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Body composition and nutritional status of active and sedentary elderly people: are gender and age intervening factors?

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Abstract

Considering the functional changes and in view of the changes in body composition to which the elderly are exposed, it is necessary to conduct studies that seek to verify the influence of variables such as sex and age on body composition and nutritional status in this population. This study compared body composition and nutritional status among physically active and sedentary elderly people according to sex and age. 651 elderly users of Basic Health Units in Maringá-PR participated, who answered the Mini Nutritional Assessment and the International Physical Activity Questionnaire. Data analysis was performed using the Kolmogorov-Smirnov, Kruskal-Wallis and Mann-Whitney U tests ($p<0.05$). The results showed that irregularly active men had a lower weight, waist circumference and body mass index than active and sedentary men. Sedentary men had a greater hip circumference than the other groups, while the active ones had a higher score in the mini nutritional assessment. Active women had a lower waist-to-hip ratio than irregularly active and sedentary women. In addition, irregularly active men reported a poorer nutritional status than active and sedentary men. It was concluded that the level of physical activity can be considered an intervening factor in the body composition of the elderly, especially among males, in addition to interfering in the nutritional status of the elderly over 70 years old.

Keywords: Motor activity; Nutrition; Exercise.

INTRODUTION

The aging process reduces the physiological reserve in different organic systems[1,2]. Thus, it contributes to the progressive loss of functional capacity and interferes with both nutritional status and body composition, consequently exposing the elderly to a state of greater vulnerability[1,2]. It is possible that there is also a decrease in certain abilities of the nervous system, such as sensory processing and adaptive reflexes, which cause situations of postural instability, changes in motor coordination, imbalance and greater predisposition to falls[3]. In addition, musculoskeletal changes may occur, which are mainly due to muscle hypotrophy and bone demineralization[2]. These changes, in turn, decrease the efficiency of the musculoskeletal system, negatively influence flexibility and muscle strength and, therefore, compromise the level of physical activity of these individuals[2].

Like physical performance, nutritional status

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is also an important indicator of the health of the elderly[4]. Nutritional changes during aging are linked to body changes, such as a reduction in lean mass, mainly in muscle mass and bone mineral density, and an increase in the redistribution of body fat; with a greater accumulation in the trunk and viscera and a decrease in the limbs[5]. Nutritional status has been used to measure and monitor the body's changes during aging, through variables indicative of fat accumulation and the loss or gain of muscle mass[6,7].

However, on the one hand, determining the nutritional diagnosis and the identification of associated factors in the elderly are fundamental for specific intervention policies to be developed, on the other, it can be said that they are quite complex processes[4]. Such complexity is due to the existence of changes inherent to the aging process itself as well as to the existence of social, economic and lifestyle factors, which can also directly interfere with nutritional status[8].

Considering the functional changes and given the changes in body composition to which the elderly are exposed, it is necessary to carry out studies that seek to verify the influence of variables such as sex and age on body composition and nutritional status in this specific population. Therefore, this study aimed to compare body composition and nutritional status among physically active and sedentary elderly people according to sex and age.

The initial hypothesis is that women, and older, sedentary elderly people, would have greater weights, body mass indexes (BMI) and greater circumferences than their peers.

METHODOLOGY

Participants

The sampling process of this cross-sectional epidemiological study was carried out in two stages. Initially, Basic Health Units (BHUs) were listed in the four regions of the city of Maringá, PR: Eastern Region (7 BHUs), which included 21.8% of the population, Northern Region (8 BHUs) with 34.5% of the population, Western Region (8 BHUs) with 23.2% of the population and the Southern Region (8 BHUs) which included 20.4% of the total elderly population. From this, three BHUs from each geographic region were selected at random to participate in the study, totaling 12 BHUs. According to data from the Health Department of Maringá, PR, in 2016, approximately 42,000 elderly people are attended to by the BHUs in the city. From this target population, the sample considered was 651 elderly people, who were selected for convenience while recognizing possible sample losses. A 95% confidence level and a 4% margin of error were adopted, and the software used to obtain the calculations was StatDisk version 8.4.

