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SARC-F as a Case-Finding Tool for Sarcopenia in Older Adults

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Abstract

Introduction. Sarcopenia is defined as a progressive decrease of skeletal muscle mass associated with aging. It is associated with an increased risk of adverse outcomes, such as falls, fractures, physical disability, and death. Early detection of sarcopenia in older adults is of utmost importance as it has been shown to be crucial for providing appropriate interventions, primarily in terms of physical exercise and nutrition, to maintain a quality of life. Sarcopenia screening is crucial for public health given its significant prevalence and adverse outcomes.

Aim. The aim of the research was case-finding for sarcopenia in individuals aged 65 and older and to determine whether there are differences in the prevalence of sarcopenia according to the SARC-F questionnaire in three groups of participants.

Methods. A total of 138 individuals aged 65 and older of both sexes participated in the research. There were three groups of participants: residents in a retirement home, outpatients in an orthopaedic clinic, and community-dwelling individuals (general group). SARC-F questionnaire (Strength, Assistance with Walking, Rising from a Chair, Climbing Stairs, and Falls) was used as a highly recommended tool for screening.

Results. The results showed that participants with an indication for sarcopenia were significantly older, with a mean age of 80.7 years (SD = 7.65) compared to 75.1 years (SD = 5.97) in the no indication group ($t = 4.76$; $p < 0.001$). In terms of residential setting, participants with an indication for sarcopenia were more likely to reside in nursing homes (36.5%) compared to those without an indication (12.0%). Conversely, participants without an indication were from the general population (62.7%) more frequently than

those with an indication (41.3%). The proportion of participants from clinical settings was similar between the groups (22.2% vs. 25.3%).

Conclusion. Age is the only significant risk factor when assessing the sarcopenia risk in this research. Individuals at risk of sarcopenia were significantly older than those not at risk, with an average age difference of approximately five years. According to the results of this research, each additional year of age increases the odds of sarcopenia by approximately 12%. Retirement home residents are at the highest risk of sarcopenia. When it comes to the significant public health consequences caused by sarcopenia in the community, further similar research is necessary with an emphasis on an interdisciplinary approach to the disease.

Introduction

Sarcopenia was first mentioned in 1989 (1, 2, 3) and defined as a "decrease of muscle mass associated with aging". This definition has been improved and changed several times, and sarcopenia is now defined as a "progressive decrease of skeletal muscle mass associated with aging". Sarcopenia was included in the International Classification of Diseases (4, 5) in 2016, which confirmed the seriousness of this geriatric syndrome.

The increasing life expectancy as well as aging of the global population requires special attention from each country's health and public health strategies to benefit the health of older population. Sarcopenia prevention could reduce the financial, social and health burden often associated with an aging population. Screening for sarcopenia should be a public health priority to reduce the prevalence and the adverse outcomes of sarcopenia (3). Negative outcomes, such as falls, reduced mobility and functionality, can jeopardise the independence as well as the quality of life in older individuals to a great extent (2, 6). The SARC-F questionnaire is one of the most commonly used tools when screening for sarcopenia (7). Validation of the SARC-F questionnaire is in the centre of interest of many scientists (8), and some of them consider it a valid tool not only for sarcopenia screening but also for future mortality related to sarcopenia (9). Recently, there has been increasing research into possibilities of new assessment instruments related to screening for sarcopenia such as anthropometric measurements, Ishii Test and Mini Sarcopenia Risk Assessment (MSRA) questionnaire, a new test designed by Thai researchers – Taiwan Risk Score for Sarcopenia (TRSS), Sarcopenia Scoring Assessment Model (SarSA-Mod), and others. More specific tests are used in research to make predictions about the development of sarcopenia, such as Sarcopenia Quality of Life (SARQoL) questionnaire and fracture risk assessment questionnaires (8). Although these tests show high validity and make a good choice for screening for sarcopenia, the European Working Group on Sarcopenia in Older People 2 (EWGSOP2) assessment algorithm recommends the SARC-F questionnaire as a valid and validated tool for screening for risk of sarcopenia (10). Some authors who have researched the connection between sarcopenia and recovery of orthopaedic and trauma patients recommend a pre-operative treatment of sarcopenia patients, especially of the respiratory muscles since they have found a correlation between sarcopenia and the duration of hospitalisation and increased mortality (11, 12). Older individuals who live alone are more independent in daily activities; they have a higher level of physical activity and are generally more independent than individuals living in retirement homes who can be more likely to suffer from sarcopenia. This has been confirmed by the research conducted by De Oliveira et al. (2021), which presented a high likelihood of developing sarcopenia in institutionalized elderly (13). Research conducted in Japan among older individuals living alone showed that prevalence of sarcopenia was most closely associated with physical activity (14). Independent living implies autonomy in instrumental activities of daily living such as shopping, going to the bank, etc. A higher risk of sarcopenia has been noted in orthopaedic patients (15) and could be associated with pain and restrictions in motion. Older patients after hip surgery are particularly predictive, as confirmed by several studies (16, 17), as well as patients with osteosarcopenia (18).

