

# ELDERLY'S PHYSICAL-FUNCTIONAL FITNESS AND PERCEIVED FUNCTIONAL CAPACITY AND HEALTH AFTER PARTICIPATION IN A HYDROTHERAPY PROGRAM

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## ABSTRACT

Several studies have demonstrated how physical activity in older people benefits their physical fitness, health and well-being. The relation between physical activity and perceived functional capacity and health is yet to be considered. This study is a quantitative research design that investigated the improvement of the physical-functional fitness and the perception of the functional capacity and health of an elderly group participating in a water-based exercise program (hydrotherapy). The data was collected in three different moments of the exercise program through a battery of tests of physical-functional fitness established by Batista and Sardinha (2005) and a questionnaire adapted from SABE project (Lebrão and Duarte, 2003). Twenty-six elderly persons (23 women and 3 men) aged between 60 and 84 years old participated in a 31-week hydrotherapy program (twice a week; 45 minutes by session). Friedman test was used for assessing statistical differences between the physical-functional fitness and the questionnaire responses in each of the three evaluation moments. Results revealed that this program was enough to improve the physical-functional fitness of the elderly, as well as the perception they had about their health and ability to perform activities of daily living.

Keywords: Elderly, Physical-functional Fitness, Perceived Functional Capacity, Perceived Health

JEL Classification: I19, L83

## 1. INTRODUCTION

In the last decades a new demographic phenomenon seems to have emerged in the developed countries: the aging population (European Commission, 2007). To guarantee life quality of the elderly has become a key issue to the current societies' development. Studies have evidenced that keeping the functional ability, and consequential maintenance of one's autonomy, is a vital factor to the quality of elderlies' life (Allen *et al.*, 2013; Rikli and Jones, 1999), having more impact than the appearance of diseases (Lebrão and Duarte, 2003). Functional capacity correlates with physical fitness and autonomy, being reflected in autonomy for daily and routine activities (Santos, Dantas and Moreira, 2011; Ueno, 1999). In this way, the maintenance of physical fitness through life, and during the longest period of time possible, is important to the health of the elder (Ballard, McFarland, Wallace, Holiday and Roberson, 2004; Barnett, Smith, Lord, Williams and Baumand, 2003; Skelton and

Beyer, 2003). Several studies have demonstrated the crucial effects of physical activity in physical fitness, health and well-being of the elderly at various levels (e.g., Leveille, Guralnik, Ferrucci and Langlois, 1999; Mazzeo *et al.*, 1998). For instance, by reducing the incidence of falls (Rivara, Grossman and Cummings 1997) and the risk of cardiovascular diseases (Berlin and Colditz, 1990). In this field of research, the specific practice of aquatic exercises has also been demonstrated to benefit elderly's life quality (Nakagava and Rabelo, 2007; Sato, Kaneda, Wakabayashi and Nomura, 2007, 2009). However, to our knowledge little is still known about the effect that the evidenced development of the physical-functional fitness due to a program as such may have in the perception that the elderly have about their functional capability and their health condition.

## **2. OBJECTIVES**

This study purposed to examine the relationship between the improvement of physical-functional fitness and the perception of the functional capacity and health in an elderly group, which performed a program of water-based physical activity. From this general goal, three specific ones emerged: 1) to study the variation of each physical fitness component; 2) to study the variation in perceived functional capability; 3) to study the variation in the perceived health.

## **3. DATA & METHODS**

Twenty-six Portuguese elderly persons participated in this study (23 women and 3 men) aged between 60 and 84 years old. The majority of the participants were between 65-69 years old (corresponding to 46% of the entire sample; i.e., n=12) and a minority aged between 80-84 years old. The sampling strategy was a purposive sampling in which all the individuals engaged in the hydrotherapy program were asked to participate of this study. The later were informed about the purposes and details of the research and volunteered to participate. The sampling inclusion/exclusion criterion was the continuation in the program.

Participants engaged in a 31-week water-based exercise program. The sessions of the program lasted 45 minutes each and occurred twice a week. The sessions were constituted by exercises targeting to develop the different physical fitness components (aerobic fitness, strength, flexibility and coordination).