In this case, 142 elderly people were collected in the eastern region, 125 elderly people in the northern region, 133 elderly people in the southern region, and 151 elderly people in the western region, totaling 651 elderly people.

The study included elderly people of both sexes aged 60 years or more, with preserved speech and hearing capacity, which allowed for the questionnaires to be applied. Elderly people with possible cognitive deficits were excluded, as assessed by the Mini-Mental State Examination (MMSE)[9,10].

Instruments

For the characterization of the sociodemographic and health profile, a semi-structured questionnaire was used, consisting of information regarding gender, age group, marital status, monthly income in minimum wages (MW), retirement, health perception, reason for

going to BHU, medication use, history of falls in the previous semester and history of almost falls in the previous semester.

The elderly's weight was measured using a Mondial digital scale, in which the elderly person was evaluated barefoot on the device, with appropriate clothing. Height was measured with a measuring tape attached to the wall. Through these data, the Body Mass Index (BMI) was calculated by dividing body mass in kg by height in square meters[11].

Waist circumference was measured with the aid of a flexible and inelastic measuring tape at the anatomical point between the iliac crest and the last rib, taking care not to compress the tissues. Hip circumference was measured at the largest hump of the hip. The waist-to-hip ratio (WHR) was also assessed. The calf circumference was also assessed with the aid of an inelastic measuring tape, measured around the greater prominence of the calf[12].

To complete the assessment of nutritional status, the Mini Nutritional Assessment (MNA) was used, developed by Nestlé® Nutrition Institute, which is a tool that can identify nutritional risk or installed malnutrition. The detection of these risks, to any degree, is an important measurement for the adequate nutritional guidance of these elderly people. The assessment is divided, in addition to screening, into four parts: anthropometric assessment (BMI, arm circumference, calf circumference and weight loss); global assessment (questions related to lifestyle, medication, mobility and psychological problems); dietary assessment (questions regarding the number of meals, food and liquid intake and autonomy in diet); and self-assessment (self-perception of health and nutritional condition). For the whole MNA questionnaire, the following scores were considered: adequate nutritional status: MNA ≥ 24; risk of malnutrition: MNA between 17 and 23.5; malnutrition: MNA <17[13].

The level of physical activity of the elderly was assessed using the short version of the International Physical Activity Questionnaire - (IPAQ). It consists of seven open questions and its information helps estimate the time spent per week in different dimensions of physical activity (walking and physical efforts of moderate and vigorous intensity) and physical inactivity (sitting position). The level of physical activity was classified as sedentary, irregularly active, active or very active[14].

Procedures

Initially, contact was made with the Training and Permanent Qualification of Health Workers (CECAPS) in order to obtain authorization for data collection. Then, the research project was approved by the Research Ethics Committee of the Centro Universitário de Maringá (UNICESUMAR) through opinion 1.626.966/2016, in accordance with the rules of Resolution 466/12 of the National Health Council on research involving human beings.

The elderly volunteers were approached by the researchers, informed concerning the motive, objectives and procedures to be performed. After these procedures, those who agreed to participate in the study signed the Informed Consent Form (ICF). The collection was carried out in different days, shifts and times, according to the availability of the researchers. The direct interview was chosen for the application of the questionnaires, due to the possible difficulty in reading, visual problems and understanding of the questions.

Data analysis

The analysis was performed using a descriptive and inferential statistical approach. Frequency and percentage were used as descriptive measures for categorical variables. Pearson's chi-square test (X2) was used to compare the proportions of sociodemographic

variables according to the level of physical activity (very active/active, irregularly active and sedentary). For the numerical variables, the normality of the data was initially verified using the Kolmogorov-Smirnov test. Since the data did not present a normal distribution, Medians (Md) and Quartiles (Q1; Q3) were used to characterize the results. In comparing the body composition and nutritional status of the elderly according to the level of physical activity, the Kruskal-Wallis test was used, followed by the Mann-Whitney U test for pairs of groups. A significance level of $p<0.05$ was considered.

