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Original article

Prevalance of sarcopenia according to decade

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SUMMARY

Aim: Our study aimed to identify Skeletal Muscle Mass Index (SMMI) cut-off values for sarcopenia diagnosis in our population and determine the prevalance of sarcopenia, and to collect data about reducing the disease load.

Method: The study was completed with 515 volunteers divided into groups based on ages of 18–39 years, 40–49 years, 50–59 years, 60–69 years, 70–79 years and 80 years and older. All groups had SMMI, muscle strenght physical performance assessed, with sarcopenia diagnosis made using the European Working Group on Sarcopenia in Older People (EWGSOP) diagnostic criteria.

Results: Together with advancing decades, there were significant reductions observed in SMMI, hand grip test (HGT) and 4-m walking test (4MWT) values. For females and males, the reduction in HGT and 4MWT values began after 50 years of age, while the reduction in SMMI began after 70 years for males and after 60 years for females. The prevalance of sarcopenia in the 40–49, 50–59, 60–69, 70–79 and 80 years plus age intervals were identified as 7%, 10.6%, 15.4%, 21.2% and 36.5%, respectively.

Conclusion: Identification of sarcopenia prevalence in our population is important due to limitations of treatment administered after diagnosis is made.

1. Introduction

Sarcopenia was a term first used by Irwin Rosenberg in 1989 to describe the reduction in muscle mass related to age [1,2]. The first functional definition was provided by Baumgartner et al. as muscle mass below the mean muscle mass of the young adult population [3,4].

Sarcopenia may be observed at young ages secondary to situations like chronic diseases, sedentary lifestyle and malnutrition, but primarily is seen with the aging process above 65 years. It is defined as a geriatric syndrome characterized by progressive loss of muscle mass and muscle strenght functions (dynapenia) and linked to this, negative results like falling, reduced physical and cognitive capacity, low quality of life, increased dependence and death [5–11].

Prevalence of sarcopenia varies according to gender, age, place of residence, ethnic background, assessment scales and cut-off values. Much research has stated the sarcopenia prevalence is between 5 and 25% from 60 to 70 years and 11–50% above 80 years. Studies have identified 6% muscle loss every 10 years from the age of 45 onward [12]. In a systematic review of the International Sarcopenic Initiative's study of sarcopenia studies in populations aged 50 years and over, the prevalence of sarcopenia in the community was reported to be between 1 and 29% in relation to regional and age variations [13]. The World Health Organization states the population affected by sarcopenia at present is 50 million and predicts that this number will reach 200 million within the next 40 years [5,12,14].

EWGSOP divides sarcopenia into three groups as presarcopenia, sarcopenia and severe sarcopenia. In the presarcopenia stage, muscle strength and physical performance is not affected; however, muscle mass reduces. In the sarcopenia stage, there is a reduction in muscle strenght or performance along with the reduction in muscle mass. In severe sarcopenia there are reductions for all three criteria (muscle mass, muscle strenght and performance [15].

With identification of sarcopenia in the early stages, it is possible to contribute to improvement of clinical results with precautions like adding protein supplementation to diet and performing resistance exercises to improve muscle functions.

In our study, the aim was to identify SMMI cut-off values for sarcopenia in our population and determine the prevalance of sarcopenia and to collect data related to reducing disease load.

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2. Material and method

2.1. Population and sample for the research

The sample for the research comprised a total of 515 healthy volunteers from among Ordu University Education and Research Hospital and Ordu State Hospital employees (doctors, nurses, assisting health staff, security guards, medical secretaries) and their families, who accepted participation in the study, had normal neurological examination, had no known chronic disease apart from hypertension and no chronic medication use, and had not lost more than 10% of body weight within the last 6 months. Patients in the 60 years and older groups had GDS points below 10, MMSE score above 24, while the HDRS points for the group below 60 years was below 7. The participants were divided into groups based on age as 18–39 years, 40–49 years, 50–59 years, 60–69 years, 70–79 years and 80 years and older.

2.2. Data collection tools

Detailed neurological examinations (NE) of participants were conducted. Cognitive and perceptual (mood) functions were assessed by using GDS and MMSE in groups 60 and over and by using HDRS in groups below 60 years.

