HIGHER LEVELS OF PHYSICAL FITNESS ARE ASSOCIATED WITH A REDUCED RISK OF SUFFERING SARCOPENIC OBESITY AND BETTER PERCEIVED HEALTH AMONG THE ELDERLY. THE EXERNET MULTI-CENTER STUDY

R. PEDRERO-CHAMIZO1, A. GÓMEZ-CABELLO2,3, A. MELÉNDEZ1, S. VILA-MALDONADO4, L. ESPINO5, N. GUSP6, G. VILLA7, J.A. CASAJÚS2, M. GONZÁLEZ-GROSS1, I. ARA2

Abstract: Objective: To evaluate the associations between physical fitness levels, health related quality of life (HRQoL) and sarcopenic obesity (SO) and to analyze the usefulness of several physical fitness tests as a screening tool for detecting elderly people with an increased risk of suffering SO. Design: Cross-sectional analysis of a population-based sample. Setting: Non-institutionalized Spanish elderly participating in the EXERNET multi-centre study. Participants: 2747 elderly subjects aged 65 and older. Measurements: Body weight, height and body mass index were evaluated in each subject. Body composition was measured by bioelectrical impedance. Four SO groups were created based on percentage of body fat and relative muscle mass; 1) normal group, 2) sarcopenic group, 3) obesity group and 4) SO group. Physical fitness was evaluated using 8 tests (balance, lower and upper body strength, lower and upper body flexibility, agility, walking speed and aerobic capacity). Three tertiles were created for each test based on the calculated scores. HRQoL was assessed using the EuroQol visual analogue scale. Results: Participants with SO showed lower physical fitness levels compared with normal subjects. Better balance, agility, and aerobic capacity were associated to a lower risk of suffering SO in the fittest men (odds ratio < 0.30). In women, better balance, walking speed, and aerobic capacity were associated to a lower risk of suffering SO in the fittest women (odds ratio < 0.21). Superior perceived health was associated with better physical fitness performance. Conclusions: Higher levels of physical fitness were associated to a reduced risk of suffering SO and better perceived health among elderly. SO elderly people have lower physical functional levels than healthy counterparts.

Key words: Elderly, sarcopenia, obesity, physical fitness, HRQoL.

Introduction

Aging is a continuous process characterized by a decline in several physiological systems. An important change in the musculoskeletal system, recognized among the elderly, is the loss of muscle mass (sarcopenia) and low muscle function (strength or performance) (1, 2). This phenomenon is associated with serious consequences for the individual, such as physical disability, comorbidities and mortality, and for society, increasing economic and social costs (1, 3). Further, aging involves changes in body composition, with a progressive increase in percentage of body fat mass (BF%) (4), increasing the risk of developing overweight and obesity in the elderly population, with associated consequences such as cardiometabolic complications, physical limitations, and worse health-related quality of life (5). In this sense, the presence of reduced muscle mass and increased fat mass is commonly known as sarcopenic obesity (SO) (1). As we have previously stated, the prevalence of SO in the non-institutionalized elderly in Spain is 18% in men and 14% in women (6).

The impact of SO on physical function has been given considerable attention in the gerontology literature (7-10). Physical capacity has generally been assessed through self-report measures, because it is less time consuming and it does not require adequate space, special equipment or special training for examiners and it does not compromise the subject’s health (11). However, questionnaires have methodological limitations which limit the external validity of their results, requiring additional information obtained with objective physical performance testing to provide optimal assessment and adequate interpretation of results (11, 12).

According to the American College of Sports Medicine (13) and others (14, 15), aerobic capacity, muscular endurance and muscle strength, body composition and flexibility are the components of physical fitness most linked to health. However, few studies have used physical performance testing to analyze the relation between body composition and physical function in elderly populations.

The traditional way to identify people who have too much body FM is through the body mass index (BMI), which has great limitations in older people (5). On the other hand, for measuring muscle mass more sophisticated methods are...
required. For this reason, in spite of having numerous adverse health effects, SO in older people can often go unnoticed.

The goals of the current study were to determine the association between physical fitness levels, health-related quality of life (HRQoL) and SO using objective measures of body composition and physical fitness, in a large and well-characterized cohort of non-institutionalized elderly. Additionally, the usefulness of various physical fitness tests as a tool for detecting elderly people with an increased risk of suffering SO was examined.