### **3.1 Data collection**

The physical-functional fitness was assessed according to a battery of tests of physical-functional fitness established by Batista and Sardinha (2005) and adapted from de Rikli and Jones (1999, 2001) to the Portuguese population. This battery of tests considered the following parameters: a) aerobic capacity; b) physical mobility - speed, agility and dynamic balance; c) flexibility of the lower limbs; d) flexibility of the upper limbs; e) strength and endurance of the upper limbs; f) strength and endurance of the lower limbs; g) body mass index (BMI, computed as the individual's body mass divided by the square of their height). Were considered the following test items (cf., Batista and Sardinha (2005): *2-Minute Step Test* - Number of full steps completed in 2 minutes, raising each knee; *2.44-meters Up-and-Go* - Number of seconds required to get up from a seated position, walk 2.44 m, turn, and return to seated position; *Chair Sit-and-Reach* - Number of centimetres between the extended hands and fingers and the tip of toe from a sitting position at front of chair and with leg extended; *Back Scratch* - Number of centimetres between extended middle fingers

with one hand reaching over the shoulder and the other up the middle of the back; *Arm Curl* - Number of bicep curls completed in 30 seconds holding a hand weight (2.27 kg for women and 3.63 kg for men); *Chair Stand* - Number of full stands completed in 30 seconds with arms bent across chest.

The perception of the functional capacity and health condition by the elderly was assessed through a questionnaire adapted from SABE project (Lebrão and Duarte, 2003). This questionnaire with closed-ended questions (i.e., including answer choices) allowed analysing the perception that the elderly have of their functional capacities and included: the basic activities of daily living (BADL) (i.e., self-care activities such as eating, bathing, dressing, grooming, etc.); and the instrumental activities of daily living (IADL) (i.e., ability of an individual to have an independent life within the community being, for instance, able to make purchases, handle medications, manage their own finances, etc.). As in Lima-Costa, Firmo and Uchôa (2004)'s study, here we have also included in this questionnaire a final question for health self-evaluation (e.g., *How do you consider your health in overall?*). Data was gathered in three moments: initial or first evaluation (at the beginning of the program); intermediate or second evaluation (three months after the beginning of the program); and final or third evaluation (eight months after the beginning of the program).

### **3.2 Data analysis**

Given that the data was not normally distributed (Kolmogorov-Smirnov  $p < 0,05$ ) we used the Friedman test for assessing statistical differences between the physical-functional fitness and the questionnaire responses in each of the three evaluation moments (Martinez and Ferreira, 2008). Considering that the sample was large, we found appropriate to use the Chi-Square distribution approximation to the Friedman test. Statistical analyses were performed using SPSS 17.0 at the significance level of 5%. Statistical analysis on the responses of the data collected by the questionnaire about the BADL and IADL was performed according to the following categories: *high level of functionality* (i.e., in all the six questions “can” was the chosen answer); *moderate level of functionality* (i.e., 1-2 answers as “achieved with difficulty or help”, meaning they perceived that they could do what was being asked but with a limited extent/conditioned); *low level of functionality* (i.e., 3 or more answers as “can with difficulty or help”).

## **4. RESULTS**

Results obtained are displayed according to the purposes of this study, that is, to assess the putative effects of a water-based exercise program in the: physical-functional fitness of the elderly; their perceived functional capacity; their perceived health.

### **4.1 Assessing Physical-Functional Fitness**

As shown in table 1, the different analysed parameters of physical-functional fitness improved with the program.

Table 1. Statistical parameters of the physical-functional fitness battery of tests applied during of the three evaluation moments

