Journal of Frailty, Sarcopenia and Falls

Original Article

Prevalence of probable sarcopenia in community-dwelling older Greek people

Maria Tsekoura[1], Evdokia Billis[1], Charalampos Matzaroglou[1], Elias Tsepis[1], John Gliatis[2]

[1]Department of Physiotherapy, School of Health Rehabilitation Sciences, University of Patras, Aigio, Greece; [2]Department of Medicine, School of Health Studies, University of Patras, Rio, Greece

Abstract

Objectives: The objective of this study was to assess the prevalence rate of probable sarcopenia and to determine the factors associated with it in older people living in Western Greece. **Methods**: Probable sarcopenia was estimated based on cut-off values for handgrip strength (HGS) as recommended by EWGSOP2. Information about socio-demographic, chronic diseases, fear of falls and lifestyle of the participants were also collected. HGS was assessed using a SAEHAN dynamometer. Calf circumference was assessed with inelastic tape. A logistic regression analysis was performed in order to determine associated risk factors. **Results**: The sample comprised 402 participants (292 women;110 men), with a mean age of 71.51±7.63 years. Overall, 25.4% of the elderly participants were diagnosed with probable sarcopenia (men:36.4%; women:21.2%). The findings of this study demonstrated that probable sarcopenia was positively associated with age (OR=0.14, 95% CI=0.008 to 0.200), gender (OR=-0.6, 95% CI=-0.700 to -0.530), Body mass Index (OR=0.01, 95% CI=-0.030 to -0.005), Skeletal muscle mass index (OR=0.05, 95% CI=0.030 to 0.080), calf circumference (OR=0.02, 95% CI=0.007 to 0.040), and comorbidities (OR=0.04, 95% CI=0.030 to 0.080). **Conclusion**: There was a 25.4% prevalence of probable sarcopenia in Greek elderly. The results highlight the importance of the detection of HGS and probable sarcopenia in older people in order to develop effective strategies of prevention and intervention of sarcopenia.

Keywords: Older people, Prevalence, Probable sarcopenia, Sarcopenia

Introduction

Sarcopenia is considered a muscle disease associated with low muscle quantity and quality[1]. This disease is directly associated with functional dependency, institutionalization, lengthier hospital stays, increased number of falls; poor quality of life, higher numbers of hospitalizations, cognitive impairment, higher mortality rates and higher healthcare-related costs in elderly population[1-7]. Sarcopenia is recognized as a major health problem among older adults; affecting millions of individuals worldwide and is defined with different criteria[5,8]. The European Working Group on Sarcopenia in Older People (EWGSOP) definition released in 2010 (EWGSOP1) suggested a conceptual stage as pre-sarcopenia (low muscle mass only), sarcopenia (low muscle mass and muscle strength or muscle performance), and severe sarcopenia (low muscle mass, muscle strength and performance)[2]. In 2019, EWGSOP1 was updated to EWGSOP2, with muscle strength replacing muscle mass as the primary muscle indicator for probable sarcopenia[1]. In the EWGSOP2 criteria, probable sarcopenia is defined as reduced muscle strength only (normal muscle mass). Sarcopenia is determined by loss of muscle strength and muscle mass. Severe sarcopenia is determined by the presence of low muscle strength, muscle mass, and muscle performance[1,9].

The prevalence of sarcopenia in the literature varies widely and depends on the definition used. Different definitions of sarcopenia result in a widely different prevalence of

The authors have no conflict of interest.

Corresponding author: *Maria Tsekoura, Physiotherapist, MSc, PhD. Department of Physiotherapy, School of Health Rehabilitation Sciences, University of Patras, Psaron 6, 25100, Aigio, Greece*

E-mail: *mariatsekoura@hotmail.com mariatsekour@upatras.gr*

Edited by: *Charlotte Beaudart*

Accepted *25 February 2021*

sarcopenia, ranging from 1% to 60.6% in the present population of women aged >60 years[10,11].

Probable sarcopenia, which is low muscle ability, is suggested to trigger further assessment and intervention[12]. Information about the prevalence of probable sarcopenia, according to the latest guidelines of the EWGSOP is rare and has not been determined extensively. Prevalence rates in Greece are not evaluated yet. The evaluation of probable sarcopenia provides important information, relevant for sarcopenia prevention and health promotion. Sarcopenia is significantly associated with several adverse outcomes in older people and early detection of probable sarcopenia may help to initiate timely intervention[13]. Given the above, the aim of this study was to investigate the prevalence rate of probable sarcopenia and the factors associated with probable sarcopenia in Greek older people.