Methods

Participants

The study was carried out within the framework of the elderly EXERNET multi-centre study. The complete methodology of the study has been described elsewhere (16, 17). In brief, this study was performed on a representative sample of non-institutionalized Spanish seniors aged 65–92 years. The population was selected by means of a multistep, simple random sampling, taking into account, first, the locations (six different regions in Spain: Aragón, Castilla-La Mancha, Castilla-León, Madrid, Extremadura and Canarias) that ensured the geographical and cultural diversity of the sample, then three different cities in each region and, finally, by random assignment of the civic and sports centres. The total number of subjects was uniformly distributed in the six regions and in their corresponding cities. The exclusion criteria were: people under 65 years; those who were living in nursing homes and/or were not independent or able to take care of themselves and those suffering from dementia and/or cancer. The information was collected through personal interviews using a structured questionnaire, followed by a physical examination to measure anthropometric characteristics. In this study, a sample of 2747 older adults was analyzed. Written informed consent was obtained from all the subjects included. The protocol was approved by the Clinical Research Ethics Committee of Aragón (18/2008). The ethical guidelines for human research studies as stated in the Helsinki Declaration were followed throughout the study.

Anthropometric and body composition measurements

A portable stadiometer with 2.10 m maximum capacity and a 0.001 m error margin (SÉCA, Hamburg, Germany) was used to measure height according to standardized methods (18).

Body mass, percentage of fat mass and muscle mass

A portable bioelectrical impedance analyser TANITA BC 418-MA (Tanita Corp., Tokyo, Japan) with a 200 kg maximum capacity and a +/- 100 g error margin was used to measure the body mass, %BF and the muscle mass. Individuals removed shoes, socks and heavy clothes prior to weighing.

Sex-specific (%BF) cut-off values published by Gómez-Cabello et al. (6) were used for creating SO groups. For women, the limits for %BF quintiles were (i) 35.06; (ii) 35.07–38.28; (iii) 38.29–40.90; (iv) 40.91–43.90 and (v) 43.91. The corresponding boundaries for men were (i) 25.18; (ii) 25.19–27.82; (iii) 27.83–30.33; (iv) 30.34–33.07 and (v) 33.08. Full-body skeletal muscle mass was estimated with the predictive equation developed by Janssen et al. (19) Skeletal mass (kg) = ([Ht²/R x 0.401] + [sex x 3.825] + [age in years x 0.071]) + 5.102, where Ht = height in cm, R = resistance in ohms from bioelectrical impedance analysis and sex = 0 for women and 1 for men. To account for differences in muscle mass as a function of height, relative muscle mass (RMM) was calculated as skeletal muscle (kg)/height² (m²). As with %BF, the RMM was divided into sex-specific quintiles to facilitate the interpretation of odds ratios. For women, the ranges for RMM quintiles were (i) 5.80; (ii) 5.81–6.19; (iii) 6.20–6.56; (iv) 6.57–7.00 and (v) 7.01. The corresponding ranges for men were (i) 8.11; (ii) 8.12–8.61; (iii) 8.62–9.01; (iv) 9.02–9.50 and (v) 9.51.

Body mass index (BMI) was calculated as body weight in kilograms divided by the square of height in meters. The prevalence of overweight and obesity was calculated according to the World Health Organization guidelines, considering the thresholds of overweight and obesity as a BMI of 25 kg/m² and 30 kg/m², respectively (20).

Following previous published criteria for defining SO (21), four groups were created by cross-tabulating quintile scores for %BF and RMM. High body fat was defined as the upper two quintiles for %BF, and low muscle mass was defined as the lower two quintiles for RMM. Body fat in the lower three quintiles and muscle mass in the upper three quintiles were considered normal. Using these cut-offs, the four groups included were (i) normal body fat and muscle mass; (ii) high body fat only (and normal muscle mass); (iii) low muscle mass only (and normal body fat) and (iv) high body fat in combination with low muscle mass (SO).

Physical fitness assessment

The following physical fitness components were assessed: static balance by the one leg test (22), lower and upper body strength by the chair stand test and arm curl test, respectively (23), lower and upper body flexibility by the chair sit-and-reach test and back scratch test, respectively (23), agility/dynamic balance by the 8-foot up-and-go test (23), speed by the 30-m walk (24) and aerobic capacity by the 6-min walk test (23). All the tests were performed only once, except the one leg test, which was performed twice with each leg, the 8-foot up-and-go test and the 30-m walk test, which were also performed twice.

In the current study, three different categories (tertiles) were created for each fitness test based on the calculated scores and according to sex. The low tertile was composed of subjects who had the worst results in each fitness test, while the high tertile was composed of subjects who had the best results in each fitness test.