

Functional Capacity and Physical Exercise in Older Women Living in a Rural Environment: A Correlational Cross-sectional Study

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Abstract

Introduction: The evaluation of functional capabilities in older adults is an important indicator of health status. The aim of this study is to analyse the degree of association between physical activity and functional capacity among women aged 65 years and older, living in a rural environment.

Method: This was an observational, cross-sectional correlational study of women attending physical fitness programmes for adults. Functional assessment was performed using the Barthel Index of basic activities of daily living, the Lawton and Brody scale for instrumental and advanced activities of daily living, and the Senior Fitness Test for the physical parameters associated with functional mobility (strength, flexibility, balance and aerobic endurance).

Results: Women who exercise were found to be more satisfied with their functional capacity (84% vs. 44%) and obtained better scores in all the tests conducted ($p < 0.0001$). Physical exercise is inversely associated with the degree of dependence for daily activity and functional physical capacity.

Conclusions: These results corroborate the benefits of physical exercise with respect to preventing dependence in older women living in rural areas, and highlight the long-term consequences of a sedentary lifestyle.

Keywords: Physical exercise; Functional capacity; Older people; Physical capacity; Dependence

Introduction

According to the WHO (1959), the health of the elderly is best measured in terms of function. Successful aging is a multidimensional concept that spans a broad range of factors. The criteria generally accepted (partially or entirely) to identify this form of aging as determinants of health include optimal physical performance, a high level of cognitive functioning, positive affective relations and social participation [1].

Lifestyle (nutrition and physical activity) can play a key role in determining the degree and evolution of the structural and functional changes that are inherent to aging. Therefore, interventions to optimise these aspects are of great importance for maintaining the health of this population group [2-4].

Increasing importance is being given to the concepts of frailty, characterised by a loss of functionality, and heightened vulnerability to the presentation of acute and/or degenerative diseases that can precipitate disability, institutionalisation and death [5]. Further progress is needed in methods of measuring and assessing functionality in order to promote health and prevent disability, especially in older adults.

Method

Design, setting, and sample

Observational, cross-sectional, correlational study, with measures of functional capacity, conducted of a sample of 50 older women living in a rural environment and taking part in a municipal programme for older citizens. The average age of the study population was 75.48 years ($SD=7.63$) with a median value of 74 years. Data collection consisted of non-probabilistic intentional sampling of women aged 65 years and older. Fifty subjects were included: 25 were participants in a physical exercise programme and another 25, in a memory-boosting programme,

with no element of physical exercise. Selection was performed according to convenience, among participants in the two programmes, subject to a minimum prior involvement of six months. Before conducting the functional capacity assessment, the necessary permission was obtained from the institution responsible for the programmes for the elderly, as was the written consent of the women, after they had been informed of the purpose and use to be made of the data obtained.

The municipal Care for the elderly programme

This programme seeks to provide health information, support and social relationships by means of workshops and other leisure-time activities. Participation is voluntary, in one or more activities, by attendance at scheduled one-hour sessions, held twice weekly under the guidance, supervision and monitoring of specialised personnel. The exercise sessions consist of warm-up exercises for ten minutes, followed by coordination exercises, rotary joint exercises and balance exercises, and end with stretching and relaxation. These sessions are monitored by an expert in physical education for the elderly. The memory workshop sessions consist of cognitive stimulation exercises to prevent memory loss, and are coordinated by a psychologist specialising in care for the elderly.

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Measurement instruments

The Barthel Index, formerly termed the Maryland Disability Index, is a generic measure of a person's ability to perform ten basic activities of daily living (BADL), including bathing, dressing, grooming, mobility, continence and feeding. This instrument is used to obtain a quantitative estimate of the person's degree of independence, on a scale of 0-100 points. The Lawton and Brody scale, also known as the Philadelphia Geriatric Center Instrumental Activities of Daily Living scale, assesses the instrumental activities of daily living (IADL) and the advanced activities of daily living (AADL). Functional capacity is evaluated by reference to the following eight items: ability to use the phone, do the shopping, prepare food, perform housekeeping duties, wash clothes, use means of transport, take responsibility for medication and administer personal economy. Each item is assigned a numerical value 1 (independent) or 0 (dependent). The final score is the sum of the values for all responses, and thus ranges from 0 (maximum dependency) to 8 (fully independent). Both of these instruments have been adapted and validated for use in the Spanish population, and they are commonly employed, in view of the international acceptance of their psychometric properties (validity and reliability) [6-8].