Methods

Participants

This was a cross-sectional study. Participants were recruited from the University Hospital of Rio, University of Patras, and Centers for Elderly of Patras and Aegio in Greece. Eligible participants had to be >60 years, had no self-reported upper extremity pain or stiffness on more than 50% of days of the past month (because of Hand Grip Strength (HGS) assessment), and be able to read and understand the purpose of the study. Participants were also administered the Mini Mental State Examination (MMSE), to assess their cognitive function and ensure cooperation. MMSE requires only 5-10 min to administer and has been validated and extensively used in both clinical practice and research[14]. Exclusion criteria included cognitive impairment (MMSE score below 25 out of 30), pacemaker fitted, and/or patients with an amputated limb, and body mass index (BMI) >50 were excluded from the study because of the requirements of the device measuring muscle mass (Bioelectrical impedance analysis)[15]. The assessment procedure was carried out between March of 2018 and September of 2020.

Diagnosis of Sarcopenia

Diagnosis was performed according to EWGSOP2 criteria. For the diagnosis of probable sarcopenia, handgrip strength was measured. The recent EWGSOP2 definition defines "probable sarcopenia" as reduced hand grip strength, with values <16 kg and <27 kg was considered for female and males, respectively. The cut-off thresholds for skeletal muscle mass indexes were set at 7 kg/m^2 and 5.5 kg/m^2 in males and females, respectively[1].

Outcome measures

Measures included an interview survey, body composition assessments, muscle strength assessments, physical function tests, and quality of life assessment. All measurements were performed at University of Patras by the same health professional, a geriatric physiotherapist, highly experienced in using the aforementioned measurements.

Interview survey

The older adults were interviewed with a structured questionnaire including information on the participants' socio-demographic characteristics such as their age, sex, marital status, and number of children, past occupation, lifestyle habits, and number of drugs used in the past year, comorbidities and history of falls.

Muscle strength assessment

Handgrip strength was evaluated with a calibrated hydraulic hand dynamometer (SAEHAN DHD-1, Seoul, Korea) in accordance with the standardized procedure recommended by the American Society of Hand Therapists and described in "The Nutrition UP 65 Study Protocol"[15,16]. The participants were asked to sit on a chair with elbows positioned at a 90° angle and exert maximum force. They had to squeeze as hard as possible three times with dominant hand. The highest result out of the three measurements was recorded in analysis. HGS was expressed in kilograms (kg).

Body composition assessment

Height was measured with a wall stadiometer without shoes. Body weight was measured to the nearest 0.1 kg and height was measured to the nearest 0.1 cm. Measurements of height and weight were used to calculate body mass index (BMI) (kg/m^2)[17].

Body composition was determined using bioelectrical impedance analysis (BIA), with a Tanita BC-601 (Tanita corp, USA) model body analysis monitor. Skeletal muscle mass (SMM, kg) was estimated using whole-body BIA and Skeletal Muscle Mass Index (SMMI) calculated as SMM/height^2. Fat free mass (FFM) was extracted by BIA and SMM values, using the following equation: SMM (kg)= 0.566 × FFM[17,18]. The older adults were recommended to have a bowel movement within 30 min before the measurement, and also not consume any alcoholic beverages and meals for at least 48 h and 4 h, respectively before the tests[15].

Calf circumference (CC) was measured with inelastic tape. The measurement was performed in the upright position with feet 20 cm apart, body weight equally distributed on both feet. CC was measured at the calf's greatest girth[17,19]. The measurement was performed in a standardized way, with three measurements to obtain the average of three measurements[19,20].

Functional assessment

A measure of gait speed over a 4-m distance was recorded. The values ≤0.8 m/s indicated low gait speed[1].

Fear of falling assessment

Fear of falling was assessed using the Greek version of the Falls Efficacy Scale (FES-1)[20]. The FES-I is a 16-item

Variable	Total participants (n=402)	Probable Sarcopenia (n=102)	No sarcopenia (n=300)	P value
Mean Number, SD				
Age (years)	71.51±7.63	76.4±8.5	69.85±6.5	<0.001
Drug (number)	3.1±1.1	3.7±1.32	2.2±1.5	0.001
Comorbidities (number)	2.09±1.08	2.56±1.2	1.93±1	<0.001
CC (cm)	34.94±2.39	34.7±2.53	35.2±2.35	0.250
BMI (kg/m^2)	25.78±3.43	25.6±3.5	25.8±3.49	0.200
HGS (kg)	21.73±6.	16.58±3.5	24.48±6.2	<0.001
SMMI (kg/m^2)	7.56±1.72	7.1±1.7	7.69±1.7	0.010
4m test (seconds)	3.95±0.98	4.41±0.94	3.8±0.98	<0.001
Number, percentage				
Gender Men Women	 11(27.%) 292(72.6%)	 40 (36.4%) 62 (21.2%)	 70 (23.3%) 230 (76.7%)	<0.001
Falls history Yes	 106(26.4%)	 40 (39.2%)	 66 (22%)	0.001

BMI: Body Mass Index; CC: Calf circumference; SMMI: Skeletal Muscle mass index; HGS: Hand Grip Strength; 4m test: 4 meter test.

