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PHYSICAL ACTIVITY LEVELS AND FUNCTIONAL FITNESS IN OLDER ADULTS IN THE ALENTEJO REGION, PORTUGAL

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ABSTRACT

Objective: This study aims to study the relationship between physical activity levels, measured with accelerometry, and functional fitness in older adults in the Alentejo region, Portugal.

Methods: Fifty-five men and 100 women, aged 65 years and over, were evaluated for the intensity of daily physical activity with accelerometers and for functional fitness with the Senior Fitness Test battery. The associations between functional fitness and time spent in physical activity at different intensities were analyzed.

Results: Negative associations were found between sedentary activity time and aerobic endurance, upper-body flexibility and agility. On the other hand, mild and moderate physical activity time showed a positive association with strength, upper-body flexibility, agility and aerobic endurance, both on weekdays and on weekends. Similar results were found for the time spent in moderate physical activity.

Conclusions: More active older adults exhibit better functional fitness. The results of this study reinforce the importance of promoting physical activity and reducing sedentary behaviors to improve functional fitness and autonomy in the elderly.

Descriptors: Aging; physical fitness; physical activity; accelerometry.

INTRODUCTION

The percentage of the elderly population in Portugal, aged 65 or over, has increased in recent years from 16% to 19% between 2001 and 2011[1]. This increase is most significant in the Alentejo region, where the elderly population represents 24% of the total population, worsening the aging index by 178[1], indicating that there are 178 elderly people per 100 young people in this region. Given the high representativeness of this age group, it is urgent to implement programs that help mitigate the most probable health problems and functional limitations in the elderly[2].

The levels of daily physical activity, whether assessed through sedentary behavior or through moderate to intense physical activity levels[3], are considered a good indicator of the health status[4-6] and the functional capacity of the elderly[7,8]. Physical activity plays a key role in preventing the health and autonomy of the elderly[7,8], improving significantly their functional fitness, especially if it is a moderate-intensity physical activity[9].

However, the relationship between habitual levels of physical activity and functional fitness is regularly studied through questionnaires, considered a less reliable method when applied in elderly populations[10,11], especially due to the difficulty in accurately recalling activities carried out in previous days. Alternatively, objective methods such as pedometers and accelerometers have been widely applied in the evaluation of physical activity patterns in the elderly[12,13].

Conceptually, functional fitness represents the minimum physical capacity necessary to perform normal daily activities, autonomously and without the early onset of fatigue[14].

The evaluation of functional capacity in the elderly population is very useful for predicting disability, dependence, hospitalization, institutionalization, morbidity and mortality[15], being a potentially vital aspect for the control of health care costs[16]. Rikli and Jones[9] validated a functional test battery for the elderly, consisting of six items that evaluate parameters associated with functional independence in this age group.

A positive association between physical activity and functional capacity is fundamental for functionality maintenance, mobility, autonomy, health and well-being of the elderly[17].

Our study aimed to assess the relationship between the physical activity levels, measured by accelerometry, with the variables of functional fitness in the elderly in the Alentejo region, Portugal.

METHODS

Participants

This study included a representative sample of non-institutionalized Portuguese elderly aged 65 years or older, selected using a proportional stratified random sampling, taking into account the number of people by age and gender, from the Alentejo region, in Portugal.

The sample recruitment was carried out in senior universities, municipal councils, retired associations, homes and day centers. Inclusion criteria required participants to be relatively independent, capable of performing all tasks of the Senior Fitness Test[9].

All participants were informed of the study's objectives and gave their informed consent to participate, resulting in a total of 155 participants (55 men and 100 women). The present study was supported by the project "Aging Safely in Alentejo - Understanding for Action" (ESACA), funded by Horizon 2020, Portugal 2020 (ALT20 - 03 - 0145 - FEDER - 000007) and conducted in accordance with the Declaration of Helsinki for human studies[18].

