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Changes in the functional capacity of active and institutionalized elderly

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ABSTRACT

This study aimed to observe changes in the functional capacity of the elderly. Eighteen elderly individuals (mean 74.3 years) were divided into two groups: water aerobics (GH, n = 08) and institutionalized (GI, n = 10). Functional capacity was identified through the battery of tests proposed by Rikli and Jones (1999). After the intervention period, both groups showed reductions in the valences evaluated. However, in GI the reductions were more accentuated. For Cardiorespiratory Capacity, Mobility, and Strength of lower limbs, there were reductions for GH of (-4.22%, -9.42%, and -19.23%) and GI of (-52.20, -135.43%, and -28%) respectively. For the Time up and Go test (TUG), statistical effect was present for time (with lower time post vs. pre; p = 0.021) as well as a significant interaction for time*group (p = 0.027), respectively. Physical exercise programs for the elderly can reduce the rate of decline in functional capacity, with healthier aging.

KEYWORDS: aging, exercise, water aerobics.

INTRODUCTION

Life expectancy is increasing in the world population. Aging is a complex process that alters the morphology and functions of the organism and among these changes is the reduction in functional capacity (Murabito et al., 2008).

Functional capacity is related to the ability to perform activities of daily living such as eating, bathing, riding a bus, making a phone call, and walking, and its decrease is associated with an increased risk of falls, increased hospitalizations, and mortality (Fried, 2004; Gonçalves et al., 2010; Rockwood, 2005; Silva et al., 2006;).

In addition to the aging process, one of the factors affecting functional capacity is a sedentary lifestyle. In this sense, studies report that functional capacity and physical exercise are positively related and could be responsible for postponing the degenerative process of functional capacities due to aging (ACSM, 2009; Hunter et al., 2001).

Due to the importance of physical exercise for maintaining relevant aspects of functional capacity, its practice should be directed to both community and institutionalized elderly. The literature has shown that physical exercise is useful in the prevention and treatment of frailty in institutionalized elderly, as the elderly living in institutions who did not perform physical exercise programs presented greater losses in functional capacity and higher mortality (Ferreira et al., 2018; Freitas & Scheicher, 2010; Sahin et al., 2018).

Changes in functional capacity in the elderly are directly related to lack of physical exercise; however, this is not well established in the literature, as the decrease occurs in both active and sedentary elderly. In addition, there is a lack of studies analyzing this relationship in elderly people living in long-term care facilities for the elderly. Thus, the objective of the present study was to observe the changes in the functional capacity of active and institutionalized elderly.

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METHODS

Participants

This observational study with a longitudinal design and a convenience sample was carried out from September 2017 to August 2018. A research was conducted in a long-term institution of the elderly, non-profit, and water aerobics health center, both located in the municipality of Natal, Rio Grande do Norte, Brazil. Participants were divided into two groups: sedentary institutionalized elderly (GI) and non-institutionalized elderly practitioners of water aerobics (GH). To participate in this study, participants should meet the following criteria: elderly of both sexes, apparently healthy, and acceptable to participate in the research. As exclusion criteria: for both groups, 1) elderly people in wheelchairs or with serious communication problems; for the participants of the IG, 2): an elder who returned to the family during the seven months of observation or at any time performed any physical exercise; for GH, 3) individuals who participated in less than 75% of classes during the study period.

Thus, participated in the present study 18 elderly people, who were divided into two groups: Water aerobics group (GH, n = 8 elderly, of these 5 women, aged 60-86 years) and Institutionalized Group (GI, n = 10 elderly, of these 3 women, aged 61-95 years). All the elderly people invited to participate in the present study received clarification about the objectives and methodology used for the data collection. Only those who signed the Free and Informed Consent Form were included in the sample. Research Ethics Committee of the Universidade Estadual Paulista de Presidente Prudente reviewed and approved all protocols, with protocol no. 298/2008.

Procedures

The first evaluation was carried out in September 2016. For the data collection, the two groups were evaluated in the morning between 8:00 and 10:00 a.m.. Age was recorded from the date of birth to the date of the evaluations. To verify functional capacity at the first (September 2017) and second moments (April 2018), the functional tests of the Fullerton Battery were used, proposed by Rikli and Jones (Rikli & Jones, 1997).

The Fullerton battery is composed of six functional tests:

1) Sit and Stand Test

The objective of the test is to evaluate the strength of the lower limbs. The test was performed with the participant sitting in a chair without a backrest, with the trunk in an upright position and the feet resting on the floor. The arms were crossed against the chest, with hands resting on the shoulders. At the "ready" signal, the elderly participant stood up completely and returned to the starting position. The evaluator motivated the elder before and during the test to complete the movement as many times as possible in 30 seconds. After the demonstration and practice of three repetitions, the test itself started.