Evaluation tests	1st Evaluation	2nd Evaluation	3rd Evaluation	Friedman Test
<b>2-Minute Step Test</b>				
Mean	60,62 steps	74,31 steps	80,62 steps	$\chi^2_{2,0,95} = 33,838; p < .001$
Median	58,50 steps	74,50 steps	80,00 steps	
Standard deviation	19,50 steps	24,18 steps	23,84 steps	
<b>2.44-meters Up-and-Go</b>				
Mean	6,82 sec	6,15 sec	5,81 sec	$\chi^2_{2,0,95} = 18,608; p < .001$
Median	6,90 sec	6,04 sec	5,89 sec	
Standard deviation	1,34 sec	1,13 sec	0,62 sec	
<b>Chair Sit-and-Reach</b>				
Mean	0,19 cm	3,25 cm	7,96 cm	$\chi^2_{2,0,95} = 30,765; p < .001$
Median	0,75 cm	3,00 cm	7,50 cm	
Standard deviation	7,65 cm	6,39 cm	5,15 cm	
<b>Back Scratch</b>				
Mean	-10,77 cm	-7,92 cm	-7,87 cm	$\chi^2_{2,0,95} = 8,871; p = .012$
Median	-11,50 cm	-8,00 cm	-7,00 cm	
Standard deviation	9,13 cm	8,47 cm	8,44 cm	
<b>Arm Curl</b>				
Mean	8,73 curls	11,38 curls	15,08 curls	$\chi^2_{2,0,95} = 33,204; p < .001$
Median	9,00 curls	11,00 curls	15,00 curls	
Standard deviation	4,49 curls	4,29 curls	4,64 curls	
<b>Chair Stand</b>				
Mean	10,15 stands	12,65 stands	13,88 stands	$\chi^2_{2,0,95} = 30,372; p < .001$
Median	10,00 stands	12,50 stands	14,00 stands	
Standard deviation	3,37 stands	3,29 stands	3,47 stands	

In what concerns the evaluation of the body mass index, the results showed (see table 2) a decrease in the number of participants with obesity and a small increase of participants with normal weigh.

Table 2. Body mass index in the three evaluation moments

BMI	1st Evaluation	2nd Evaluation	3rd Evaluation
Normal weight	4 (15,4%)	6 (23,1%)	6 (23,1%)
Overweight	13 (50%)	11 (42,3%)	14 (53,8%)
Obesity	6 (23,1%)	6 (23,1%)	3 (11,5%)
Super obesity	3 (11,5%)	3 (11,5%)	3 (11,5%)

## 4.2 Assessing elderly's perceived functional capacity

The perception of the functional capacity fitness focused on the basic daily living activities and the instrumental daily living activities.

### 4.2.1 Basic activities of daily living (BADL)

Results presented in table 3 indicate that during the three evaluations the majority of the participants shown a *moderate level of functionality* (between one and two conditioned activities) (1<sup>st</sup> evaluation: n=9, 34, 6%; 2<sup>nd</sup> evaluation: n=13, 50%; 3<sup>rd</sup> evaluation: n=19,

73,1%). On the other side, the number of participants with a *high level* and a *low level of functionality* decreased after the 31 weeks of the water-based exercise program although these differences were not statistically significant (high level: 1<sup>st</sup> evaluation, n=8, 30,8%; 3<sup>rd</sup> evaluation n=6, 23, 1%; low level: 1<sup>st</sup> evaluation, n= 9, 34,9%; 3<sup>rd</sup> evaluation n=1, 3,8%).

Table 3. Perceived capacity to perform Basic Activities of Daily Living (BDAL) during the three evaluation moments considering all participants

		1st Evaluation	2nd Evaluation	3rd Evaluation	Friedman Test
High	0	8 (30,8%)	9 (34,6%)	6 (23,1%)	$\chi^2_{2,0,95} = 1,877, p = ,391$
Moderate	1-2	9 (34,6%)	13 (50%)	19 (73,1%)	
Low	3 or more	9 (34,6,9%)	4 (15,4%)	1 (3,8%)	

#### 4.2.2 Instrumental Activities of Daily Living (IADL)

In what concerns the Instrumental Activities of Daily Living (table 4), the number of participants with high and moderate levels of functionality increased from the 1<sup>st</sup> to the 3<sup>rd</sup> evaluation (moderate n=17, 65,4% to n=20, 76,9%, correspondently; high n=2, 7,7% to n=5, 19,2%, correspondently). In addition, and as also verified for the BADL, the number of participants with a *low level of functionality* decreased during the program (1<sup>st</sup> evaluation: n=7, 26,9%; 2<sup>nd</sup> evaluation: n=3, 11,5%; 3<sup>rd</sup> evaluation: n=1, 3,8%). These results show that the elderly, after 31 weeks of participation in hydrotherapy sessions, significantly improved their perception of their functional capacity fitness when assessed in relation to the Instrumental Activities of Life.