The Senior Fitness Test (SFT) was developed to measure the physical parameters associated with the functional mobility of independent older persons, such as muscle strength, cardio-respiratory endurance, flexibility and balance. It is easy to use, requires few material resources and meets the basic psychometric principles of validity, reliability and reproducibility [9,10]. The results of this test can be used as the basis on which to prescribe an individualised exercise plan and to situate the subject's performance with respect to that of their peers. The test measures the following basic physical qualities:

Leg strength (30-s chair stand): The subjects are instructed to sit on a chair, leaning firmly against the seat back, with arms crossed at the wrist and hands on chest, and to stand up and sit down as many times as possible in 30 seconds.

Arm strength (arm curl): The subjects are instructed to sit on a chair and, in a limited time, to fully extend and flex the dominant arm, holding a dumbbell (weighing 4 kg for men and 2 kg for women).

Leg flexibility (chair sit-and-reach): The subjects are instructed to sit on the edge of a chair with one leg extended and the other with the foot flat on the floor, and to attempt to touch the toes of the extended leg. The distance (in cm) short or exceeded in each case is scored as a negative or positive result, respectively. Two attempts are allowed with each leg, and the best score is noted.

Arm flexibility (back scratch): The subjects are instructed to touch their hands behind the back, one above and one below. If the hands fail to touch, the centimetres by which they fall short are scored as a negative result. If the fingertips overlap, this distance is scored as a positive result. Two attempts are allowed, and the higher score is noted.

Aerobic endurance (2-min step test): The midway point between the hip and the knee is noted and a mark made at this height on the wall. The subjects are instructed to raise each knee, alternately, to the marked height as many times as possible in two minutes. The score is based on the number of times that one knee is raised.

Dynamic balance (up-and-go): A backless chair or stool is required, and a cone is placed at a distance of 2.44 m. The subjects are instructed to stand up, walk around the cone, come back to the chair and sit down again, as fast as possible. Two attempts are allowed, and the fastest time is noted.

The results of all these tests are evaluated taking into account the subject's age, according to an associated results table.

Statistical Methods

Statistical analysis was performed using SPSS v.20.0 (SPSS Inc., Chicago, IL). Frequency tables and contingency tables were obtained for the qualitative variables; for the quantitative ones, summary measures were determined, including coefficients of centralisation and dispersion (mean, median, standard deviation, minimum and maximum). The normality of the distribution of the variables was confirmed by the Shapiro-Wilk test. The inter-group comparison of the quantitative variables was performed using the Mann-Whitney U test, and the frequencies and possible associations between the variables were analysed by the chi-square test and by Fisher's exact test for 2x2 tables. In addition, the γ coefficient proposed by Goodman and Kruskal was applied to verify the degree and direction of the associations found.

In all the tests performed and coefficients calculated, the level of significance used was $\alpha=0.05$.

Results

The women in both groups were selected by peers of the same age and taking into account their willingness to participate voluntarily in the study. Both groups (Exercise and No exercise) had a similar age, with a median of 74 years, a maximum of 93 years and a minimum of 65 years. The average perceived functionality, on a scale of 0-10, on which 10 is the best score and 0 the worst, was 7.92 points for the women who exercised (median 8) and 5.92 points (median 6) for those who did not. Women who exercised were twice as likely to be satisfied as those who did not (84% vs. 44%). These and other data (such as the number of children, and marital status) are shown in Table 1.

Physical exercise was found to be significantly associated with the degree of dependence for everyday activities, with median scores of 100 on the Barthel scale and of 8 on the Lawton-Brody scale in the Exercise group, and of 85 and 6, respectively, for the No Exercise group (Table 2). Most women who exercised were independent for BADL and none presented severe dependence, while 21 of the No Exercise women were dependent, 18 slightly so and three, severely. Statistically significant values of the γ coefficient, close to one and negative, indicate a strong inverse association between exercise and the degree of dependence. In other words, this activity is associated with a greater degree of independence in performing the activities of everyday life. Similar results were observed for IADL and AADL.

