67.08	353.79 ± 245.16	2.51	26	0.19
	Post-Test	181.64 ± 66.45	716 ± 525.75	3.77	26	0.001
Time Up & Go (Dynamic balance)	Pre-Test	10.83 ± 2.32	10.37 ± 1.99	0.56	26	0.578
	Post-Test	10.85 ± 2.31	7.29 ± 1.33	4.98	26	0.000

4. Discussion

According to the obtained results, balance increased significantly after conducting the hydrotherapy program, according to Sharpened Romberg test (static balance with eyes open and close) and the Timed Up & Go test. This was similar to the results obtained by many other authors (Booth2004;Simmons&Hansen1996; Lord et al 1993;Douris et al 2003;Devereux et al 2005;Resende et al 2008) in which the application of a hydrotherapy program increased balance among elderly people. However, the functional tests and treatment programs used in these studies were different, making it difficult to make quantitative comparisons.

Studies that have found increased balance after hydrotherapy programs have also suggested that there is a reduction in the risk of falls, since balance has a direct relation with these risks (Booth2004;Simmons&Hansen1996; Douris et al 2003). These authors did not use a model with scoring that predicted the risk of falls, but was evaluated indirectly. That is, they classified the elderly people as having a low, medium or high risk of falls according to the score obtained in the balance tests. Thus, it can be suggested that subsequent studies should use scales for scoring the risk of falls, in order to directly obtain results.

Other authors are unanimous regarding the indication of aquatic exercises for individuals with fear of falling who are at risk of falls (Booth2004;Simmons&Hansen1996;Douris et al 2003; Devereux et al 2005; Resende et al 2008).

Water is viscous: it decelerates movement and retards falls, which prolongs the time available for regaining posture when the body gets out of balance. Floating acts as a support, which increases individuals'confidence and reduces the fear of falling. In this way, individuals can be challenged beyond their limits of stability without being afraid of the consequences of falls that would occur on the ground (Geigle et al 1997;Salzman1998).

This hydrotherapy program was effective in balance increased significantly among elderly men. These can vary from small injuries, mobility restrictions, limitations in ADLs and loss of functional independence, up to social isolation, can create a vicious circle of voluntary restriction of activities and, thus severely compromises the quality of life (Perracini& Ramos2002; Fabricio et al 2004).

When analyzing the time intervals between the evaluations according to the scales, it was observed that there was a greater gain in balance during the first stage of the program (up to the sixth week), as was seen by Simmons and Hansen (1996). These results possibly occurred because the responses to physical exercise are more evident during the first weeks of treatment. In the initial phase, neural changes predominate, and in the intermediate phase muscle adaptations predominate. In elderly people, the muscle strength increases are mainly due to neural adaptations, which occur with greater magnitude during the first six to eight weeks of training (Komi1986;Hakkinen1998).

In the present study, the same program was applied throughout the whole period. It is possible that modifying the program during the treatment, with progressive exercises (increasing intensity, frequency and duration) would allow results of greater magnitude.

Another possible hypothesis which may explain this result relates to the limitations of the scales that were used. This meant that there was no possibility of measuring new abilities in the next period. The Sharpened Romberg test (static balance with eyes open and close) has a increased times and many of the elderly men came very close to this value after the eight weeks; and the Timed Up & Go test cannot indefinitely show reducing times. As a reference, 10 s is the time considered normal for healthy and independent elderly people (Podsiadlo&Richardson1991). Furthermore, other functional tests that were used to evaluate balance, such as functional reach, Tinetti gait and balance scale and the dynamic gait index resulted in similar limitations.

The proposal of this hydrotherapy program consisted of stimulating balance reactions, in order to promote increased balance among elderly men. It also sought to create a program that would be easy to replicate, since each exercise and its frequency, intensity and duration were described, differently from most studies on this same theme, in which the descriptions of the programs are simple and general (Booth2004;Simmons&Hansen1996;Lord et al 1993,Douris et al 2003;Devereux et al 2005;Resende et al 2008). Well defined programs are fundamental for reproducing new research, and for confirmation of the results.

Although the sample size was small, and there was with control group, the results indicated that the hydrotherapy exercise program promoted increases in balance among elderly men.

5. Conclusions

Thus, hydrotherapy is a possible physical therapeutic resource to be recommended for increase balance and preventing falls among elderly people.