RESULTS

Elderly females (56.0%), married (61.3%), aged between 60 and 69 years (59.2%), with monthly income of one to two minimum wages (70.0%), white (81.0%) and retirees (75.0%) were more prevalent. It was also observed that the majority of the elderly had an incomplete elementary education (43.0%).

When comparing the proportions of sociodemographic variables according to the level of physical activity (very active/active, irregularly active and sedentary), there was a significant difference in the proportions only between the age group (p=0.017) and education (p=0.034), showing a tendency for very active/active elderly people to be younger and to have a higher level of education. There was no significant difference (p>0.05) in the proportions of the other sociodemographic variables.

Regarding the level of physical activity (Table 1), it was noted that the elderly did not perform vigorous activities and few moderate activities during the week. However, elderly individuals had a median of 3.0 walking days, with a median of 40.0 and 140.0 minutes of walking per day and week, respectively. Regarding BMI and the mini nutritional assessment score, the elderly participants had a median of 26.5 and 25.5, respectively.

There was a significant difference (Table 2) between groups for men regarding weight (p=0.001), abdominal circumference (AC) (p=0.002), hip circumference (HC) (p=0.027), MNA (p=0.002) and BMI (p=0.025). This result indicates that the irregularly active elderly had a lower weight, AC and BMI than the very active/active and sedentary elderly. In addition, sedentary elderly people had a higher HC than elderly people in other groups, while physically active elderly people had a higher score in the mini nutritional assessment.

There was a significant difference among the groups of women (Table 3) only regarding the WHR (p=0.048). This result indicates that the very active/active elderly women had lower WHR than the irregularly active and sedentary elderly women. No significant difference was found (p>0.05) in the other variables depending on the level of physical activity for women.

No significant difference was found (p>0.05) in any of the variables of body composition and mini nutritional assessment of the elderly aged between 60 and 69 years depending on the level of physical activity (Table 4). This result indicates that the level of physical activity does not seem to be an intervening element in the body composition and nutritional status of younger elderly people. Table 5 shows the comparison of body composition and nutritional status of elderly users of primary health care over 70 years of age comparing with the level of physical activity.

There was a significant difference only in the mini nutritional assessment (p=0.002) of the elderly over 70 years of age due to the level of physical activity (Table 5), indicating that the irregularly active elderly reported a poorer nutritional status than the physically active and sedentary elderly. No significant difference was found (p>0.05) in any of the body composition variables.

Table 1- Descriptive analysis of body variables, physical activity and nutritional status of elderly primary health care users in Maringá, PR.

VARIABLES	Md	Q1-Q3
Weight	71.0	63.0-80.0
Height	1.62	1.54-1.68
Waist circumference	90.0	81.0-98.0
Hip circumference	100.0	94.0-106.0
Calf circumference	34.0	31.0-36.0
Waist-to-hip ratio	0.91	0.85-0.96
BMI	26.5	24.1-29.4
Mini nutritional assessment	25.5	23.0-27.5
Physical activity		
Walking Days	3.0	2.0-6.0
Min. Walk per day	40.0	20.0-90.0
Min. Walk per week	140.0	60.0-420.0
Moderate activity days	1.0	0.0-3.0
Min. of moderate activity per day	20.0	0.0-60.0
Min. of moderate activity per week	30.0	0.0-180.0
Days of vigorous activity	0.0	0.0-0.0
Min. of vigorous activity per day	0.0	0.0-0.0
Min. of Vigorous activity per week	0.0	0.0-0.0

BMI: body mass index; min.: minutes.

Table 2- Comparison of body composition and nutritional status of elderly male primary health care users according to the level of physical activity.

