Acta Scientific MEDICAL SCIENCES (ISSN: 2582-0931)

Volume 7 Issue 9 September 2023

Research Article

Effects of Nutritional Status on Sarcopenia in Elderly Adults in Mexico

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DOI: 10.31080/ASMS.2023.07.1652

Received: July 18, 2023

Published: August 07, 2023

Abstract

Introduction: Sarcopenia is a musculoskeletal pathology associated with age, resulting in the loss of muscle mass and function. It has a high prevalence among the population of elderly adults. Its etiology is multifactorial; the intervening factors are nutrition, lifestyle and hormonal factors. Therefore, changing the aforementioned factors through a nutritional and physical rehabilitation approach is of great importance.

Objective: To identify the effect of nutritional status on sarcopenia in older adults. Material and Methods: Quantitative, cross-sectional, non-experimental study, which was carried out in 80 years old adults, from 60 to 70 years of age. The participants underwent an evaluation that included physical performance, strength and muscle mass; In addition, each participant completed two questionnaires to assess the risk of developing sarcopenia, along with a cognitive assessment, a nutritional assessment, and information about their independence in carrying out their normal daily activities.

Results: Mean nutritional status was 6.6 ± 1.30 in the group with sarcopenia. The mean BMI was 27.0 kg/m^2 ± 4.0 SD, with a lower and upper limit of 16.4 and 37.9 kg/m^2. 27% of the patients studied presented grade I obesity.

Conclusions: The ability to maintain strength and function of muscle mass in older adults is essential to prevent sarcopenia.

Keywords: Sarcopenia; Aging; Nutritional Assessment; Geriatric Evaluation; Muscle Mass; Muscle Strength

Introduction

Currently, the proportion of the population of elderly people is increasing rapidly throughout the world; statistically, the global population of people aged 60 and above has increased from 5 million, in 1990, to reach a total of 15.1 million in 2020. Elderly adults are a vulnerable group, in situation of crisis, their care rationed and are even denied medical treatment; this situation places elderly adults in a clinical context whereby there is a need for preventative measures. There is a large body of research that has widely shown that malnutrition is associated with higher rates of morbidity and mortality among elderly adults, mainly above the age of 70; it is, therefore, essential for the elderly to maintain an adequate, nutritious diet, both qualitatively and quantitatively, as well as maintaining a healthy lifestyle. The objective of the study was to identify the effect of nutritional status on sarcopenia among older adults, the aim being to carry out opportune diagnoses

on elderly adults regarding both their nutritional status and sarcopenia. To address the possible impacts of diet on sarcopenia, it is important to standardize the assessment of nutritional status. This will help in guiding elderly patients towards healthier lifestyle choices.

In 2010, the European Working Group on Sarcopenia in Older People (EWGSOP) expanded the definition to include impaired performance, determined by gait speed, or muscle weakness, regarding manual dynamometry; the Group also proposed an algorithm for the systematic evaluation of people with possible sarcopenia [1].

Sarcopenia is a disease of the elderly, which presents a gradual loss of skeletal muscle mass and a loss of muscle function. The disease is currently one of the most serious health problems among the elderly; it increases the risk of disability, falls, hospital admissions, and limits the activities necessary for everyday life. There are several risk factors for developing sarcopenia, including age, gender, type of physical activity, and comorbidities.

Preserving muscle mass and skeletal strength is crucial for maintaining the health and vitality of elderly individuals. After the age of 50, muscle mass declines annually by 1% to 2%, accumulating to a loss of up to 45% by age 80. Muscle strength reaches its peak in the second and third decades of life, after which it declines annually by approximately 1.5% between ages 50 and 60, and as much as 3% thereafter [2]. Additionally, after the age of 70, muscle strength in men may decline by around 1% per year, while in women it may decline by around 0.5% per year.

The European Working Group on Sarcopenia in Older People (EWGSOP) defines sarcopenia as a loss of skeletal muscle mass accompanied by decreased performance and/or muscle strength. Sarcopenia is commonly classified as primary or secondary. Primary sarcopenia is associated with the natural process of aging in the absence of other underlying factors. On the other hand, secondary sarcopenia may arise as a result of comorbidities which lead to muscle deterioration, compounded by factors such as insufficient physical activity, sedentary lifestyle, and inadequate intake of proteins [2].

Several risk factors have been identified, including muscular factors. Age-related loss of muscle function is characterized by both quantitative and qualitative changes, with structural and electrophysiological alterations observed in skeletal muscle from the sixth decade of life onwards. Skeletal muscle strength also begins to decline above the age of 30 and continues to decline with increasing age, as per [3].