Table 1. Participants' characteristics.

self-administered questionnaire and assess fear of falling in mainly community-dwelling older population. Older participants were instructed to rate each item. The scores were added up to calculate a total score that ranges from 16 to 64. A higher score indicates a greater fear of falling[21]. FES-1 has excellent psychometric properties, and assesses concerns relating to basic and more demanding activities, both physical and social[22].

Ethics approval

All participants signed an informed consent form prior to their inclusion. They were assured that information obtained would be anonymous and confidential. The protocol was approved by the Ethical Committee of the University of Patras.

Statistical analysis

The normality of variables was checked using the Shapiro-Wilk test. Descriptive analysis was done by means of frequency for qualitative variables and mean (±SD) for quantitative variables. T-test for independent samples was used to determine the differences between participants with sarcopenia and participants with no sarcopenia. Chi-square analyses was performed for inter-gender comparisons. A logistic regression was also performed to describe the relation between the dichotomous HGS variable and the factors associated with low HGS according to EWGSOP2 criteria. The analyses were performed using the SPSS software version 25.0, and p values of <0.05 were considered significant.

Results

The sample consisted of 402 elderly people (292 women and 110 men), with a mean age of 71.51±7.63 years and a mean BMI of 25.78±3.43 kg/m^2. The prevalence of probable sarcopenia was 25.4% (n=102). In addition, the prevalence of sarcopenia was 13.2% (n=53). Men had significantly (p<0.001) greater HGS (28±7.36 kg vs 19.37±3.97 kg) and SMMI (9.08±1.53 kg/m^2 vs 6.9±1.42 kg/m^2). Characteristics of the study participants are shown in Table 1.

Comparison of the associated factors between probable sarcopenic and non-sarcopenic Greek elderly is shown in Table 2. The findings of this study demonstrated that probable sarcopenia was positively associated with age, gender, BMI, SMMI, CC and comorbidities. Low handgrip strength in men was related to age, SMMI, BMI and Calf circumference and in women to age, SMMI, 4 meter test and calf circumference.

Discussion

In the current study updated EWGSOP2 guidelines have applied in order to give insights into probable sarcopenia in Greek community-dwelling older people. To our knowledge, this is the first study to examine prevalence rates of probable sarcopenia in Greek older people. The prevalence rate of probable sarcopenia in Greek elderly was 25.4%.

Variable	OR	95% CI	P value
BMI	-0.01	-0.030- (-0.005)	0.006
Gender	-0.6	-0.700- (-0.530)	<0.001
Age	0.14	0.008-0.200	0.001
SMMI	0.05	0.030-0.080	<0.001
HGS	-0.03	-0.040-(-0.030)	<0.001
4 m test	-0.03	-0.080-0.200	0.210
Drug	0.60.	0.460-0.940	0.300
Comorbidities	0.04	0.030-0.08	0.003
Falls	0.39	0.120-1.210	0.640
CC	0.02	0.007-0.040	0.008

NS: non-significant; BMI: Body Mass Index; CC: Calf circumference. SMMI: Skeletal Muscle mass index; HGS: Hand Grip Strength; 4m test: 4 meter test.

Table 2. Factors associated with low HGS (probable sarcopenia) among Greek older people.

This result provides important health-related data of a group not previously studied in Greece. Present results are in accordance with studies in other countries that assessed elderly population[13,23-26]. Franzon et al., detected a prevalence of lower HGS in Swedish men of 28% (mean age 86 years)[24]. Probable sarcopenia affected one in every four Swiss-German older adults over 75 years[13]. In a sample of UK participants' prevalence rate of probable sarcopenia was reported at 8%[27]. However, these participants were in early old age (60-70 year); justifying the differences in the results.

The results demonstrate a high percentage of probable sarcopenia in community-living older people; indicating that sarcopenia assessment should be applied routinely in clinical assessments of older people. Probable sarcopenia is linked to negative health outcomes and early detection of probable sarcopenia may help to initiate timely intervention[13].