Participants had SMMI (bioelectrical impedance analysis BIA), muscle strenght (Jamar hand dynamometry) and physical performance (4-m walking test) measured.

2.3. Standardized mini mental state examination (MMSE)

First published by Folstein et al. [16]. The test may be used to identify global cognitive levels with a short, useful and standardized method. The test comprises eleven items collected under five main headings of orientation, recording memory, attention, calculation, recall and language and total points are assessed as 30. The Turkish validity and reliability study was performed by Güngen et al. [17].

2.4. Hamilton depression rating scale (HDRS)

Developed by Hamilton [18], the scale contains 17 items. The scale is used to determine the severity of depression. The subdimensions are depressive mood, suicide, loss of work and functions, mental retardation, agitation, gastrointestinal symptoms, general psychosomatic symptoms, hypochondriac symptoms, loss of insight in the individual, reduced appetite and weight loss, insomnia and anxiety [18,19]. Total points of 0–7 are accepted as no depression, 8–12 indicates mild levels of depression, 13–17 indicates moderate levels of depression, 18–29 shows major depression and 30–52 shows severe major depression [18]. Validity and reliability studies for our country were completed by Akdemir et al. [19].

2.5. Geriatric depression scale (GDS)

Yesavage et al. were developed, validity and reliability studies were performed [20]. It consists of 30 questions for elderly, based on self-determination and easy to answer. Somatic symptoms such as sleep disturbances, sexual dysfunction, body pain and seizures are not evaluated on the scale. Answering is simply a measure of “yes” or “no”. Each response is worth one point in favor of depression, and the other answers are worth zero points. In our country, validity and reliability have been made by two different groups [21,22].

2.6. Sarcopenia and dynapenia

With the aim of determining body composition to assess sarcopenia, BIA, handgrip strength and 4-m walking speed were examined. EWGSOP diagnostic criteria were used for sarcopenia diagnosis.

Height (cm) and weight (kg) were measured in light clothing without shoes. Body mass index (BMI) was obtained by dividing body weight by the square of height (kg/m^2).

Measurements were made with TANİTA TBF-300 brand bioimpedance device in order to determine "muscle mass" in the individuals who meet the criteria. The measurements were made after at least 4 h fasting in the morning hours, resting for 4–5 min in the lying position and with bare feet. The SMMI was calculated by dividing the skeletal muscle mass by the width of the neck. SMMI according to the BIA,2 standard deviations (8,89 kg/m^2 for females, 10,50 kg/m^2 below for males) were considered as low in muscle mass.

A Jamar brand hand dynamometer was used for the hand grip test to assess muscle strenght. Individuals were asked what hand they actively used to determine the dominant hand. Measurements were performed by the same assisting researcher in accordance with the literature [23]. Individuals sat on a chair, with elbows on the table and arms parallel in 90-degree flexion; measurements were made 3 times with 1 min rest periods for both right and left hands. The highest value of the three measurements was taken. Measurements below 30 kg for males and below 20 kg for females was accepted as “low muscle strenght (dynapenia)” [15].

Physical performance was assessed with general walking speed. For the 4-m walking test, the patient walked 4 m while standing and this duration was recorded in seconds with a chronometer. Walking rate for both males and females was accepted as normal for 0.8 m/s, while those with rate 0.8 m/s and below were accepted as at risk of sarcopenia [15].

2.7. Ethical aspect of the research

To perform this study with the aim of determining the prevalance of sarcopenia according to decade, permission was granted by Ordu Provincial Health Directorate and Ordu University Education and Research Hospital ethics committee decision number 2018/52. Participation in the research was on a voluntary basis, with no names written on data collection forms. Participants were told that the information collected would not be used for any aim outside the research. Written informed consent was obtained from all participants included in the study.

2.8. Statistical analysis

The Shapiro–Wilk test was applied to check the assumption of normality for characteristics investigated in the research ($P > 0.05$). To determine the differences in BMI, SMMI, HGT and 4MWT according to gender (female-male) and age groups, the one-way ANOVA and Tukey multiple comparison tests were used. The results are given as sample size (n), mean ± standard deviation and p-values. According to the BIA, SMMI cut-off values were considered below 2 standard deviations (8,89 kg/m^2 for women and 10,50 kg/m^2 for men) compared to the young healthy group.