Inadequate diets, malnutrition, and poor nutritional status are prevalent among older adults. Inadequate intake of macro and micronutrients has been linked to weight loss, as well as loss of muscle mass and strength [4]. Deficiencies in specific nutrients such as vitamins D, E, and C; proteins; and antioxidants, including carotenoids and selenium, can also contribute to muscle weakness, weight loss, and loss of muscle mass, ultimately leading to the onset of sarcopenia in affected individuals [5].

Sedentary behavior, a form of physical inactivity characterized by low energy expenditure, is a well-known risk factor for developing sarcopenia [6]. It is noteworthy that older adults spend an average of up to 10 hours daily in sedentary activities [7]. Research indicates that with every increase of one hour in daily sitting time, older adults are 33% more likely to develop sarcopenia [8].

A systematic review estimated that the prevalence of sarcopenia in older adults is up to 10%; however, only certain methods were applied to make the diagnosis, without considering other variables such as gender, physical activity, and comorbidities [9].

Other authors have also reported that various factors, such as the living environment, may influence the development of sarcopenia in older adults. A study identified significant differences in the prevalence of sarcopenia among older adults living in rural communities, nursing homes, and hospitals [10]. Hospitalized patients had a prevalence of up to 24%, whereas adults living in nursing homes reached a prevalence of 42%, according to [11].

There are several research groups that regulate the diagnostic criteria for sarcopenia. The main ones are the European Working Group on Sarcopenia in the Elderly (EWGSOP), the International Working Group on Sarcopenia (IWGS), the Asian Working Group on Sarcopenia (AWGS) and the American Foundation for the National Institutes of Health (FNIH) [12]. These research groups standardize the cut-off value in diagnostic criteria to assess muscle mass, muscle strength, and physical performance.

Sarcopenia is diagnosed when the older adult meets 2 of the following criteria: Decreased muscle strength, decrease in muscle mass and decreased physical performance. If all 3 criteria are met, sarcopenia is considered severe. The validated tests and instruments currently available for the use and identification of sarcopenia in clinical practice, and in research, depend on patient characteristics such as presence of disability or mobility, health conditions and comorbidities; however, the European Working Group on Sarcopenia in the Elderly (EWGSOP) recommends the application of the SARC-F questionnaire, in order to obtain information from older adults who present signs of sarcopenia.

The SARC-F questionnaire is easily used in clinical settings, since it has just 5 items and can be applied in the self-reported form, as a screening test for sarcopenia [13]. The responses to the questionnaire are based on the patient's perception of his/her limitations in strength, on the ability to walk, on getting up from a chair, climbing stairs and experiences with falls. This screening instrument was evaluated in three large populations by the African American Health Study, the Baltimore Longitudinal Study of Aging, and by the National Health and Nutrition Examination Survey, and was also used in a Chinese population study. In all these populations, the SARC-F was valid, and consistent, in identifying older adults at risk of developing sarcopenia [14-16].

Methodology

A cross-sectional study and descriptive was conducted elderly adults were included, who attended the internal medicine area clinic of the Regional General Hospital No. 58, in León, Guanajuato, México. The participants were selected using a simple random technique based on the availability of patients. The elderly adults were divided into two groups: the Group without Sarcopenia and the Group with Sarcopenia. The selection criteria included older adults of both genders within an age range of 60 to 70 years, with no cognitive impairment, and with the ability to maintain an upright position, the ability to perform a gait speed test. All the participants agreed to voluntarily participate in the research and sign the informed consent form. In addition, the participants were sedentary, presented a stable body weight and stated they had taken their medication consistently for 6 months prior to the study.

The exclusion criteria were older adults with any pathology that affects the strength of the extremities; patients with metabolic diseases; presence of non-specific pain in the extremities, if they had been discharged from hospital for any other health condition in the six months prior to the study. Additionally, older adults with cognitive impairment, a history of pacemaker use, or some physical disability, were also excluded from participation in the study.

Instruments

Two questionnaires were used to assess sarcopenia in the elderly: SARC-F and SARC-CalF [17-22]. Among the various evaluations administered, the assessment of cognitive functions was carried out using the Mini-Mental State Examination (MMSE) [23]. Regarding the nutritional, the Mini-Nutritional Assessment (MNA) scale was chosen. Independence in basic and instrumental activities of daily living was assessed using both the Katz scale [24] and the Lawton scale [25].

Results

A total of 250 older adults were studied. The average age of the participants was 68.9 years (60-70 years), 58.5% of the study sample were men; 36% of the patients had up to 5 years of primary schooling and 4% could neither read nor write; 76% belonged to a medium, or low, socioeconomic stratum. Sarcopenia was observed more frequently in patients who lived with someone else ($p < 0.001$). Women lived alone three times more frequently than men ($p < 0.001$) (Table 1).