In this study muscle strength was assessed via HGS. The HGS test is easily applicable to older adults, possible to do in clinical settings and provides important information on current and future health status[13,24]. In the EWGSOP2 definition, low muscle strength, could be measured by HGS and/or chair stand test (CST)[1]. In the study conducted by Dodds et al., researchers reported a limited agreement between low HGS and slow CST with only 15% of those with probable sarcopenia having poor performance on both tests (28). Researchers suggest that prevalence of probable sarcopenia could be dependent on applied measures of detection in previous literature[13,24]. However, HGS below a cut-off value of <16 kg for women and <27 kg for men is present in a substantial percentage of the older old population, even in non-institutionalized people[13].

There were seven factors associated with probable sarcopenia (low HGS) in Greek elderly using regression analysis: age, gender, BMI, comorbidities, SMMI, HGS and Calf Circumference. Understanding the association between sarcopenia-related variables and associated factors may help to design interventions; aiming at preventing its occurrence by reducing the identified risk factors[29]. Aging, low BMI (body mass index), chronic illnesses and multimorbidity are associated with sarcopenia[9,30,31]. The results of this study are relevant in supporting the development of clinical interventions to aid in the prevention of sarcopenia in older people. Therapeutic interventions should aim at preventing decrease in muscle strength and muscle mass on older people. Further studies with a longitudinal design are necessary to confirm these results[29].

Clinical relevance

Detection of low handgrip strength in older individuals is particularly important to evaluate the status of sarcopenia and provides important information on current and future health status[1,13]. Early detection of low muscle strength is crucial to prevent further decline in older adults. In addition, the European Working Group on Sarcopenia in Older People 2 (EWGSOP2) consensus definition introduced the concept of probable sarcopenia as a basis on which to begin treatment[27]. Results of this study may increase awareness of health clinicians about the importance of muscle strength assessment and may serve as a support for decision making in clinical practice.

Limitations

Firstly, the sample included 402 volunteers >60 years living only in Western Greece. Furthermore, the entire study population were independent and may not represent the general older Greek population, so the results might not be representative of the Greek population. Secondly, the subgroup of male participants was relatively small compared

to the total population. Further research is required to identify those with sarcopenia and to clarify the risk factors involved.

Conclusions

The percentage rate of probable sarcopenia in Greek elderly was 25.4%. More research is needed in order to clarify the precise association of specific characteristics of patients with probable sarcopenia and other factors.