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Reference

Barnett A, Smith B, Lord SR, Williams M, Baumand A. (2003). Community-based group exercises improves balance and reduces falls in at-risk older people: a randomised controlled trial. *Age Aging*.32:407-14.

Booth CE. (2004). Water exercise and its effects on balance and gait to reduce the risk of falling in older adults. *Activities, Adaptation Aging*.28(4):45-57.

Caromano FA, Candeloro JM.(2007). Fundamentos da hidroterapia para idosos. *Arq Ciênc Saúde Unipar*.5(2):187-95.

Carter ND, Kannus P, Khan KM(2001). Exercise in the prevention of falls in older people: a systematic literature review examining the rationale and the evidence. *Sports Med*.31(6):427-38.

Devereux K, Roberston D, Briffa NK.(2005). Effects of a water-based program on women 65 years and over: a randomized controlled trial. *Aust J Physiother*.51(2):102-8.

Douris P, Southard V, Varga C, Schauss W, Gennaro C, Reiss A.(2003).The effect of land and aquatic exercise on balance score in older adults. *J Geriatr Phys Ther.* 26(1):3-6.

Fabrício SCC, Rodrigues RAP, Costa Junior ML.(2004). Causas e conseqüências de quedas de idosos atendidos em hospital público. *Rev Saúde Pública*.38(1):93-99.

Fuller GF.(2000). Falls in the elderly. *Am Family Fhysician*.61:2159-68.

Geigle PR, Cheek WL, Gould ML, Hunt HC, Shafiq B.(1997). Aquatic physical therapy for balance: the interaction of somatosensory and hydrodynamic principles. *The Journal of Aquatic Physical Therapy*.5(1):4-10.

Gregg EW, Pereira MA, Caspersen CJ. (2000). Physical activity, falls, and fractures among older adults: A review of the epidemiologic evidence. *J Am Geriatr Soc*.48:883-93.

Hakkinen K, Kallinen M, Izquierdo M, Jokelainen K, Lassila H, Malkia E, et al. (1998). Changes in agonist-antagonist EMG, muscle CSA, and force during strength training in middle-aged and older people. *J Appl Physiol.* 84:1341-9.

Komi PV. (1986). Training of muscle strength and power: interaction of neuromotoric, hypertrophic, and mechanical factors. *Int J Sports Med*.7:10-5.

Lord S, Mitchell D, Willians P. (1993). Effect of water exercise on balance and related factors in older people. *Aust Physio*.39(3):217-22.

Lord SR, Matters B, George RS.(2006). The effects of water exercise on physical functioning on older people. *Aust J Ageing*.25(1):36-41.

Miyamoto ST, Lombardi Junior I, Berg KO, Ramos LR, Natour J.(2004). Brazilian version of the Berg balance scale. *Braz J Med Biol Res*.37:1411-21.

Newton RA.(1995). Standing balance abilities of elderly subjects under altered visual and support surfaces. *Phys Can*.;47:25-9.

Paula K, Yim-Chiplis Laura AT.(2000). Defining and measuring balance in adults. *Biol Res Nurs*, 1: 321-331.

Perracini MR, Ramos LR. (2002).Fatores associados a quedas em uma coorte de idosos residentes na comunidade. *Rev Saúde Pública*.36(6):709-16.

Podsiadlo D, Richardson S. (1991).The timed "Up & Go": a test of basic functional mobility for frail elderly persons. *J Am Geriatr Soc*.39(2):142-8.

Resende SM, Rassi CM, Viana FP (2008). Effects of hydrotherapy in balance and prevention of falls among elderly women. Rev Bras Fisioter.12(1):57-63

Rissel C. (1987).Water exercises for the frail elderly: a pilot programme. *Aust J Physiother*.33(4):226-32.

Salzman, AP. (1998).Evidence-based aquatic therapy for proprioceptive-training. The Aquatic Resources Network. *Atri's Aquatic Symposium;* Set H95-9.

Shumway-Cook A, Baldwin M, Polissar NL, Gruber W. (1997).Predicting the probability for falls in community-dwelling older adults. *Phys Ther*.77(8):812-9.

Simmons V, Hansen PD.(1996). Effectiveness of water exercise on postural mobility in the well elderly: an experimental study on balance enhancement. *J Gerontol*.51A(5):M233-8.

Stevens JA, Olson S.(2000). Reducing falls and resulting hip fractures among older women. *MMWR Morb Mortal Wkly Rep*. 49:1-12.