Physical activity

Physical activity was assessed using accelerometers (ActiGraph Model, GT1M, Fort Walton Beach, Florida) that measure the multidirectional center-of-gravity oscillations, accurately recording accelerations between 0.05 and 2G's of magnitude. Participants used the accelerometer on the right hip near the iliac crest for four consecutive days, including two days of the week and two days of the weekend. The devices were programmed through ActiLife Lifestyle software (v.3.2, Fort Walton Beach, FL) to begin registration on the first day at 7 AM in the morning with a 15-second epoch. Participants were asked not to use the device during sleep and in water activities, and data collected on a day with a minimum of 600 minutes of recording were considered valid, corresponding to the minimum daily use period. Data extracted from the software were processed in the Matlab program (MathWorks, Natick, MA). The intensity of physical activity was assessed as sedentary (less than 100 counts per minute), light (between 100 to 2019 counts per minute), moderate (between 2020 to 5998 counts per minute) and vigorous (5999 or more counts per minute)[19], although in this sample none of the participants recorded scores equal to or greater than 5999 counts per minute.

Anthropometry

Participants were weighed in minimal dress and without shoes, and the value was registered to 0.1 kg (SECA 791, Hamburg, Germany Selecta Classic Line). The height was measured using a stadiometer (Secca 770, Hamburg, Germany), to the nearest 0.1 cm, according to the standard procedures described above[20].

Functional fitness tests

Functional fitness was assessed according to the Senior Fitness Test[9], validated for the evaluation of functional fitness in the elderly. The upper and lower strength parameters were evaluated by the number of repetitions in arm curl (AC) and chair stand (CS) tests, respectively. The flexibility was assessed by distance (cm) in the back scratch (BS) test and chai sit-and-reach (CSR), respectively. The agility was evaluated by the duration (s) of the 2.44m time up-and-go test (TUG) and the aerobic resistance was evaluated by the distance walked (m) in the 6-minute walk test (6MWT).

Statistical analysis

All analyzes were performed in the SPSS Statistics program version 24.0, 2016 (SPSS Inc., Chicago, Illinois, U.S.A.). Descriptive statistics (mean ± SD) were calculated by gender for age, height and weight. Normality was performed by the Kolmogorov-Smirnov test. Pearson's correlation coefficient was used to study the relationship between the intensity of physical activity and each of the functional fitness tests. The minimum level of significance was set at $p < 0.05$.

RESULTS

Table 1 summarizes the demographics of participants and anthropometric measures for the entire sample and separately for men and women.

Correlation analysis was performed to understand the association between the mean intensity of physical activity performed during the week and the functional fitness (Table 2).

As can be seen in Table 2, there is a negative association between the sedentary activity time during the week and the majority of functional fitness tests, being significant for aerobic endurance tests and upper flexibility ($p < 0.001$). The agility test also shows a direct relationship with the sedentary activity, indicating that more time spent in sedentary activity implies more time in the TUG test ($p < 0.001$). The time spent in light physical activity seems to have a positive impact on functional fitness, especially in tests that evaluate upper and lower strength ($p < 0.001$), upper flexibility ($p < 0.05$), agility ($p < 0.001$) and aerobic resistance ($p < 0.001$). Similar results were found for the time spent in moderate physical activity, however with less significant associations in upper and lower strength tests ($p < 0.05$).

Table 3 summarizes the results of the association between the mean intensity of physical activity performed at the weekend and the functional fitness.

The associations found between the time spent in physical activity of light intensity at the weekend are similar to those found during the week at the same intensity, reinforcing previous results.

None of the participants in this study achieved values of vigorous physical activity during the week. During the weekend, neither vigorous nor moderate physical activity values were reached.

DISCUSSION

This study aimed to relate the levels of physical activity, measured by accelerometry, with the variables of functional fitness in the elderly in the Alentejo region, Portugal. The main results of this investigation revealed that the elderly who perform activities with very low intensity, below 100 counts per minute, have a lower general functional capacity, supporting studies that consider sedentary behavior as a risk to the health of the elderly[21].

We highlight the positive association found in our study between aerobic resistance and light to moderate physical activity, with aerobic resistance being one of the most important variables in reducing the risk of mortality from all causes and particularly from cardiovascular events[22].

