Physical fitness and elderly health effects of hydrogymnastics

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ABSTRACT

Basis and objectives: The practice of physical exercises, besides avoiding idleness, contributes expressively for the maintenance of the physical fitness of the elderly. The objective of this study was to verify the effect of hydrogymnastics on the physical fitness and the elderly health. **Methodology:** A controlled assay on 74 elderly women with no regular physical activity was performed. A group of 37 women had two weekly hydrogymnastics classes during 3 months and other 37 women served as control. The physical fitness was evaluated though the Rikli and Jones (1999) test battery, where the following parameters were evaluated: power and resistance of the lower members (to sit down and to stand up), power and resistance of the upper members (forearm flexion), lower members flexion (at sitting position, to touch lower members), physical mobility – velocity, agility and balance (to stand up, to walk 2.44 m and to sit back down), flexibility of the upper members (reading up the back with hands) and aerobic resistance (6-minute walk). The test battery was applied before the beginning of classes and at the end of the program 3 months later. The groups had similar behavior with regard to age, IMC, familiar income and educational level. **Results:** During the three months, 30 women of each group were followed, sampling loss of 18.9%. In the hydrogymnastics group, a better performance in all post-tests was observed, when compared to results of the own group in the pre-test and to the control group in the post-test ($p < 0.05$). **Conclusion:** One concludes that the practice of hydrogymnastics for elderly women with no regular physical exercises, contributes to the improvement of the physical fitness and elderly health.

Key words: Elderly. Idleness. Physical activity. Hydrogymnastics. Physical fitness.

INTRODUCTION

The aging, unavoidable process of all human beings, leads to a progressive loss of the organism functional fitness, increasing the risk of idleness[1]. Those alterations, in the bio-psycho-social domains, threaten the life quality of the elderly by limiting their capacity to perform vigorously daily activities and by increasing the vulnerability of their health[2].

The idleness, which tends to follow the aging and has been target of pressure from the technological advancements occurred in the last decades, is also an important risk factor for chronic-degenerative diseases, especially the cardiovascular affections, main cause of elderly death[3,4]. The practice of physical exercises, besides avoiding idleness, contributes expressively for the maintenance of the physical fitness of the elderly with regard to both their health and their functional capacities[3]. However, physical exercises may present some limitations for the elderly due to the physiological modifications imposed by the aging process. The hydrogymnastics shows some advantages for this populational group with the utilization of the water physical properties, enabling a better yield for the elderly, besides showing less risks[6]. Despite these potential benefits, the hydrogymnastics practice for the elderly has been yet not deeply studied. Thus, we intend to evaluate the effects of the hydrogymnastics on the functional physical fitness in elderly women with no regular physical activity.

METHODOLOGY

A controlled, prospective study was performed at the Physical Education School from the Pernambuco University (ESEF-UPE), Recife (PE), Brazil, in the period from February to May 2001. Women above 60 years of age who

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have not practiced any regular physical exercise program in the last 12 months were recruited from two low-income communities of the city of Recife. Those women with any medical contraindication for the practice of exercises and carrier of neuro-motive deficiency, not approved in the medical evaluation, were excluded from the program, besides the women who did not accomplish more than 90% of the physical activity program established.

The size of the sample was calculated for a power of 80% and a type-I error of 5%. An average variation of 20% between the pre and post test "sitting down and standing up" was admitted, and the size of the sample was calculated among 50 participants. Once a maximal casuistic loss of around 40% was estimated, one has chosen to elevate the casuistic number to 74 participants.

The participants were divided in two distinct groups, according to the residence site. 45-minutes duration hydrogymnastics classes were ministered to the training group (n = 37) twice a week, during a period of 12 weeks. The classes were ministered always in the morning in a swimming pool with 1.20 m depth and 25 m x 12.5 m and the water temperature ranged from 26 to 28°C. The classes were composed of 4 phases: 1 – Warming up (elongation and flexibility, static method, during 5 minutes); 2 – Aerobic exercises (running, dislocations and combined movements of arms and legs in intervals, 1 minute for the activity and 1 minute for recovering, during 20 minutes); 3 – Localized exercises (power/resistance of the upper and lower members and abdominal exercises using the water resistance, during 15 minutes) and 4 – Relaxation (5-minute slow walking).