Table 4. Perceived capacity to perform Instrumental Activities of Daily Living (IDAL) during the three evaluation moments considering all participants

		1st Evaluation	2nd Evaluation	3rd Evaluation	Friedman Test
High	0	2 (7,7%)	9 (34,6%)	5 (19,2%)	$\chi^2_{20,95} = 7,684, p = ,021$
Moderate	1-2	17 (65,4%)	14 (53,8%)	20 (76,9%)	
Low	3 or more	7 (26,9%)	3 (11,5%)	1 (3,8%)	

#### 4.3 Assessing elderly's perceived health status

When asked about their health status, over 50% of elderly said *reasonable* at the three evaluation moments (1<sup>st</sup>: n = 15, 57.7%; 2<sup>nd</sup> evaluation: n = 17, 65.4%; 3<sup>rd</sup> evaluation n = 14, 53.8%) (see table 5). Elderly people who responded that they had *good health* in the third evaluation doubled compared to the first evaluation performed. Those who recognized their *poor health* in the first evaluation (n = 5) changed their minds on the third moment (n= 0). Overall, in all three evaluations, participants seem to perceive that their health improved with the implementation of the physical activity program.

Table 5. Perceived health during the three evaluation moments considering all participants

	1st Evaluation	2nd Evaluation	3rd Evaluation	Friedman Test
Good	6 (23,1%)	6 (23,1%)	12 (46,2%)	$\chi^2_{2,0,95} = 8,109, p = ,017$
Reasonable	15 (57,7%)	17 (65,4%)	14 (53,8%)	
Poor	5 (19,2%)	3 (11,5%)	0 (0%)	

## 5. CONCLUSIONS

In general, this study showed that the water-based exercise program (hydrotherapy) that was applied to elderly people during 31 weeks might have lead to an improvement of their physical and functional fitness levels in what concerns most of the parameters analysed. These findings corroborate previous studies showing evidence of physical activity benefits on the following parameters: aerobic capacity (e.g., Gonçalves, 2003; Carvalhais, 2004; Teixeira, 2004); mobility (e.g., Gonçalves, 2003; Teixeira, 2004; Botelho, 2002; Alves, 2001); superior flexibility (e.g., Cavani *et al.*, 2002); lower limb strength (e.g., Batista and Sardinha, 2005); upper limbs strength (e.g., Gonçalves, 2003; Carvalhais, 2004).

The evolution observed over the three evaluation moments in relation to the lower limb flexibility contrast with those observed in studies of Carvalhais (2004) and Padilha (2007) in which no changes were verified in lower limb flexibility after eight months and ten weeks of participation in a program of physical activity and water aerobics, respectively. This can be explained by the fact that the present program did not include specific exercises stimulating this capacity.

Although in this study body composition measures (e.g., percentage of fat mass, lean mass, and water) of the elderly were not considered, nor were controlled variables such as diet and basal metabolism, the trend of decrease in BMI values is consistent with the results obtained by Gonçalves (2003) and Hunter *et al.* (2002).

In what concerns the influence of the program on the perception of the elderly about their functional capacity, both dimensions had improvements but only the perception about the Instrumental Activities of Daily Living (IADL) verified significant changes. Additionally, participants seemed also to perceive that their health improves with the physical activity program. This suggests that the improvement of physical-function fitness levels, and the general improvement of the IADL, may be relevant for the elderly on the overall perception of their health status. The “having a life” category found in the study of José, Barros, Samitca and Teixeira (2013) may be related with the aforementioned relation, in the sense that “*having a life*” considers “the capacity to be independent (although with some restrictions and adjustments) associated to the capacity to sustain some daily routines” (p.197).

In short, this study’s findings suggest that a program of water-based physical activity, held twice a week and lasting 45 minutes by session, during 31 weeks, seems enough to induce changes in the physical-functional fitness of the elderly, as well as in the perception they have about their health and ability to perform activities of daily living.

## 6. MAIN CONTRIBUTIONS OF THE STUDY

This study reinforced the known relation between physical-functional fitness and the systematic practice of physical activity, in this case a water-based exercise program. The study also revealed that an improvement in physical-functional fitness might have also

induced an improvement in the perception of the capacity to perform daily living activities and of elderly's health condition.

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