Additionally, the prevalance rate according to the age groups (18–39, 40–49, 50–59. 60–69. 70–79, 80 years and older) and sarcopenia stages (normal, presarcopenia, sarcopenia and severe sarcopenia) were assessed with the chi-square test (Fisher's exact test). The results for the Chi-square test (Fisher's exact test) are given as sample size (n), percentages (%) and p-values. All statistical computations were completed using SPSS 21.0 V. statistical package program.

3. Results

In our study, there were 60 healthy female volunteers in the 18–39year control group. The BMI, SMMI, HGT and 4MWT values were 27.49 ± 4.69 kg/m^2, 11.26 ± 1.18 kg/m^2, 28.50 ± 4.89 kg and 1.57 ± 0.30 m/s respectively. The SMMI cut-off value for females (mean-2SD) was 8.89 kg/m^2.

There were 60 healthy male volunteers in the 18–39 year control group in our study. The BMI, SMMI, HGT and 4MWT values were 27.51 ± 3.32 kg/m^2, 12.32 ± 0.91 kg/m^2, 44.28 ± 7.57 kg and 1.89 ± 0.39 m/s, respectively. In males the SMMI cut-off value (mean-2SD) was 10.50 kg/m^2.

When the BMI, SMMI, HGT and 4MWT measurement distribution of participants according to age group are investigated, in both females and males apart from BMI values the investigated parameters (SMMI, HGT, 4MWT) had significant differences determined ($P < 0.001$).

With advancing decades, there was a statistically significant fall observed in SMMI, HGT and 4MWT values. In males and females, HGT and 4MWT values began to fall significantly after 50 years of age, with SMMI identified to significantly fall in males after 70 years and in females after 60 years.

The SMMI, HGT and 4MWT values were at lowest levels in males and females above the age of 80 years compared to other age groups, while these values were highest in male and female participants in the 18–39 year age group ($P < 0.001$; Table 1).

The severity of sarcopenia in the study (normal, presarcopenia, sarcopenia and severe sarcopenia) varied in all age groups. The sarcopenia prevalance in the 40–49, 50–59, 60–69, 70–79 and 80 years and older age groups was identified as 7%, 10.6%, 15.4%, 21.2% and 36.5%.

The prevalance of severe sarcopenia increased as age advanced in both females and males. The prevalance of sarcopenia increased in parallel with advancing decades in women from 70 years of age and in males from 50 years of age.

Nearly ¼ of all female and male individuals above the age of 80 years participating in the study had severe sarcopenia. Additionally, the prevalance of sarcopenia (presarcopenia, sarcopenia and severe sarcopenia) in male patients above 80 years (48.3%) was higher compared to female patients (26.5%) (Table 2).

4. Discussion

EWGSOP defined sarcopenia as a syndrome characterized progressive and generalized loss of skeletal muscle mass and strenght, carrying the risk of unwanted results like physical disability, low quality of life and death. Sarcopenia is accepted as basically a result of the aging process and a geriatric syndrome. Loss of muscle mass, strenght and function together with aging is at rates of 3–8% each decade after the thirties, and speed increases with advanced age [24]. In accordance with the literature data, our study observed statistically significant falls in SMMI, HGT and 4MWT with the advancing decades, with significant falls in HGT and 4MWT values in males and females identified to begin after 50 years, and significant falls in SMMI beginning after 70 years for males and after 60 years for females.

In our population, the cut-off values of SMMI of 8.89 kg/m^2 for females and 10.50 kg/m^2 for males were obtained. In the literature, cut-off values for SMMI for males are in the interval 8.51–10.75 kg/m^2 and for females are 5.76–6.85 kg/m^2 [25]. Bahat et al. in a study of 301 participants aged from 18 to 39 years and 406 participants above the age of 65 identified the cut-off values for SMMI as 7.4 kg/m^2 for females and 9.2 kg/m^2 for males [25,26]. Our study data for population SMMI cut-off values are close to the study by Bahat et al. but are above the values in the literature. This situation may be explained by our population having relatively higher socioeconomic level, being active workers (a significant portion are security guards who participate in sporting activity), and individuals with normal and/or upper limit of normal BMI values.