Aim

The aim of this study was case-finding for sarcopenia in individuals aged 65 and older and to determine whether there are differences in the prevalence of sarcopenia according to the SARC-F questionnaire in three groups of participants. An additional aim was to determine the significant predictors associated with sarcopenia indication.

Methods

Study design

The research was carried out in the House of St Francis - a home for the elderly and disabled in Zagreb, in the Department of Orthopedics and Traumatology at the Dubrava University Hospital, and in respondents' homes.

The research period was from June 2024 to March 2025.

Respondents

The research was carried out on 138 individuals from Zagreb aged 65 and older of both sexes.

The sample was a convenience sample.

The participants were divided into three groups: the first group consisted of residents of the House of St Francis – a home for the elderly and disabled (Nursing Home Group), the second group was comprised of outpatients in the Department of Orthopedics and Traumatology at the Dubrava University Hospital (Clinical Group), and the third group was a General Group. The General Group consisted of respondents who lived independently and did not have any fractures in the past year. There were 32 participants in the first group, the Nursing Home Group, of whom 25 (78.12%) were women and 7 (21.87%) were men. In the second group, the Clinical Group, there were 33 participants, of whom 26 were women (78.78%) and 7 were men (21.21%). In the third group studied, the General Group, there were 73 participants, 50 of whom were women (68.49%) and 23 men (31.50%). They were informed about the purpose and aims of the research prior to completing the questionnaire. Anonymity of the respondents was guaranteed. They completed the questionnaire voluntarily, confirmed their participation by a written consent, and gave a written consent for their data to be used for the purpose of the research. The participants had the possibility withdraw from the research at any time.

The exclusion criteria for the research were: individuals younger than 65, immobile patients, people with dementia, and individuals who had an extremity fracture in the past year.

Instruments

The aim of the SARC-F questionnaire is to identify people at risk of sarcopenia (19). The questionnaire consists of five questions examining the following items: Strength, Assistance in walking, Rising from a chair, Climbing stairs, Falls (Table 1). The respondent is asked how much difficulty he/she has when performing the abovementioned components of various activities, e.g. "How many times have you fallen in the last year?". The possible answers are: "None", "Some" and "A lot or unable". Individual answers are awarded the following points: "None" = 0 points; "Some" = 1 point; "A lot or unable" = 2 points. The points awarded for the answers in the last question about the number of falls in the past year are: "None" – 0 points; 1 to 3 falls – 1 point; 4 and more falls – 2 points. The highest possible score in the questionnaire is 10, which is the worst result, while the best result is 0 points. If a respondent gets four or more points, he/she is considered to be at a risk of sarcopenia and, according to the guidelines of the European Working Group on Sarcopenia in Older People (EWGSOP), should be included in further assessments to confirm the diagnosis or not (2).

To assess the internal consistency of the SARC-F questionnaire in the present sample, Cronbach's α was calculated (Table 2). The scale demonstrated acceptable internal reliability with a Cronbach's α of 0.765. Item-level analysis showed that removing the Strength (α = 0.713), Assistance in walking (α = 0.693), Rising from a chair (α = 0.700), or Climbing stairs (α = 0.702) items would result in only a slight decrease in overall reliability, indicating that those

items contribute meaningfully to the scale's consistency. The item-rest correlations for these items ranged from 0.561 to 0.612, indicating moderate associations with the total score. In contrast, removal of the Falls item increased the α to 0.787, and its lower item-rest correlation (0.312) suggests that this item was less consistent with the rest of the scale in this sample.