2) Arm flexion

The objective of the test is to assess the strength of the upper limbs. The test was performed with the elder sitting in the chair with the trunk in an upright position and feet resting on the floor. The participant chose which limb to use to perform the test. At the "ready" signal, the elder performed elbow flexions without moving the elbow forward, executing as many repetitions as possible in 30 seconds.

3) Stationary Walk

The objective of the test is to assess cardiorespiratory fitness. The test was performed with the elder standing and required to raise the knee to the 90-degree point in relation to the trunk. The elderly were instructed to perform the greatest number of repetitions in 2 minutes. To score at the test, 1 point was awarded each time the right knee reached the maximum point.

4) Sit and Reach;

The objective of the test is to assess the flexibility of the trunk and lower limbs. The test was performed with the elderly sitting in a chair. The knee of one of their legs was flexed at approximately 90°, and the foot rested on the floor while the other leg was extended. With arms outstretched and middle fingers overlapping, the elder performed a hip flexion over the extended leg, reaching as far as possible and remaining in this position for two seconds while the evaluator measured the result. This measure was the distance between the middle fingers and the tip of the foot, the distance being considered negative when before the tip of the foot and positive when the fingers passed the tip of the foot, using the tip of the foot as the zero mark. All distances were measured in centimeters. The elderly chose the body's side to perform the test and was allowed two attempts, with the best result being recorded.

5) Reaching Behind Back;

The objective of the test is to assess the flexibility of the shoulder and upper limbs. The test was performed with the elderly standing and touching their backs with one hand over the shoulder and the palm facing the back, while the other hand was held under the shoulder and with the palm

facing outwards. The goal is to approximate the middle fingers, with the zero mark being the touching of the fingertips. A positive value was the distance that the elderly could pass the zero mark, and a negative distance the gap between the fingers. This distance was measured in centimeters.

The elderly chose the body's side to perform the test and was allowed two attempts, with the best result being recorded.

6) Timed Up and Go;

The goal of the test is to assess mobility, agility, and dynamic balance. The elderly began the test sitting in the middle of the chair in an upright position with the feet flat on the floor and hands on the thighs. At the "ready" signal, the elder got up from the chair and walked quickly (without running), turned at a cone within six feet of the chair, and returned to the starting position. On giving the start signal, the evaluator started the stopwatch and only stopped it when the participant sat back in the chair. After a demonstration and a practice attempt, the elderly´s were allowed two attempts to record the best result.

Statistics

The *Shapiro-Wilk* test was performed and verified that the data did not present normality, so nonparametric analysis was used. The quantitative variables are presented as mean, standard deviation, median, and interquartile range (25% - 75%). All variables were distributed and compared according to groups (institutionalized and water aerobics). For the intergroup analysis, the Mann-Whitney test for independent samples was used, and for the intra-group analysis, the Wilcoxon test for dependent samples. To identify the effect of changes in functional capacity after seven months of follow-up, the intra-group percentage delta (Δ%) was performed. For this analysis, the *SPSS* program (*SPSS inc. Chicago, IL*), version 22 was used, and a significance level of less than 5% was adopted.

RESULTS

The elderly who participated in this study presented a mean age of 74.06 years. Regarding the variables age and functional capacity, after seven months, the elderly presented a statistically significant difference in age, upper limb strength, mobility, and agility (Table 1).

The results of the variables age and functional capacity comparison between and within groups before and after seven months indicated the following: the Δ%, that is, the changes in the functional capacity of the GI were higher than the GH. After seven months, the institutionalized elderly presented a higher decrease in functional capacity, except for lower limbs flexibility, although both groups suffered functional capacity losses during this period. The intergroup evaluation demonstrated that only age and flexibility of the upper limbs at the post moment did not present statistically significant differences; however, in the other variables, the GH presented better functional capacity at the two analyzed moments.

The intra-group evaluation showed that the GI presented statistically significant decreases in functional capacity in the variables cardiorespiratory fitness and agility/mobility, whereas the GH presented decreases only in the flexibility of the lower limbs (Table 2).

Table 3 presents the effect of the pre and post-intervention moments (time) and group influences in the motor tests in the elderly.

Table 1. Description of the variables age and functional capacity of all participants before and after 7 months of follow-up.