VARIABLES	Physical activity level			P
	1. . Very active/ active (n = 396)	2. . Irregularly active (n = 179)	3. Sedentary (n = 76)	
	Md (Q1;Q3)	Md (Q1;Q3)	Md (Q1;Q3)	
Weight	77.4 (68.3; 84.9)	70.9 (65.9; 77.0)[a]	76.8 (68.4; 87.8)	**0.001***
WC	93.0 (85.0; 99.8)	89.0 (80.0; 98.0)	94.5 (85.5; 101.0)	0.060
AC	97.0 (90.0; 104.0)	93.0 (84.0; 101.0)[a]	102.5 (93.0; 109.8)	**0.002***
HC	99.0 (94.0; 104.0)	98.0 (90.0; 102.5)	103.0 (97.0; 107.8)[b]	**0.027***
CC	34.0 (32.0; 36.0)	33.0 (30.0; 36.0)	35.0 (33.0; 37.0)	0.108
WHR	0.94 (0.90; 0.99)	0.94 (0.89; 0.99)	0.94 (0.85; 0.98)	0.380
BMI	26.7 (24.4; 29.5)	25.4 (23.7; 28.2)[a]	27.3 (24.9; 30.0)	**0.025***
Mini Nutritional Evaluation	26.5 (24.0; 28.0)[c]	25.0 (22.5; 26.5)	24.5 (22.5; 26.9)	**0.002***

Significant difference: p<0.05 - Kruskal-Wallis test between: a) 2 with 1 and 3; b) 3 with 1 and 2; c) 1 with 2 and 3. NOTE: WC = Waist circumference; AC = Abdominal circumference; HC = Hip circumference; CC = Calf circumference; WHR = Waist-to-hip ratio; BMI = Body Mass Index.

Table 3- Comparison of body composition and nutritional status of elderly female primary health care users according to the level of physical activity.

VARIABLES	Physical activity level			P
	1. Very active/ active (n = 396)	2. Irregularly active (n = 179)	3. Sedentary (n = 76)	
	Md (Q1;Q3)	Md (Q1;Q3)	Md (Q1;Q3)	
Weight	67.6 (60.4; 75.6)	69.9 (60.3; 79.0)	72.0 (60.4; 82.7)	0.158
WC	88.0 (79.1; 94.8)	89.0 (82.5; 96.5)	90.0 (80.5; 99.0)	0.188
AC	95.0 (86.1; 102.9)	96.0 (89.5; 102.5)	97.0 (87.0; 104.0)	0.553
HC	100.0 (93.0; 107.0)	101.0 (97.0; 108.0)	100.0 (96.0; 110.0)	0.261
CC	33.0 (31.0; 35.5)	34.0 (30.1; 36.0)	33.0 (31.0; 36.0)	0.961
WHR	0.87 (0.82; 0.93)a	0.89 (0.85; 0.94)	0.88 (0.84; 0.93)	**0.048***
BMI	26.9 (24.2; 30.0)	25.8 (23.5; 29.4)	26.7 (24.3; 31.7)	0.387
Mini Nutritional Evaluation	25.5 (23.0; 27.5)	24.0 (22.0; 26.8)	26.0 (22.8; 27.0)	0.209

* Significant difference: p<0.05 - Kruskal-Wallis test between: a) 1 with 2 and 3. NOTE: WC = Waist circumference; AC = Abdominal circumference; HC = Hip circumference; CC = Calf circumference; WHR = Waist-to-hip ratio; BMI = Body Mass Index.

Table 4- Comparison of body composition of elderly primary health care users aged between 60 and 69 years old, depending on the level of physical activity.

VARIABLES	Physical activity level			P
	1. Very active/ active (n=248)	2. Irregularly active (n=97)	3. Sedentary (n=42)	
	Md (Q1;Q3)	Md (Q1;Q3)	Md (Q1;Q3)	
Weight	73.0 (63.0; 81.0)	70.9 (64.5; 78.7)	75.6 (63.5; 88.0)	0.271
WC	89.0 (81.0; 98.0)	90.0 (81.0; 98.0)	90.0 (81.0; 98.5)	0.924
AC	96.0 (87.0; 103.0)	94.0 (88.0; 102.0)	98.0 (87.8; 105.0)	0.397
HC	100.0 (94.0; 107.0)	100.0 (94.0; 105.0)	99.5 (96.0; 108.0)	0.892
CC	34.0 (31.0; 36.0)	34.0 (30.1; 36.0)	34.8 (31.9; 36.6)	0.684
WHR	0.90 (0.83; 0.95)	0.91 (0.86; 0.96)	0.90 (0.85; 0.95)	0.243
BMI	27.4 (24.5; 30.5)	26.2 (23.9; 29.4)	27.7 (24.6; 32.3)	0.080
Mini Nutritional Evaluation	26.0 (23.0; 28.0)	25.0 (23.0; 26.8)	24.8 (22.5; 26.6)	0.160