The physical fitness was measured through the test battery developed by Rikli and Jones[7], where the members' resistance and power, the physical mobility and flexibility (velocity, agility and dynamic balance) and the aerobic resistance were evaluated respectively through the following tests: "to stand up and to sit down", "forearm flexion", "chair sit-and-reach", "to sit down, to walk 2.44 minutes and to sit back down", "to touch the back" and "6-minute walk". All tests were performed all over again at the same conditions 3 months after the hydrogymnastics classes.

In the analysis, the results were compared between and within the groups, through the analysis of variance with replicates and the *t*-Student test was used for pairing samples. The computer program SPSS was used and the tests with *p* value smaller than 0.05 were considered as significant.

The present study has followed the establishments of the Helsinki Declaration, and resolution 196/96 of the Health National Council. The project was previously approved by the Ethics Committee from the Pernambuco University and only participants who have given their written consent were admitted.

RESULTS

From the 74 participants initially recruited for the research, who performed the tests battery at the "baseline", 14 of them (18.9%) did not repeat the post-test. In the study-group, 7 participants did not accomplish the 3 months of hydrogymnastics classes, all by the following health reasons: cerebral vascular disease (2), surgery (2), familiar disease (2) and traumatism (1). In the "control" group, 7 participants did not respond the calling for the performance of the post-test.

The groups had been comparable in the "baseline" with regard to age, familiar income and educational level, according to table 1.

The groups "study and control" showed the same results in the "test of standing up and sitting down" at the beginning of the research. Three months later, it was observed a better performance of group submitted to the hydrogymnastics training (table 2).

With regard to the "forearm flexion" test, it was observed a better performance of group submitted to hydrogymnastics classes (table 3).

In table 4, it was observed results of the "chair sit-and-reach" test. Those results also showed significant differences after 3 months of hydrogymnastics training.

In the "to sit down, to walk 2,44 m and to sit back down" test, the results of the group were also different between tests (table 5).

With regard to the "reaching up the back" test, the results were better for the group submitted to the hydrogymnastics training (table 6).

TABLE 1
Comparison between some variables from the two groups studied

Variable	Hydrogymnastics group (average ± dp)	Control group (average ± dp)	P**
Age (years)	78 ± 3	79 ± 5	> 0.05
IMC	27.4 ± 6.0	27.7 ± 4.4	> 0.05
Familiar income*	1.2 ± 2	1.1 ± 2	> 0.05
Educational level (years)	4.5 ± 1.3	4.8 ± 1.5	> 0.05

* Minimum wage, in Reais.
** Chi-squared.

TABLE 2
Results of the test "standing up and sitting down" before and after the hydrogymnastics training

Group	Test of standing up and sitting down*		Difference of averages (Δ) (post-pre)	P**
	Pre (average ± dp)	Post (average ± dp)		
Study	8.7 ± 1.6	14.9 ± 1.8	6.2	< 0.001
Control	9.4 ± 2.3	8.5 ± 1.7	–0.9	< 0.001
Difference of averages (Δ) (study-control)	0.7	–6.4		
P	0.161	< 0.001		

* Number of repetitions in 30 seconds.
** *t*-Student.

TABLE 3
Results of the "forearm flexion" test before and after the hydrogymnastics training

Group	"Forearm flexion" test*		Difference of averages (Δ) (post-pre)	P**
	Pre (average ± dp)	Post (average ± dp)		
Study	12.2 ± 2.5	21.6 ± 2.8	9.4	< 0.001
Control	11.3 ± 2.8	10.5 ± 2.7	–0.8	0.135
Difference of averages (Δ) (study-control)	0.9	11.1		
p	0.176	< 0.001		

* Number of repetitions in 30 seconds.
** *t*-Student.