Table 1. **SARC-F questionnaire (19)**

Component	Question	Scoring
Strength	How much difficulty do you have in lifting and carrying 4.5 kg?	None = 0 Some = 1 A lot or unable = 2
Assistance in walking	How much difficulty do you have walking across a room?	None = 0 Some = 1 A lot or unable = 2
Rising from a chair	How much difficulty do you have transferring from a chair to bed?	None = 0 Some = 1 A lot or unable = 2
Climbing stairs	How much difficulty do you have climbing a flight of 10 stairs?	None = 0 Some = 1 A lot or unable = 2
Falls	How many times have you fallen in the past year?	None = 0 Some = 1 A lot or unable = 2

Table 2. **Internal consistency statistics for the SARC-F screening tool**

	Cronbach's α	
	0.765	
Item Reliability Statistics	**If item dropped**	**Item-rest**
Strength	0.713	0.561
Assistance in walking	0.693	0.612
Rising from a chair	0.700	0.597
Climbing stairs	0.702	0.589
Falls	0.787	0.312

Procedure

Prior to completing the SARC-F questionnaire, the respondents were informed about the purpose of the questionnaire, and they had the opportunity to ask questions to avoid any doubts. The participants completed the questionnaire independently, but in cases when they could not fill in the questionnaire on their own, the answers were entered by the interviewers or researchers.

Ethics

For the purpose of this research, consent was obtained from the Ethics Committee of the University of Applied Health Sciences (registered under the number: 251-379-10-23-02), from the City Office for Social Protection, Health, War Veterans and People with Disabilities (registered under the number: 251-09-12--/2-23-2, and from the Dubrava University Hospital (registered under the number: 251-379-12-24-05). The respondents filled in and signed an adult information consent to participate in the research in which safety of personal data collected in the research is guaranteed.

Statistics

Descriptive statistics were used to summarize the characteristics of the sample, including gender, age, and residential setting, stratified by sarcopenia indication. The assumption of normality for t-tests was evaluated using the Shapiro-Wilk W test and visual inspection of density plots. Differences between groups were assessed using independent t-tests or non-parametric Mann-Whitney U test for continuous variables and chi-square tests for categorical variables. For significant chi-square tests involving more than two groups, post hoc pairwise chi-square comparisons with Bonferroni correction were conducted. For posterity, before performing the main analysis, internal consistency of the SARC-F scale was evaluated using Cronbach's α. Item reliability was assessed by calculating the change in Cronbach's α if individual items were removed and examining item-rest correlations. To analyse potential differences in proportion of subjects with sarcopenia between groups, binomial logistic regression model was used to correct for age and gender.

Model 1 included age as the sole predictor. Model 2 added gender, female vs. male with males as a reference category, as an additional predictor. Model 3 further included residential setting, general and clinical setting vs. nursing home with the nursing home group as the reference category. Model fit was evaluated using the deviance, Akaike Information Criterion

(AIC), and McFadden's R^2. Improvement in model fit between nested models was tested using likelihood ratio tests. Statistical significance was set at $p < 0.05$ for all tests. Logistic regression results were reported as log odds ratios their standard errors, and odds ratios (OR).

Results

Table 3 presents the descriptive characteristics of the study sample, including age, gender distribution, and residential setting (group), stratified by presence or absence of sarcopenia indication.

Table 3. **Descriptive parameters of the sample by sarcopenia indication**

	Yes (n = 63)	No (n = 75)	Overall (n = 138)
Gender			
Male	13 (20.3%)	24 (32.0%)	37 (26.6%)
Female	50 (79.4%)	51 (68.0%)	101 (73.2%)
Age			
Mean (SD)	80.7 (7.65)	75.1 (5.97)	77.7 (7.31)
Median [Min, Max]	80.0 [66.0, 95.0]	75.0 [65.0, 87.0]	76.5 [65.0, 95.0]
Group			
General	26 (41.3%)	47 (62.7%)	73 (52.9%)
Nursing home	23 (36.5%)	9 (12.0%)	32 (23.2%)
Clinical	14 (22.2%)	19 (25.3%)	33 (23.9%)
Prevalence within group			
General	35.6%	64.4%	-
Nursing home	71.9%	28.1%	-
Clinical	42.4%	57.6%	-

Of the 138 participants, 63 had an indication for sarcopenia (indication group) and 75 had no indication for sarcopenia (no indication group). Overall, 73.2% of participants were female, with a higher proportion in the indication group (79.4%) compared to the no indication group (68.0%), though this difference was not statistically significant ($\chi^2 = 2.25$; $p = 0.133$). Participants with an indication for sarcopenia were significantly older, with a mean age of 80.7 years (SD = 7.65) compared to 75.1 years (SD = 5.97) in the no indication group ($t = 4.76$; $p < 0.001$). The prevalence of sarcopenia indication was 71.9% among nursing home residents, 42.4% among clinical participants, and 35.6% in the general population. The overall distribution of residential setting across groups was statistically significant ($\chi^2 = 11.97$; $p = 0.003$). Post hoc chi-square pairwise comparisons with Bonferroni correction revealed a significantly higher proportion of nursing home residents among those with sarcopenia indication compared to the general population group ($p_{Bonferroni} = 0.004$). No statistically significant differences were observed between the clinical setting and either of the other two groups after adjustment ($p_{Bonferroni} > 0.05$).