The analysis performed in our study revealed that at the weekend none of the participants achieved moderate or vigorous physical activity levels, being those values reached during the week, which leads us to conclude that the pattern of physical activity varies between the weekdays and the weekend days. A relatively recent study reported that the mean time in sedentary activity, measured by accelerometers, did not differ significantly between weekdays and weekend days, however, physical activity assessed through a questionnaire revealed that at the weekend the time in sedentary activity increased[23]. Our study results do not allow us to compare the time in sedentary activity between the week and the weekend, but we verified the existence of variations in the physical activity patterns, especially of moderate intensity.

Our research suggests that the elderly that perform physical activity above the sedentary intensity have greater functional fitness and consequently greater functionality and autonomy. This fact is supported by previous research showing that lower rates of lower muscular strength, aerobic resistance and flexibility are associated with an increased risk of falls and greater severity of injuries, as well as increased functional limitations in this age group[24,25]. Our results reinforce not only the importance of promoting physical activity but also the importance of reducing sedentary behaviors, in line with the recommendations of other authors that recommend aerobic activities of moderate intensity, muscle strengthening activities and sedentary behavior reduction in the elderly[24]. Public health would benefit substantially if functional limitations could be postponed or eliminated in the elderly population, as this age group is more likely to be hospitalized, have disabilities and inability to live independently[16].

Health professionals should consider the importance of recommending regular physical activity and reducing sedentary behaviors as a way to preserve functional capacity during aging[24].

This study had some limitations, mainly due to the reduced number of participants, which limits the generalization of the results. Being a cross-sectional study, we cannot determine if it is the intensity of physical activity that influences functional fitness or if individuals with greater functional fitness tend to do physical activity with greater intensity. Longitudinal surveys may better clarify the direction of this relationship.

CONCLUSIONS

In the elderly who participated in the present study, physical activity of light and moderate intensity was positively associated with functional fitness. The most active seniors, both during the week and weekend, have shown better results in strength, aerobic capacity and agility tests. The results of this study reinforce the importance of promoting physical activity and reducing sedentary behaviors to improve functional fitness and autonomy in the elderly.

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Table 1 - Mean and standard deviation of age and anthropometric characteristics of participants.

	Total (n=155)	Men (n=55)	Women (n=100)
Age (years)	80.3 ± 7.5	80.2 ± 7.0	80.4 ± 7.7
Weight (kg)	66.6 ± 12.0	68.9 ± 11.9	65.3 ± 11.9
High (cm)	149.0 ± 18.6	158.6 ± 15.4	143.7 ± 18.0

Table 2 - The relationship between mean intensity of weekly physical activity and functional fitness.

	Sedentary	Light	Moderate
AC (repetitions)	-.080	.292**	.188*
CS (repetitions)	-.142	.357**	.187*
BS (cm)	-.305**	.165*	.095
CSR (cm)	-.139	.085	.054
Tug (s)	.277**	-.283**	-.071
6MWT (m)	-.309**	.472**	.279**

Abbreviations: AC, arm curl; CS, chair stand; BS, back scratch; CSR, chair sit-and-reach; TUG, 2.44m time up-and-go; 6MWT, 6-minute walk test.
The values expressed correspond to the correlation coefficients.
* $p < 0.05$ significant correlation.
** $p < 0.001$ significant correlation.

Table 3 - The relationship between intensity of physical activity at the weekend and functional aptitude.

	Sedentary	Light
AC (repetitions)	.061	.061
CS (repetitions)	.104	.104
BS (cm)	.320**	.320**
CSR (cm)	.165*	.165*
Tug (s)	-.237**	-.237**
6MWT (m)	.238*	.238*

Abbreviations: AC, arm curl; CS, chair stand; BS, back scratch; CSR, chair sit-and-reach; TUG, 2.44m time up-and-go; 6MWT, 6-minute walk test.
The values expressed correspond to the correlation coefficients.
* $p < 0.05$ significant correlation.
** $p < 0.001$ significant correlation.