	Exercise	no exercise
Age	75.44 (7.62)	75.52 (7.80)
Children	3.32 (1.80)	2.64 (2.36)
Live alone	60%	55%
Functionality	7.92(1.37)	6.94(2.30)
Satisfaction	84%	44%

Table 1: Characteristics of the women in the two groups (X ± SD or %).

	BADL/IADL		
	Severe dependence	Slight dependence	Independent
Exercise	0 / 0	5 / 4	20 / 21
No exercise	3 / 3	18 / 14	4 / 7
Total	3 / 3	23 / 18	24 / 28

Goodman and Kruskal γ coefficients: Barthel = -0.912; Lawton = -0.867 ($p < 0.0001$)

Table 2: Association between Exercise and degree of independence for the variables BADL (Barthel) / IADL (Lawton and Brody).

Variables	Exercise Mean (SD)	No Exercise Mean (SD)	Mann-Whitney p-value	γ Coefficient p-value
Leg strength	12.94 (4.49)	7.24 (4.18)	p<0.0001	-0.974 (p<0.0001)
Arm strength	17.48 (6.58)	8.40 (3.28)	p<0.0001	-0.979 (p<0.0001)
Aerobic endurance	125.04 (62.37)	31.36 (27.43)	p<0.0001	-0.985 (p<0.0001)
Leg flexibility	-0.65 (1.35)	-10.60 (10.02)	p<0.0001	-0.957 (p<0.0001)
Arm flexibility	-4.97 (4.60)	-17.46 (14.07)	p<0.001	-0.974 (p<0.0001)
Balance	6.43 (1.64)	9.91 (7.31)	p<0.003	-1.000 (p<0.0001)

Table 3: Association between exercise and functional capacity.

The women who exercised also scored significantly higher for the functional capacity variables included in the Senior Fitness Test. The strength of association between physical activity and functional capacity was statistically significant in all the variables, and the γ coefficients for this association were very close to one, or even reached this level. In all cases, the association was statistically significant (p<0.0001) (Table 3). For this test, too, we recorded an inverse association, indicating that increased physical activity was associated with a lower presence of functional disability.

Discussion

There is great research interest in studying populations of older adults, as a generalised increase in life expectancy has led to a sharp increase in the global population of people aged over 65 years and, in many countries, to a rapidly aging population. It is estimated that by 2050 almost a third of the Spanish population will be made up of people aged over 65 years [11]. The key aspect of demographic trends in recent decades has been the increased life expectancy among people who are middle-aged and older, especially among women, whose life expectancy now exceeds that of men by almost a decade. This gender difference is very important, because among the older population, within an aging society, there will be an increasing proportion of women. Therefore, disease and accident prevention strategies aimed specifically at women should be designed and implemented, in accordance with their particular characteristics and background [12,13].

In our study, the sample was exclusively female, because women are the majority participants in the types of healthcare programme considered, particularly in a rural environment, as is the case in our study. Men have other options due to their customs and the relationships consolidated during their working lives.

In subjective terms, women who take regular physical exercise have a better perception of their functional capacity, i.e., they are more satisfied in this respect than are women who do not exercise. In our study group, the women who led a sedentary lifestyle were also interested in interpersonal relationships, in maintaining their independence and in participating in other activities organised for the elderly, in order to enhance their social relations and cognitive activities. Some studies [14] have highlighted the importance of social relationships, together with positive attitudes toward aging and the physical and emotional well-being, observing that positive relationships between these two variables enhance the quality of life and optimise the final stage of life. However, there exists a widespread lack of motivation to participate in physical exercise programmes, because this population is mainly composed of housewives, living in a rural setting, where household and family concerns tend to focus their attention within the home. Although factors such as widowhood, the absence of children and the