Variables	Mean (SD)	Median	Interquartile Range 25% - 75%	P
LL Strength Pre	11.11 (6.02)	10.00	6.00 – 15.50	0.082
LL Strength Post	9.06 (5.16)	9.50	5.25 – 13.25	
UL Strength Pre	15.67 (7.27)	15.50	7.75 – 22.00	0.043
UL Strength Post	13.44 (7.11)	15.00	9.75 – 18.50	
APT. Cardiorespiratory Pre	50.28 (35.70)	34.00	17.50 – 94.00	0.085
APT. Cardiorespiratory Post	44.44 (37.59)	31.00	12.50 – 85.50	
LL Flexibility Pre	-8.00 (10.47)	-5.00	-15.50 – 01.00	0.243
LL Flexibility Post	-11.06(12.97)	-8.50	-19.25 – 00.00	
UL Flexibility Pre	-26.44(20.47)	-23.00	-41.00 – -10.25	0.363
UL Flexibility Post	-38.33(20.50)	-22.50	-38.75 – -13.50	
Mobility and Agility Pre	18.83 (13.83)	9.00	8.00 – 30.25	0.003
Mobility and Agility Post	38.39 (42.58)	12.00	9.00 – 70.00	

LL: lower limbs; UL: upper limbs; APT: Fitness; SD: Standard Deviation.

Table 2. Inter and intra-group comparison of the variables age and functional capacity for GI and GH before and after 7 months of follow-up.

Variables	Institutionalized (n=10)	Water aerobics (n=8)	p
	Mean (SD)		
LL Strength Pre	7.60 (2.72)	15.50 (6.23)	0.002
LL Strength Post	5.90 (4.43)	13.00 (2.72)	0.001
Δ%	-28.00%	-19.23%	
p	0.107	0.440	
UL Strength Pre	11.30 (5.70)	21.12 (5.03)	0.001
UL Strength Post	9.20 (6.43)	18.75 (3.41)	0.002
Δ%	-22.83%	-12.64%	
p	0.091	0.183	
APT. Cardiorespiratory Pre	21.40 (9.57)	86.37 (17.23)	0.001
APT. Cardiorespiratory Post	13.70 (12.13)	82.87 (14.30)	0.001
Δ%	-56.20%	-4.22%	
p	0.046	0.779	
Flexibility LL Pre	-14.00 (10.25)	-0.50 (3.89)	0.003
FlexibilityLL Post	-17.70 (13.65)	-2.75 (5.23)	0.010
Δ%	-26.43%	-450.00%	
p	0.592	0.018	
FlexibilityUL Pre	-36.00 (22.70)	-14.50 (7.87)	0.022
FlexibilityUL Post	-36.20 (24.48)	-18.50 (7.21)	0.067
Δ%	-0.56%	-27.59%	
p	0.833	0.225	
Mobility and Agility Pre	25.40 (14.14)	10.62 (8.30)	0.019
Mobility and Agility Post	59.80 (47.26)	11.62 (7.63)	0.012
Δ%	-135.43%	-9.42%	
p	0.008	0.340	

LL: lower limbs; UL: upper limbs; APT: Fitness; SD: Standard Deviation.

Table 3. Multivariate comparison of the effect of Time and Group on applied Functional Tests

Functional Tests	Value	f	p	power observed
Reaching Behind Back				
time	0.14	2,285[b]	0.15	0.29
time * group	0.04	0.618[b]	0.44	0.11
Sit and Stand Test				
time	0.19	1.894[b]	0.19	0.25
time * group	0.30	0.439[b]	0.51	0.09
Stationary March				
time	0.13	2.101[b]	0.16	0.27
time * group	0.01	0.245[b]	0.62	0.07
Sit and Reach				
time	0.02	0.387[b]	0.54	0.08
time * group	0.02	0.310[b]	0.58	0.08
Arm flexion				
time	0.01	0.273[b]	0.6	0.07
time * group	0.11	1.785[b]	0.2	0.23
Timed Up and Go				
time	0.32	6.809[b]	*0.021*	0.68
time * group	0.30	6.071[b]	*0.027*	0.63

p = 95% confidence interval, reflected in the value of (<0.05) in MANOVA using the Pillai Screening test. B. Accurate Statistics ç. Calculated using alpha = 0.05

For the Reaching Behind Back, Sit and Stand Test, Stationary March and Sit and Reach tests, the significant effect over time and the influence of the group ($p < 0.05$) were not verified. However, for the TUG test, the statistical effect was present for time (with lower time post vs. pre; $p = 0.021$) and a significant interaction for time*group ($p = 0.027$), respectively.

DISCUSSION

The objective of the present study was to observe the changes in functional capacity, for seven months, on active elderly water aerobics practitioners, and institutionalized elderly, with an average age pre of 74.06 years. Whether active or institutionalized, the elderly presented reduced functional capacity in all the tests observed, emphasizing upper limb strength, mobility, and agility.

However, as in our research, other studies have shown that institutionalized elderly individuals present unique functional and social conditions, marked by sedentarism and functional incapacity when compared with those living in the community (Conwell, 2009; Gawryszewski, 2010).

Although both groups demonstrated declining functional capacity, the active group achieved significantly better scores and lower reductions, which is in agreement with the literature since research indicates that participation in physical exercise programs represents an alternative for reducing or preventing several functional declines associated with aging. These results can be explained as, despite the unavoidable consequences of aging, the possibility of physiologically modifying this process through an appropriate exercise program as a preventive health strategy (Bezerra et al., 2018).