Table 4 presents the result of three binomial logistic regression models predicting the likelihood of sarcopenia indication. Model 1 tested the effect of age on sarcopenia indication. Model 2 added gender as a predictor, and Model 3 further included residential setting, with nursing home group being the reference group. Model fit improved very slightly from Model 1 to Model 3, with the deviance decreasing from 170 to 165 and McFadden's R^2 increasing from 0.109 in Model 1 to 0.134 in Model 3, indicating virtually no improvement in explanatory power. Expectedly, the differences in fit between models were not statistically significant (Model 1 vs. Model 2: $\chi^2 = 2.80$, $p = 0.091$; Model 2 vs. Model 3: $\chi^2 = 1.99$, $p = 0.371$).

Table 4. **Fit measures for three models and model comparisons**

Model Fit Measures	Model 1	Model 2	Model 3
Deviance	170	167	165
AIC	174	173	175
R^2 (McFadden)	0.109	0.124	0.134
Model Comparisons	χ^2	df	*p*
Model 1 vs. Model 2	2.80	1	0.094
Model 2 vs. Model 3	1.99	2	0.371

According to Table 4, in all models, age was a significant predictor of sarcopenia indication, with each additional year of age increasing the odds of sarcopenia indication by approximately 12% (Model 1: OR = 1.12, $p < 0.001$; Model 2: OR = 1.13, 10 $p < 0.001$; Model 3: OR = 1.11, $p = 0.003$). In Model 2, the effect of gender was not significant, and this effect remained non-significant in Model 3. In Model 3, the odds of sarcopenia indication were lower in the General Group compared to nursing home residents (OR = 0.49, $p = 0.177$) and in the Clinical Group compared to nursing home residents (OR = 0.68, $p = 0.524$), but these differences were not statistically significant (Table 5). Overall, age was the only consistent and significant predictor across all models. This result is not surprising with regard of the average age in the three groups which showed that the highest average age of the participants was in the Nursing Home group, namely 84.7 (SD 6.99), whereas the average age of the participants in the General Group was 75.8 years (SD 6.10) and in the Clinical Group 75.0 years (SD 5.79). The lowest age of the participants was 65 (in the General Group) while the highest age was 95 (in the Nursing Home group).

Discussion

This research examined prediction of sarcopenia in three groups: the Nursing Home Group, a group of outpatients in the Department of Orthopedics and Traumatology (Clinical Group), and a group of community-dwelling members as the General Group. The results are based on the data from the SARC-F questionnaire, age, gender, and comparison between the groups. Individuals at risk of sarcopenia scored 4 or more points on the SARC-F questionnaire. The results showed that individuals at risk of sarcopenia were significantly older in comparison with those who were not at risk. Among those at risk of sarcopenia, the youngest participant was 66.0 years old and the oldest was 95.0 years old.

When it comes to residential setting, participants with an indication for sarcopenia were more likely to reside in nursing homes compared to those without an indication. Moreover, older individuals and nursing homes residents had the highest likelihood of having an indication for sarcopenia. Participants with an indication for sarcopenia were, on average, about five years older than those without such indication (80.7 vs. 75.1 years) and were more likely to live in nursing homes (36.5% vs. 12%). It can be concluded that the Nursing group, the group with the oldest participants, is physically least active and in need of help in some activities of daily living, such as shopping, cooking, cleaning up, etc. Conversely, individuals without an indication of sarcopenia were more com-

Table 5. **Specific model results for three tested models**

Model Coefficients	Estimate	SE	Z	*p*	OR
Model 1					
Age	0.117	0.028	4.17	< 0.001	1.12
Model 2					
Age	0.119	0.028	4.21	< 0.001	1.13
Female vs. Male	0.713	0.434	1.64	0.10	2.04
Model 3					
Age	0.104	0.032	3.27	0.001	1.11
Female vs. Male	0.643	0.440	1.46	0.14	1.90
General vs. Nursing Home	-0.712	0.528	-1.35	0.18	0.49
Clinical vs. Nursing Home	-0.385	0.604	-0.64	0.52	0.68

Note: Estimates represent the log odds of "sarcopenia indication = Yes" vs. "sarcopenia indication = No."

monly drawn from the general population, likely due to their younger age and higher levels of functional mobility in daily activities.