* Significant difference: p<0.05 - Kruskal-Wallis test between: a) 1 with 2 and 3. NOTE: WC = Waist circumference; AC = Abdominal circumference; HC = Hip circumference; CC = Calf circumference; WHR = Waist-to-hip ratio; BMI = Body Mass Index.

Table 5- Comparison of body composition and nutritional status of elderly primary health care users over 70 years of age according to the level of physical activity.

VARIABLES	Physical activity level			
	1. Very active/ active (n=149)	2. Irregularly active (n=83)	3. Sedentary (n=35)	P
	Md (Q1;Q3)	Md (Q1;Q3)	Md (Q1;Q3)	
Weight	68.3 (62.0; 76.0)	70.0 (64.0; 76.0)	73.0 (64.5; 79.7)	0.258
WC	89.0 (82.0; 95.5)	89.0 (81.5; 95.5)	93.0 (83.5; 100.5)	0.424
AC	95.5 (88.0; 102.5)	94.0 (87.7; 101.3)	99.0 (89.5; 108.5)	0.253
HC	99.0 (93.0; 105.0)	99.3 (92.7; 103.0)	102.0 (97.5; 109.0)	0.071
CC	33.0 (31.0; 35.0)	33.0 (30.0; 36.0)	33.5 (31.0; 36.8)	0.532
WHR	0.92 (0.85; 0.96)	0.93 (0.88; 0.98)	0.89 (0.85; 0.96)	0.080
BMI	25.8 (24.0; 28.4)	25.2 (23.4; 28.2)	26.7 (24.2; 29.5)	0.211
Mini Nutritional Evaluation	26.5 (24.0; 28.0)	24.0 (21.5; 26.5)[a]	26.0 (23.5; 27.0)	**0.002***

* Significant difference: p <0.05 - Kruskal-Wallis test between: a) 1 with 2 and 3. NOTE: WC = Waist circumference; AC = Abdominal circumference; HC = Hip circumference; CC = Calf circumference; WHR = Waist-to-hip ratio; BMI = Body Mass Index.

DISCUSSION

The main findings revealed that among elderly males, those who were irregularly active had a lower weight, AC and BMI, while those who were sedentary had a higher HC and those who were active had a higher MNA score. Among women, the very active/active women had lower WHR. On the other hand, the level of physical activity does not seem to be an intervening element in the body composition and nutritional status of younger elderly people. Moreover, among the elderly aged 70 and over, the irregularly active reported a poorer nutritional status than the physically active and sedentary elderly.

Irregularly active elderly men had lower weight, AC and BMI. At first, having a lower weight and lower BMI seems positive, however weight loss after the age of 60 may be associated with some negative health conditions, such as sarcopenia and sarcodinapenia15. Thus, in order to characterize this data as bad or good, it is interesting to analyze other variables that could measure nutritional status. Therefore, abdominal circumference is used as an important indicator of body composition16. Abdominal circumference is a measure of adiposity and when high, it can confer important cardiometabolic risks[16]. Considering that they are irregularly active elderly people, it is possible to infer that they do not practice enough physical exercises to generate a significant increase in lean mass or even have a substantial energy expenditure. However, we can agree with Araújo Leite, who suggests that performing physical activity even though irregularly, that is, without reaching the frequency and intensity values proposed by health agencies, it is considered better than being totally physically inactive[17].