Variables	Without Sarcopenia n = 110	With Sarcopenia n = 140	p
Age (years)	65.9 ± 4.8	63.6 ± 4.6	0.190
Gender			
Male (%)	63 (57.2)	89 (63.5)	0.149
Feminine (%)	47 (42.7)	51 (36.4)	
Education			
6-11 years (%)	49.0	39.2	0.440
Civil Status			
Accompanied (%)	59 (53.6)	102 (72.8)	0.001
Single (%)	51 (46.3)	38 (27.1)	

Table 1: Demographic characteristics of the Patients.

The data is expressed as mean ± standard deviation. Median, Frequency and Percentage. *p < 0.05.

In this study, the SARC-F scale was used to detect sarcopenia in 250 older adults. The results showed that 13.2 ± 3.2 of the patients had sarcopenia, and that there was a significant difference in the proportion of older adults evaluated as shown in Table 2. The results of this study clearly indicate that the prevalence of sarcopenia was 35.6% for men and 20.4% for women. Older adults with sarcopenia perform approximately four hours a week of physical activity. Total body fat did not show significant differences between the groups. Patients with sarcopenia showed a higher prevalence of disability regarding the instrumental activities of everyday life, thereby obtaining scores for dependence, or partial dependence, which showed significant differences when compared with the group of patients without sarcopenia. A high percentage of comorbidities were reported in the group of patients with sarcopenia.

Variables	Without Sarcopenia n = 110	With Sarcopenia n = 140	p
SARC-Cal F	5.4 ± 2.2	13.2 ± 3.2	0.001
Physical Activity	4.4 ± 1.5	4.1 ± 1.3	0.391
Total Body Fat	42.5 ± 6.1	43.6 ± 4.0	0.253
Mini-Mental State Examination (MMSE)	29.2 ± 1.3	27.2 ± 2.6	0.133
Katz Scale	4.8 ± 1.2	2.8 ± 0.2	0.001
Lawton Scale	17(5.9)	4(2.0)	0.004
Comorbidities (%)	108 (43.2)	138 (55.2)	0.499

Table 2: Clinical Characteristics of the Patients.

The data is expressed as median ± Standard deviation. *p < 0.05.

The variables to determine sarcopenia showed significant differences in the older adults studied, and the presence of sarcopenia was identified in 140 participants; in total, 1472 falls were reported by the group of patients with sarcopenia (Table 3).

Regarding nutritional status, the mean number of patients with sarcopenia was 6.6 ± 1.30. The maximum MNA score is 14 points. The Body Mass Index (BMI) classification identifies older adults in both overweight groups (Table 4). The average BMI was 27.0 kg/m^2 4.0 SD, with lower and upper limits of 16.4 and 37.9 kg/m^2. BMI was similar in both groups (29.4 ± 2.60 vs. 27.8 ± 1.7 kg/m^2). Finally, 27% of the patients studied presented Grade I obesity (Table 4).

Variables	Without sarcopenia n=110	With Sarcopenia n=140	*p*
Strength	1.01 ± 0.29	2.78 ± 0.26	0.001
Walking assistance	1.01 ± 0.24	2.38 ± 0.01	0.001
Rising from a chair with difficulty	1.05 ± 0.80	2.40 ± 0.12	0.001
Difficulty climbing stairs	1.02 ± 0.25	2.40 ± 0.98	0.001
Frequency of falls	1.06 ± 0.23	2.23 ± 0.97	0.001

Table 3: Comparison Questionnaire of SARC-F among patients.

The data is expressed as median ± standard deviation. *p < 0.05.

Variables	Without sarcopenia n = 110	With Sarcopenia n = 140	p
MNA	11.4 ± 1.60	6.6 ± 1.10	0.006
IMC (kg/m^2)	29.4 ± 2.60	27.8 ± 1.70	0.180

Table 4: Nutritional Status.

The data is expressed as median ± standard deviation. *p < 0.05. Mini Nutritional Evaluation (MNA), Body Mass Index (BMI).

Table 5 shows the results of the logistic regression analysis. The group of patients with sarcopenia had a significantly higher frequency of falls (OR = 2,911, 95% confidence interval = 1,526-5,550). The group of patients with sarcopenia had a significantly lower strength score (OR = 1.109, 95% confidence interval = 0.803-1.531). The group of patients with sarcopenia had a significantly higher Total Body Fat (OR = 1,392, 95% confidence interval = 1,048–1,850).

Variables	Without sarcopenia n = 110 OR (CI 95%)	With Sarcopenia n = 140 OR (CI 95%)	p
Frequency of falls	1.403 (0.949-2.075)	2.911 (1.526-5.550)	*p < 0.05
Strength	4.396 (2.030 – 9.518)	1.109 (0.803-1.531)	** p < 0.01
Total Body Fat	0.845 0.611-1.1657)	1.392 (1.048-1.850)	*p < 0.05

Table 5: Results of the logistic regression analysis.