Logistic regression confirmed that age was the only significant predictor of sarcopenia indication, with each additional year of age increasing the likelihood by about 12%. No significant difference was found in the incidence of sarcopenia between male and female respondents, which suggests that gender did not play a significant role in this sample. A possible cause for this result was a small proportion of men in the sample.

It can therefore be concluded that neither gender nor residential setting were significant predictors, although there is a noticeable trend toward higher occurrence of sarcopenia in nursing home residents, which can be explained by their age. It is important to highlight that, in this study, residents of nursing homes were generally older than individuals living in the community. Understandably, those with greater mobility and independence tend to remain in their own homes for as long as possible. This may partially explain the higher prevalence of sarcopenia risk among nursing home residents and older age.

Research using the SARC-F questionnaire was conducted in Poland on a sample of 73 community-dwelling participants (78.1% of whom were women) of ≥65 years of age. The average age of the participants was 77.8 years, and the results showed that 19% of the entire group were at a risk of sarcopenia (9), which is a considerably lower result than in the community-dwelling group in our research (the General Group).

The average age of community-dwelling participants in the research conducted by Patel et al. (2024) was 79.8 years, and the result indicated that older age was associated with sarcopenia in both sexes (20) which was confirmed by our research showing that the oldest group of respondents (M = 80.4) had the highest sarcopenia prediction.

Research using the SARC-F questionnaire carried out on Turkish population older than 65 showed an even lower degree of risk of sarcopenia. A study demonstrated the result of 12.7% of risk (21), and the prevalence of sarcopenia in another study ranged from 1.9% to 9.2% (22). One of the possible explanations of such a low result is the age of the respondents, who were relatively young in comparison with respondents in other studies, and whose average age was 74.6 ± 6.6 years with less prevalent comorbidities such as heart failure, chronic kidney failure, etc. (22).

Diagnostic accuracy of the following four sarcopenia screening tools was compared in a retirement home in China: the Mini Sarcopenia Risk Assessment full version (MSRA-7) and the short version (MSRA-5), the SARC-F, and the SARC-F combined with calf circumference (SARC-CalF). It is interesting that the mean age of participants was 81.6±3.3 years (range 74-93 years), which is on average higher than the mean age of residents in the retirement home in this research, but the former group of participants had a lower prevalence of risk of sarcopenia, ranging from 31.4% to 38.3% when using different diagnostic criteria (23).

Similar results were found in another research in nursing homes in China. The respondents' median age was 85 years, and the prevalence of SARC-F-defined sarcopenia was 9.8% (24).

A very high risk of sarcopenia was found in the research conducted in nursing home residents across 12 sites in South Australia. The average age of the respondents was 87.7 years, and 72.6% of them were female. As many as 89.5% of respondents were at a risk of sarcopenia. It is interesting that diabetes was cited as a significant risk factor of sarcopenia (25).

Limitations

One limitation of this research was the use of a convenience sample. Additionally, the gender distribution within the sample could have been more balanced, particularly by increasing the proportion of male participants.

The practical implications of this research include the implementation of sarcopenia risk assessment among the elderly, both in nursing homes and in community-dwelling populations. This involves not only using the SARC-F questionnaire as an initial screening tool but also incorporating further diagnostic steps in accordance with the protocol of the European Working Group on Sarcopenia in Older People (EWGSOP) (2), which has not been adopted in Croatia yet.

The benefit of this approach is that individuals who are not only at risk of sarcopenia but also those already affected can be identified in a relatively short

period, allowing for timely interventions. In this context, improving nutrition is particularly important, especially considering that many elderly individuals are malnourished. Interventions should include increased protein intake and regular physical exercise.

Conclusion

Age is the only significant risk factor when assessing the sarcopenia risk in this sample. Moreover, each additional year of age increases the odds of sarcopenia by approximately 12%. Individuals at risk of sarcopenia were significantly older than those not at risk, with an average age difference of approximately five years. Nursing home residents had the highest risk of sarcopenia, while lower risk levels were observed among the general population and orthopaedic clinic outpatients. According to this research, gender is not a significant predictor for the risk of sarcopenia.

When it comes to the significant public health consequences caused by sarcopenia in the community, further similar research is necessary since there is insufficient data on sarcopenia in Croatia and there is still no systematic monitoring of this illness.

Author contributions

Conceptualization (AMĆ, MF, IJ, MT, EP); Investigation (MT, MF, AMĆ, KT, VB); Methodology (IJ, LFT, TNJZ); Writing – Original Draft (AMĆ, MT, TNjZ, EP); Writing – Review & Editing (AMĆ, MT, IJ, MF). All authors have approved the final manuscript.

Conflict of interest

The authors declare no conflicts of interest.

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