References

1. Cruz-Jentoft AJ, Bahat G, Bauer J, et al. Writing Group for the European Working Group on Sarcopenia in Older People 2 (EWGSOP2), and the Extended Group for EWGSOP2. Sarcopenia: revised European consensus on definition and diagnosis. Age Ageing 2019;48:16-31.
2. Cruz-Jentoft AJ, Baeyens JP, Bauer JM, et al. Sarcopenia: European consensus on definition and diagnosis: report of the European Working Group on Sarcopenia in Older People. Age Ageing 2010;39:412-423.
3. Bischoff-Ferrari HA, Orav JE, Kanis JA, et al. Comparative performance of current definitions of sarcopenia against the prospective incidence of falls among community-dwelling seniors age 65 and older. Osteoporos Int 2015;26:2793-802.
4. Moreira VG, Perez M, Lourenço RA. Prevalence of sarcopenia and its associated factors: the impact of muscle mass, gait speed, and handgrip strength reference values on reported frequencies. Clinics (Sao Paulo) 2019;8;74:e477.
5. Tsekoura M, Kastrinis A, Katsoulaki M, et al. Sarcopenia and its impact on Quality of life: a literature review. Springer's Advances in Experimental Medicine and Biology (AEMB) Chapter Genedis 2017:213-218.
6. Chang KV, Hsu TH, Wu WT, et al. Association Between Sarcopenia and Cognitive Impairment: A Systematic Review and Meta-Analysis.J Am Med Dir Assoc 2016;17:1164.e7-1164.e15.
7. Beaudart C, Zaaria M, Pasleau F, et al. Health Outcomes of Sarcopenia: A Systematic Review and Meta-Analysis. PLoS One 2017;12:e0169548.
8. Purcell S.A, Mackenzie M, Barbosa-Silva TG. et al. Sarcopenia Prevalence Using Different Definitions in Older Community-Dwelling Canadians. J Nutr Health Aging 2020;24:783-790.
9. Su Y, Hirayama K, Han TF, et al. Sarcopenia Prevalence and Risk Factors among Japanese Community Dwelling Older Adults Living in a Snow-Covered City According to EWGSOP2. J Clin Med 2019;8:291.
10. Cruz-Jentoft, AJ, Landi F, Schneider SM, et al/ Prevalence of and Interventions for Sarcopenia in Ageing Adults: A Systematic Review. Report of the International Sarcopenia Initiative (EWGSOP and IWGS). Age Ageing 2014;3:147.
11. Khanal P, He L, Stebbings G, et al. Prevalence and association of single nucleotide polymorphisms with sarcopenia in older women depends on definition. Sci Rep 2020;10:2913.
12. Sobestiansky S, Michaelsson K. Cederholm T. Sarcopenia prevalence and associations with mortality and hospitalisation by various sarcopenia definitions in 85-89 year old community-dwelling men: a report from the ULSAM study. BMC Geriatr 2019;19:318.
13. Wearing J, Konings P, de Bie RA, et al. Prevalence of probable sarcopenia in community-dwelling older Swiss people - a cross-sectional study. BMC Geriatr 2020;20:307.
14. Folstein MF, Folstein SE, Mc Hugh PR.Mini Mental State: A practical method for grading the cognitive state of patients for the clinician. J Psychiatr Res 1975;12:189-198.
15. Tsekoura M, Billis E, Tsepis E, et al.The Effects of Group and Home-Based Exercise Programs in Elderly with Sarcopenia: A Randomized Controlled Trial. J Clin Med 2018;7:480.
16. Amar TF, Santos,A, Guerra RS, et al.Nutritional Strategies Facing an Older Demographic: The Nutrition UP 65 Study Protocol. JMIR Res Protoc 2016;14: 5e184.
17. Fess E. Grip strength. In: Casanova JS, editor. Clinical assessment recommendations. 2. Chicago: American Society of Hand Therapists; 1992;41-45.
18. Bahat G, Tufan A, Tufan F, et al. Cut-off points to identify sarcopenia according to European Working Group on Sarcopenia in Older People (EWGSOP) definition. Clin Nutr 2016;35:1557-63.
19. Pagotto V; Ferreira dos Santo K, Malaquias SGet al. Calf circumference: Clinical validation for evaluation of muscle mass in the elderly. Rev. Bras. Enferm 2018;71:322-328.
20. Lohman TG, Roche AF, Martorel R. Anthropometrics standartization reference manual. Champaign: Human Kinetics Books; 1988
21. Helbostad JL, Taraldsen K, Granbo R, et al. Validation of the Falls Efficacy Scale-International in fall-prone older persons. Age Ageing 2010;39(2):259.
22. Billis E, Strimpakos N, Kapreli E, et al. Cross-cultural validation of the Falls Efficacy Scale International (FES-I) in Greek community-dwelling older adults. Disabil Rehabil 2011;33:1776-84.
23. Yardley L, Beyer N, Hauer K, et al. Development and initial validation of the Falls Efficacy Scale-International (FES-I). Age Ageing 2005;34(6):614-9.
24. Franzon K, Zethelius B, Cederholm T, et al. The impact of muscle function, muscle mass and sarcopenia on independent ageing in very old Swedish men. BMC Geriatr 2019;19(1):153.
25. Reiss J, Iglseder B, Alzner R, et al. Consequences of applying the new EWGSOP2 guideline instead of the former EWGSOP guideline for sarcopenia case finding in older patients. Age Ageing 2019;48:719-724.
26. Kim M, Won CW. Prevalence of sarcopenia in community-dwelling older adults using the definition of the European Working Group on Sarcopenia in Older People 2: findings from the Korean Frailty and Aging Cohort Study. Age Ageing 2019;48:910-916.
27. Dodds RM., Murray JC., Robinson SM.et al.The identification of probable sarcopenia in early old age based on the SARC-F tool and clinical suspicion: findings from the 1946 British birth cohort. Eur Geriatr Med 2010;11:433-441.
28. Dodds RM, Granic A, Robinson SM, Sayer AA. Sarcopenia, long-term conditions, and multimorbidity: findings from UK Biobank participants. J Cachexia Sarcopenia Muscle 2020;11:62-68.
29. Silveira E, Souza J, Santos AS, et al. What are the factors associated with sarcopenia-related variables in adult women with severe obesity? Arch Public Health 2020;8:71.
30. Dodds RM, Granic A, Davies K, et al. Prevalence and incidence of sarcopenia in the very old: findings from the Newcastle 85+ Study. J Cachexia Sarcopenia Muscle 2017;8:229-237.
31. König M, Spira D, Demuth I, et al. Polypharmacy as a Risk Factor for Clinically Relevant Sarcopenia: Results From the Berlin Aging Study II. J Gerontol A Biol Sci Med Sci 2017;73:117-122.