The data is expressed as median ± standard deviation. *p < 0.05. ** p < 0.01.

Discussion

The objective of the study was to identify the effects of nutritional status on sarcopenia in older adults. This study offers novel results on sarcopenia among the Mexican population. The main findings of the present study were that the older adults, in whom sarcopenia was identified, had the characteristics of being overweight, with high levels of body fat mass, and low skeletal muscle mass.

The prevalence of sarcopenia in older adults varies widely between different countries. Sarcopenia occurred in 56% of the patients evaluated. Although the results of previous studies on the prevalence of sarcopenia are heterogeneous. Lee., *et al*. in 2019 have stated that the prevalence of sarcopenia range is between 10% and 20% [26]; however, the previous studies were not carried out on the Mexican population, which stands out due to the significant presence of comorbidities. In Mexico, the prevalence ranges between 9.3 and 33.6% [27].

These results are similar to those of previous studies conducted by Chan, in 2016, in which it was shown that male patients have a higher prevalence of sarcopenia. In the older adults of the present investigation, there was a higher prevalence of sarcopenia in men, which is consistent with the results of several previous studies [28].

Barbalho., *et al*. in 2020, stated that a sedentary lifestyle accelerates the aging process, which significantly contributes to the development of sarcopenia; this is consistent with the results obtained in this study, since 84.3% of the patients reported a sedentary lifestyle [29]. An increase in the number of falls among the group of patients with sarcopenia was also confirmed, and sarcopenia was shown to have a significant relationship with a history of falls. These results may be explained by the different risk of falls in men and women. Since the risk factors for falls are associated with those for sarcopenia, the correlation between falls and sarcopenia has been studied. However, the said association between sarcopenia and falls is controversial. Several previous studies have evaluated the association between sarcopenia and falls, defined by standardized diagnostic criteria. In an Italian study, Landi., *et al*. studied the relationship between sarcopenia and the risk of falls over a 2-year period. From a total of 250 patients, aged ≥80 years, falls were highly prevalent among the older adults with sarcopenia, regardless of differences in gender [30]. Obesity is a risk factor for many chronic diseases, including cardiovascular and metabolic diseases [31]. Obesity also affects muscle quality and decreases physical capacity [32]. Sarcopenic obesity is the term used to describe the condition that involves low muscle mass and a high percentage of body fat [33]. All the patients evaluated were overweight, according to the BMI classification; obese, according to the percentage of total body fat, which is consistent with that stated by Blüher, in 2019., where he points out that the decrease in muscle mass and strength, known as sarcopenia, is very common among obese older adults [34].

Other authors point out that older adults with sarcopenia present malnutrition, with a prevalence of 30%, though this contradicts the results obtained in the present study, since none of our patients presented malnutrition [35], This may be partly because, the SARC-F questionnaire is a simple tool specifically designed for the rapid diagnosis of sarcopenia. However, it does

not incorporate nutritional aspects in its screening process for sarcopenia. In our opinion, addressing questions related to regular meals and protein intake is crucial when it comes to secondary sarcopenia, as inadequate nutrition is one of the most common contributing factors. It is well-documented that both the overall caloric intake and the appropriate quantity, quality, and distribution of dietary proteins play significant roles in preventing muscle mass loss [36-38].

While BMI is a straightforward measure for estimating obesity, it may not provide a comprehensive assessment of muscle mass and body fat. Increasing evidence emphasizes the importance of considering both muscle function and mass when evaluating the risk of obesity in older individuals.

Limitations

The limitations of this study are as follows. First, the number of participants was relatively small. Second, the study was conducted in a part of Mexico. Third, the use of the SARC-F questionnaire to identify sarcopenia is a major limitation to our study. While it is well known that the most accurate methods of muscle assessment are magnetic resonance imaging (MRI), computed tomography (CT) or dual energy X-ray absorptiometry (DEXA), these methods are difficult to use due to their high cost and technical requirements. In addition, its availability in the diagnosis of sarcopenia in our country is limited.

The evaluation of sarcopenia with the use of the SARC-F questionnaire is a non-invasive method and can be repeated without restrictions. The SARC-F instrument is simple and inexpensive, allowing for evaluation in the patient's place of life.

Conclusions

The assessment of sarcopenia by means of scales is a non-invasive method that can be repeated without restrictions. The scales for evaluate sarcopenia are simple and cheap, thus allowing the evaluation to be carried out in the patient's residence.

More research is required to determine the mechanisms of increased adipose tissue, resulting from decreased muscle mass in older adults. Finally, it is important to highlight that the ability to maintain musculoskeletal mass, strength, and muscle function in older adults, is essential to preventing the occurrence of sarcopenia.

Interest Conflict

The authors declare no conflict of interest.

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