TABLE 4
Results of the "chair sit-and-reach" test before and after the hydrogymnastics training

Group	"Chair sit-and-reach" test*		Difference of averages (Δ) (post-pre)	P**
	Pre (average ± dp)	Post (average ± dp)		
Study	–5.6 ± 7.5	5.2 ± 9.2	10.8	< 0.001
Control	–4.2 ± 11.6	–5.0 ± 11.3	–0.8	0.528
Difference of averages (Δ) (study-control)	1.4	–0.2		
p	0.580	< 0.001		

* Distance in centimeters for reaching, with superposed hands, the ruler placed with the zero point at the feet fingers position. Negative results, less than feet fingers; positive results, beyond feet fingers.
** *t*-Student.

TABLE 5
Results of the "to sit down, to walk 2,44 m and to sit back down" test before and after the hydrogymnastics training

Group	"To sit down, to walk 2,44 m and to sit back down" test*		Difference of averages (Δ) (post-pre)	P**
	Pre (average ± dp)	Post (average ± dp)		
Study	7.3 ± 1.5	5.8 ± 1.0	–1.5	< 0.001
Control	7.3 ± 1.3	7.1 ± 1.5	–0.2	0.401
Difference of averages (Δ) (study-control)	0	1.3		
p	0.984	< 0.001		

* Time in seconds.
** *t*-Student.

TABLE 6
Results of the "reaching up the back" test before and after the hydrogymnastics training

Group	"Reaching up the back" test*		Difference of averages (Δ) (post-pre)	P**
	Pre (average ± dp)	Post (average ± dp)		
Study	–11.1 ± 10.9	–1.1 ± 7.6	10	< 0.001
Control	–7.9 ± 9.9	–8.2 ± 9.9	–0.3	0.839
Difference of averages (Δ) (study-control)	3.2	–7.1		
p	0.249	< 0.003		

* Distance in cm of superposition or the distance between the middle fingers tips.
** *t*-Student.

TABLE 7
Results of the "6-minute walk" test before and after the hydrogymnastics training

Group	"6-minute walk*		Difference of averages (Δ) (post-pre)	P**
	Pre (average ± dp)	Post (average ± dp)		
Study	419.8 ± 72.4	513.0 ± 83.6	93.2	< 0.001
Control	382.0 ± 77.8	338.0 ± 73.6	–44	0.528
Difference of averages (Δ) (study-control)	–37.8	–175		
p	0.059	< 0.001		

* Distance elapsed in meters.
** *t*-Student.

In the "6-minute walk" test, the performances were also better for the group submitted to the hydrogymnastics training (table 7).

DISCUSSION

A significant improvement in all tests of applied physical fitness after the hydrogymnastics training was verified in our study. Those results seem to confirm the importance of the practice of physical exercises, in this case, the hydrogymnastics, on the maintenance and improvement of the physical fitness of elderly women who live their lives with no regular exercise practice.

We believe that the employed methodology provides reliance to our results, once both groups studied were comparable in their main socioeconomic and biological variables, besides tests have been applied with the same technique and the same instructors as well, in both at the initial moment and three months later.

Several tests for the assessment of the physical fitness on elderly adult are currently described. We have selected the Rikli and Jones [7] test for being more complete, practical, replicable and of low operational cost. Another advantage is that it deals about a test already approved[8].

In the literature we have made use of, no studies with similar methodology that have evaluated the effects of hydrogymnastics on the functional physical fitness of elderly women were found. This fact made the comparative analysis of our results more difficult.

In the first test applied, the "to sit down and to stand up" test, we have attempted to verify basically the power and the resistance of the lower body segment[9]. Our results are similar to results from Frontera *et al.*[10],who verified a power gain in the elderly of up to 227% after a 12-weeks training. Hagber *et al.*[11] and Hicks *et al.*[12], also verified a power gain in elderly women and men who performed muscular power training during 12 to 26 weeks. For some authors, this test shows a hindrance for its performance and results interpretation: the back pain, frequent complaint in this population that sometimes makes it infeasible. In our study, such complaint was not observed from any of the patients.