It was also found that sedentary elderly men had a higher HC. The ratio between waist and hip circumference is an anthropometric indicator of fat[16]. The literature points out that high circumference and hip measurements

suggest a higher concentration of fat, which are also risk factors for cardiovascular diseases[16,18]. Considering that sedentary elderly people do not reach the recommended energy expenditure, it is assumed that the accumulation of fat is more expressive in this group. As suggested by the studies by Correa *et al.*[16] and by Tavares[18]. According to Tavares, physical inactivity proved to be one of the most significant factors in relation to the increase in HC and other risk associations related to cardiovascular disorders[18].

In the present study, active elderly men demonstrated a better nutritional status. This finding agrees with the study by Fontenelle *et al.*[19]. In the study by Fontenelle *et al.,* the nutritional status of the elderly was assessed using the MNA (Mini Nutritional Assessment) and these data were crossed with the physical activity profile of the elderly19. The authors found that the elderly who practiced physical activity between 3 and 6 days a week daily presented a nutritional profile superior to the sedentary and irregularly active elderly[19].

Very active/active women had a lower WHR. The high measurements of the ratio between circumference and hips is indicative of adiposity[16,19]. The literature shows that a high WHR increases the likelihood of cardiometabolic disorders, in addition to suggesting inadequate nutrition[16,19]. The fact that very active and physically active women have a lower WHR is a very relevant fact, since elderly women have already gone through menopause, which leads to a reduction in the secretion of the hormone estrogen (which among its various functions provides a cardio-protective effect) and the increased chance of accumulation of adipose tissue in the waist and hip[18]. Therefore, the finding in the present study corroborates the effectiveness of regular physical activity in terms of reducing body fat and reducing the WHR.

In the study by Costa and collaborators, carried out with undeclared elderly participants in physical activities, a high rate of adiposity in the WHR was demonstrated[20]. The authors pointed out that the aging process causes a reduction in muscle mass as well as an increase in the percentage of fat, and these changes compromise both the anthropometric measurement and the health of the elderly[20]. In addition to the changes inherent to aging, it is also important to mention the individual's nutrition, which is influenced by socioeconomic conditions and also by the elderly's food preferences, which end up being modified throughout life; especially since the elderly tend to prefer softer and easier to prepare foods.

Silva and collaborators point out that changes in smell and taste and chewing difficulties can reduce appetite[21]. In addition, psychosocial factors such as widowhood, evasion of children from home, leaving work and retirement and the difficulty in preparing food itself can lead to changes in the elderly's food preferences[21]. Thus, anthropometric data take us beyond sedentary behavior and make us reflect on the nutritional status of the elderly. In a study carried out by Paiva and collaborators with physically active elderly people, it was found that although 39.99% of the elderly practice physical activities 3 to 5 times a week, their waist circumference was high in both sexes[22].

The present study showed that physical activity does not seem to be an intervening element in the body composition and nutritional status of younger elderly people (60 to 69 years old). In fact, more recent studies have admitted the categorization of elderly people within their own age group[23,24]. This may be partly due to the increase in life expectancy and partly due to the increase in the number of studies that reveal the heterogeneity of this population[23,24]. Therefore, placing elderly people of different ages in the same group is not the most appropriate approach.

One study[18] demonstrated that younger elderly people can in fact have better levels of health compared to older elderly people, just as adults can have more satisfactory levels of health in relation to younger

elderly people[18,25]. Another important factor highlighted by Tavares[18] is that younger elderly people tend to be more physically active in their daily activities, as the tendency is for them to still have functionality, autonomy and independence in better conditions when compared to older elderly people. This may be a factor that leads us to better understand this finding.

Among the limitations of the study, it is important to mention that this was a cross-sectional study, without monitoring over time, so it is not possible to establish cause-effect relationships. In addition, there the limitation with the use of a self-reporting instrument to assess the level of physical activity.

CONCLUSION

It can be concluded that the level of physical activity can be considered an intervening factor in the body composition of the elderly, especially in the male sex, in addition to interfering in the nutritional status of the elderly over 70 years. From a practical point of view, the importance of physical activity programs during the aging process for men and the elderly over 70 years old is highlighted, since sedentary lifestyle for such groups can lead to worsening body composition.

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