The prevalence of sarcopenia varies according to gender (more common in males), age, place of residence (more common in care homes and hospitals), ethnic background (more common in those with Asian heritage), assessment scales, cut-off values and race (more common in whites). In their study with 724 cases and two separate diagnostic criteria (cut-off values for EWSGOP and Mexico City population) in Mexico City, Rodriguez-Garcia et al. found that the prevalence of sarcopenia was higher when EWSGOP cut-off values were used. In the study, the importance of determining the cut-off values of the studied region was emphasized for the determination of the prevalence of sarcopenia [27]. When the EWSGOP criteria are used in England, the prevalence is stated as 4.6% for older persons males and 7.9% for females [28]. A study in the United States of America reported the sarcopenia prevalence as 36.5% [29]. A study in Japan using DEXA to assess fat-free body mass reported sarcopenia prevalence was 2–28% for males and 2.3–11.7% for females; when bioelectrical impedance analysis was used, rates varied from 7 to 98% for males and 19.8–88% for females [30]. A systematic review by the International Sarcopenia Initiative assessing sarcopenia studies stated that sarcopenia was observed in at least one person in every 20 individuals living in society. In conclusion, they stated the sarcopenia prevalence was between 1 and 29% in society related to regional and age-linked variations, with this rate 14–33% for the long-term care population [13].

An important advantage of our study is the identification of the prevalance of sarcopenia according to decade in the same population (common ethic background, race, place of residence, nutritional properties, etc.) by the same two researchers. In our study

Table 1
BMI, SMMI, HGT and 4MWT measurements of participants according to age groups.

Characteristics	Age distribution						P-values
Female	18–39 (n = 60)	40–49 (n = 35)	50–59 (n = 40)	60–69 (n = 43)	70–79 (n = 46)	80veüstü (n = 34)	
BMI(kg/m^2)	27,49 ± 4,69	28,40 ± 4,73	28,98 ± 5,17	28,48 ± 4,93	28,88 ± 5,16	26,08 ± 3,06	0,072
SMMI(kg/m^2)	11,26 ±d 1,18a	11,28 ± 1,41a	11,32 ± 1,47a	11,15 ± 1,38a	10,73 ± 1,51ab	10,15 ± 1,48b	<0,001
HGT (kg)	28,50 ± 4,89a	26,86 ± 5,15a	22,53 ± 4,83b	22,36 ± 4,85b	19,48 ± 5,19bc	16,38 ± 4,54c	<0,001
4MWT (m/s)	1,57 ± 0,30a	1,30 ± 0,25b	1,15 ± 0,34b	1,28 ± 0,40b	0,88 ± 0,25c	0,76 ± 0,25c	<0,001
Male	(n = 60)	(n = 36)	(n = 43)	(n = 50)	(n = 39)	(n = 29)	
BMI(kg/m^2)	27,51 ± 3,32	28,07 ± 4,59	26,78 ± 3,08	26,91 ± 3,63	26,99 ± 4,03	25,94 ± 4,17	0,279
SMMI(kg/m^2)	12,32 ± 0,91a	12,40 ± 1,11a	11,88 ± 1,03a	11,78 ± 1,32ab	11,74 ± 1,20ab	11,13 ± 1,35b	<0,001
HGT (kg)	44,28 ± 7,57a	40,56 ± 9,14a	30,49 ± 6,06b	30,10 ± 7,40b	30,10 ± 6,70b	23,00 ± 6,63c	<0,001
4MWT (m/s)	1,89 ± 0,39a	1,60 ± 0,43b	1,24 ± 0,33c	1,18 ± 0,35c	1,10 ± 0,22c	0,87 ± 0,25d	<0,001

BMI: Body Mass Index, a,b,c letters show differences between groups in the same row ($P < 0.05$).

Table 2
Prevalance of sarcopenia stages according to age group.