Regarding upper limb strength and mobility, the present study observed that older adults presented lower values of strength and mobility. These findings were expected since, with the aging process, there is a decrease in motor neuron connections with muscle fiber, especially those of fast contraction, which, consequently, increases the chance of sarcopenia, especially in the elderly of 80 years and over (Santos et al., 2017).

In a study with institutionalized elderly, Geraldes et al. (2018) demonstrated that the reduction in upper limb strength in fragile elderly is associated with loss of functionality, which, in turn, increases dependency levels. In our findings, the upper limb strength of the GH was higher pre and post when compared to the GI (Geraldes et al., 2008).

Macedo et al. (2014) analyzed arm strength and functional mobility in the elderly with different levels of physical activity. To this end, 44 elderly people aged 60 or older were divided into three groups: 18 elderly people practicing volleyball adapted for the elderly, 13 active elderly people practicing a physical activity not related to sports practice, and 13 sedentary elderly. The authors concluded that both arm strength and functional mobility were better in the volleyball group.

Regarding the variable flexibility, especially of the lower limbs, it can be observed that only the GH presented significant decreases. It is important to point out that the flexibility of the lower limbs is related to alterations in the gait pattern (ACMS, 2009), which influences the daily activities of the elderly. For Justine et al. (2012), as improvements in flexibility are not as visible as those related to muscle strength, they are not given adequate importance in the majority of studies.

Costa Moreira et al. (2017) analyzed 90 women aged 50 to 70 years for 12 weeks, divided into three groups, two groups of water aerobics and a control group. The results identified that the groups practicing water aerobics, regardless of the class objectives, obtained greater gains in flexibility. Studies indicate that physical exercise programs are of great importance for the maintenance and improvement of functional capacity, including flexibility (ACMS, 2009; Thaís et al., 2015)

The present study verified that the two groups observed (GI and GH) presented decreased flexibility of lower limbs, but for the GH, this loss was statistically significant.

Contrary to our findings, studies indicate that the practice of water aerobics can facilitate improvements in the flexibility of the lower limbs of the elderly (Thaís et al., 2015). Corroborating this statement, Colpo et al. (2013), in a study of 20 individuals aged 50 years and over, reported maintained flexibility after three months of water aerobics.

Due to the methodological differences in the articles regarding the intensity and volume of the water aerobics sessions, we cannot affirm the importance they present to maintain the flexibility of the elderly, especially in periods over three months. However, we understand that studies, which control variables such as intensity and volume, are necessary to infer the importance of these variables to improve this population's flexibility.

In the present study, at both evaluation moments, the institutionalized elderly individuals presented a statistically significant difference compared to the elderly who practiced water aerobics. In addition, after seven months of follow-up, only the GI presented significantly decreased agility/mobility; the same did not occur for the GH. Studies that observed mobility in institutionalized elderly verified that despite being institutionalized, if the elderly people practiced physical leisure activities, such as dance, they demonstrated improvement of up to 16% in agility and mobility (Marchon et al., 2010).

The progressive loss of functionality can be attributed to some morphophysiological modifications that occur in the

individual during the aging process. In the group of institutionalized elderly, these alterations lead to an even more pronounced reduction in functional capacity, especially in institutions that do not offer physical exercise programs (Freitas & Scheicher, 2010). Active elderly are less prone to problems with agility and dynamic balance since their functional mobility resembles young individuals (Alfieri et al., 2009).

This study presented some limitations: first, the reduced number of participants, which limited the power of extrapolation of the results; second, the lack of data on drug use, since polypharmacy (continuous use of 3 or more drugs) in institutionalized elderly reduces functional capacity and mobility, as it increases the risk of falls (Ferreira et al., 2016).

However, as this is a cohort study with seven months of follow-up, we understand that this limitation applies only to the inter-group comparison and not to the intra-group, since the elderly did not increase their number of medications in a little more than half a year.

This study also presents strengths: first, few studies analyzed functional capacity in institutionalized elderly in northeastern Brazil; second, this study presented questioning data on the performance of water aerobics for the deleterious effects of aging.

CONCLUSION

After seven months of follow-up, the elderly generally reduced functional capacity, especially upper limb strength, mobility and agility. However, this reduction was greater among the institutionalized elderly, with an average of 20%.

From this study, it is concluded that, to reduce the rate of decline in functional capacity and for healthy aging, it is necessary to disseminate public policy programs focused on the offer of physical activity for this population.

To advance, further research on the subject it is suggested, analyzing changes in the functional capacity of elderly residents in institutions that practice physical activity programs compared with sedentary and active elderly living in society, as well as other types of physical training involved.

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