social changes that have taken place in recent years are fostering the participation of older women in the programmes offered by municipal authorities, participation in physical exercise programmes is still subject to self-limitations; thus, study subjects have referred to a lack of time and to the infirmities of old age. Nevertheless, they may be able to participate in other activities. Breaking down the barriers and promoting physical exercise as one of the elements to be considered in the context of a healthy lifestyle remains a goal to be achieved. Our data indicate that women who practice physical exercise have a greater level of independence with respect to ADL, IADL and BADL than those who do not. These results are consistent with those reported elsewhere [15], and thus physical exercise should be considered an appropriate target for intervention strategies to increase the ability of elderly persons to perform the activities of daily living [16]. As regards functional physical fitness, in our study the women who exercised achieved better scores in all the parameters measured (strength, endurance, flexibility and balance) than those who did not. These results are in accordance with those reported by other authors, who have concluded, moreover, that the practice of physical exercise is the most effective means of delaying disability and the adverse events commonly associated with the frailty syndrome [16,17]. Strength training, in particular, obtains very favourable results among this population, and its effects are very apparent in other domains of frailty syndrome, such as falls [18]. It has been reported [19] that exercise training increases muscle strength in the arms, which in adults aged over 70 years can enable better performance of the basic and instrumental activities of daily living. Decreased muscle strength is considered to be a determinant factor in the functional limitations suffered by the elderly. Thus, the women in our study who did not perform physical exercise presented less muscle strength and endurance and poorer functional capacities. With respect to flexibility, too, the exercise group obtained better scores, corroborating the results obtained in other studies [20]. On the other hand, some authors have observed no such difference in strength or flexibility, but their reports do not specify the duration of the programmes or the frequency of the sessions. Our findings with respect to the balance assessment were in accordance with those of other studies [18], which have reported a decreased risk of falls, although we have not quantified the number of falls, this being an area we intend to address in future research.

The association observed between exercise, physical condition and dependence leads us to conclude that the women who take part in the physical exercise programme have a greater level of independence in the performance of their daily activities, and a better functional physical condition than non-exercisers. These results are in line with those reported by other authors [21,22] and corroborate the need to improve the information and guidance offered to older women to encourage them to adopt a physically active lifestyle, thus promoting successful aging and preventing or delaying the development of functional limitations and situations of dependence [2,15,18,23-25].

The results of the functional capacity assessment conducted in both groups of women allowed us not only to verify the benefits of physical exercise, but also to present them to all the study participants, in order to raise awareness and to encourage the participation of as many elderly persons as possible, in order to improve their functional capabilities and to prevent or delay the dependence that is a progressive feature of aging. However, further studies are needed in populations of older adults, both male and female, with samples that are fully randomised and with larger numbers of subjects.

Our results suggest the need for greater coordination between those responsible for these programs with professional system of primary health care, in line with what was reported by some authors [26-28],

about the importance of a “care manager” as a figure of mediation between the PHC and the user. Nurses could respond to this profile by providing the necessary conditions for monitoring elderly people, orienting and strengthening their confidence to shift them more favorable changes in habits and health behaviors.

Conclusions

Women who practice physical exercise tend to be more satisfied and to have better perceptions of their functional capacity than do those who do not exercise (84% versus 44%). Physical exercise is inversely associated with the degree of dependence in activities of daily living – instrumental, basic and advanced – indicating that those who exercise are likely to suffer less dependence or to be totally independent. Physical exercise is inversely associated with all the variables of functional fitness analysed, in the sense that the more physical activity practiced, the lower the probability of functional disability.

Limitations

The use of questionnaires can be considered as a limitation, however these instruments have been adapted and validated for use in the Spanish population, and they are commonly employed, in view of the international acceptance of their psychometric properties (validity and reliability).

A limitation of this study lies in the type of convenience sampling performed, since it was based on the groups that had been established “a priori” by the programme organisers. However, the activities undertaken within the programme for the elderly were selected voluntarily by each person according to their own perceptions and attitudes developed over a lifetime. In a rural setting, it is difficult for older women to decide voluntarily to exercise, and therefore new strategies should be proposed to encourage older people to take part in these physical exercise groups.

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