Sarcopenia Stages	Age Distribution						χ^2-values	P-values
	18–39	40–49	50–59	60–69	70–79	80 ve üstü		
Female	n = 60	n = 35	n = 40	n = 43	n = 46	n = 34		
Normal	60 (100,0)	32 (91,4)	37 (92,5)	39 (90,7)	37 (80,4)	25 (73,5)	39,261	<0,001
Presarcopenia	0 (0,0)	2 (5,7)	0 (0,0)	0 (0,0)	0 (0,0)	0 (0,0)		
Sarcopenia	0 (0,0)	1 (2,9)	1 (2,5)	1 (2,3)	2 (4,3)	1 (2,9)		
Severe Sarcopenia	0 (0,0)	0 (0,0)	2 (5,0)	3 (7,0)	7 (15,3)	8 (23,6)		
Male	n = 60	n = 36	n = 43	n = 50	n = 39	n = 29		
Normal	60 (100,0)	34 (94,4)	37 (86,0)	40 (80,0)	30 (76,9)	15 (51,7)	53,599	<0,001
Presarcopenia	0 (0,0)	1 (2,8)	0 (0,0)	1 (2,0)	2 (5,1)	1 (3,4)		
Sarcopenia	0 (0,0)	1 (2,8)	6 (14,0)	6 (12,0)	2 (5,1)	6 (20,7)		
Severe Sarcopenia	0 (0,0)	0 (0,0)	0 (0,0)	3 (6,0)	5 (12,9)	7 (24,2)		
Total	n = 120	n = 71	n = 83	n = 93	n = 85	n = 63		
Normal	120 (100,0)	66 (93,0)	74 (89,2)	79 (84,9)	67 (78,8)	40 (63,5)	77,108	<0,001
Presarcopenia	0 (0,0)	3 (4,2)	0 (0,0)	1 (1,1)	2 (2,4)	1 (1,6)		
Sarcopenia	0 (0,0)	2 (2,8)	7 (8,4)	7 (7,5)	4 (4,7)	7 (11,1)		
Severe Sarcopenia	0 (0,0)	0 (0,0)	2 (2,4)	6 (6,5)	12 (14,1)	15 (23,8)		

the sarcopenia prevalance in the 40–49, 50–59, 60–69, 70–79 and 80 years and over age groups were 8.6%, 7.5%, 9.3%, 19.3% and 26.4% for females, 5.6%, 14.0%, 20.0%, 23.0% and 48.2% for males and 7%, 10.6%, 15.4%, 21.2% and 36.5% in total, respectively. In their study which was published in 2012 in Mexico City, Arango-Lopera et al. used the cut-off values suggested in the EWGSOP algorithm consisting of 345 cases and over 70 years old and the prevalence of sarcopenia was determined as 33.6%. In the same study, the prevalence of sarcopenia was determined as 50.4% in patients aged 80 years and over. Our data generally are in parallel with the literature data [30–32].

The detailed assessment of sarcopenia stages in data from all groups is considered an advantage of our study. The prevalance of sarcopenia was observed to increase in parallel with advancing decades from 70 years for females and from 50 years for males. In our study, as age advanced for both females and males, the prevalance of severe sarcopenia increased. Nearly ¼ of both females and males above the age of 80 participating in our study had severe sarcopenia. Additionally, the prevalance of sarcopenia (presarcopenia, sarcopenia and severe sarcopenia) in male patients (48.3%) was higher compared to female patients (26.5%). Our data complies with the study by Kim et al. which showed sarcopenia was more common in males and seen at earlier ages, with increased prevalance and degree of severity above the age of 80 years [30].

The most important limitation of our study is that the anthropometric (e.g. height, weight, waist, hip, calf and forearm circumference etc.), demographic and nutrition characteristics of the groups within the scope of our study have not evaluated for the possible effects of their education status and regular exercise. The cross-sectional nature of our work limits our ability to identify any causal relationship between variables. In addition, our relatively small sample size is another limitation. For this reason, with the prospective increase in age, there is a need for more wide and extensive population studies that assess the prevalence of sarcopenia.

5. Conclusion and recommendations

In our study, cut-off values for SMMI for the Turkish population are recommended and the prevalance of sarcopenia is reported. There is a need for more studies to determine reference values to identify the sarcopenia prevalence in different populations.

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Appendix A. Supplementary data

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