The forearm flexion test assesses the muscular power and resistance of the body upper segment. Our results are in agreement with the observations of McCartney *et al.*[13] that, despite the decrease on the power of the body upper segment with the aging, this alteration may be modified with the exercise practice.

The test of "chair sit-and-reach" assesses with accuracy the flexibility of the body lower segment (hips and vertebral spine flexion)[9]. In our study, patients submitted to the hydrogymnastics training began performing this test with higher ability. Hoerger and Hopkins[14] in a controlled study with women with 55 to 77 years of age, also verified improvement on the score of this test after a program of elongation, walking and dance movements during 12 weeks. It is likely that the flexibility, once properly worked in water exercises, has justified those findings.

The test of " to reach behind the back" seeks to evaluate the shoulder general movement: adduction, abduction and internal and external rotation. In our results this test has also shown significant changes after a period of three months of hydrogymnastics training. Hubley-Kozey *et al.*[15] observed significant improvements on the movement amplitude of several articulations (neck, shoulder, elbow, wrist, hip, knee and ankle) in elderly individuals who participated of a regular exercises program. With the osteo-articular deterioration process, which is sped up from the 65 years of age on, a slight increase on the movement amplitude from physical training works, may represent an important gain of life quality for these people[16].

The test of "to sit down, to walk 2.44 m and to sit back down" assesses mobility, velocity and dynamic balance. Our results have also demonstrated the positive effect of the hydrogymnastics classes on the performance of the participants of this test. Lord and Castell[17] reported improvements on the balance of the elderly after practice of regular physical exercises during 10 weeks. Topp *et al.*[18] observed a tendency of improvement of the balance, although not significant from the statistical point of view, in elderly submitted to a power training during 12 weeks. Hoerger and Hopkins[14], observed an increase of 12% of the mobility in elderly at the end of a 12-weeks duration physical exercise program.

The test of "6-minute walk" assesses the aerobic resistance, important capacity for people to be able to perform daily tasks such as to walk, to go shopping or recreation activities. This test had been successfully used to evaluate the physical resistance of patients carrier of several clinical conditions; however, only recently it was approved for the use on healthy elderly people[19]. An outstanding increase on the aerobic resistance of the hydrogymnastics group was also observed in our study. The physical exercise increases the aerobic power from 10 up to 40%, especially through the increment of the artery-venous difference of oxygen, systolic volume, cardiac debt and plasmatic and blood volume[20].

Although we have performed the physical training for a period of time relatively short, 3 months, we have observed expressive results. According to Spirduso[2], the improvement on the power quantity occurs relatively quickly, in an average time of 2 months, data corroborated by Frontera *et al.*[10]. Some authors admit that the power gain in the elderly occurs more intensively than in younger people[2]. They jus-

tify that old-aged people usually begin an exercise program in poorer conditions if compared to younger people, what provides gains relatively higher. However, according to Matsudo[21], the effects of the training programs in the elderly on the musculature strengthening are quickly lost with the activity suspension, with losses of 32% in power within 4 weeks after the training suspension. Thus, they recommend the maintenance of those programs in order for those positive results to be long lasting. In our study, we recommend to all participants, including the control group, the continuous and regular participation on physical exercises programs, especially the hydrogymnastics.

The drop on the physical fitness with the aging is an unavoidable fact, which progressively begins, around the fifth decade of life. However, several other studies like ours, point out to the benefits of physical exercise programs for the elderly as an important prophylactic procedure in order to preserve or to delay as possible the aging effects on the physical fitness[21,22]. Besides the improvement on the physical fitness, the physical activity also contributes for the reduction of the morbid-mortality of the elderly[23,24].

CONCLUSIONS

Hydrogymnastics programs contribute for the improvement and maintenance of the elderly physical fitness. However, further studies are required in order to evaluate the effects herein approached and other effects of the hydrogymnastics on the elderly physical fitness.

All the authors declared there is not any potential conflict of interests regarding this article.

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