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Original Article

Sensitivity and specificity of SARC-F in the classification of sarcopenia among the elderly: preliminary results

Sensibilidade e especificidade do SARC-F na classificação de sarcopenia em idosos: resultados preliminares

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ABSTRACT

Introduction: In addition to being prevalent in the elderly population, sarcopenia has become a precursor to functional decline in this population. Alternative means for screening is necessary. **Objectives:** The aim of this study was to evaluate the sensitivity and specificity of the SARC-F sarcopenia screening instrument. **Methods:** The sample consisted of 153 elderly of both sexes. Screening of sarcopenia was evaluated by the SARC-F questionnaire. Strength, function and muscle mass were evaluated through the protocol adapted from the European Working Group on Sarcopenia in Older People (EWGSOP). The sensitivity and specificity of the questionnaire were evaluated using the ROC curve. **Results:** 13.72% of the elderly evaluated were classified as sarcopenic. The parameters most related to sarcopenia were older and lack of physical exercise. Sex was not a parameter that had a relationship in classification. Sensitivity was 60.0% and specificity of 80.92% with an area on the curve of 0.70. **Conclusion:** Our data supports the use of SARC-F as a screening tool that can be used in community and hospital environments as a quick screening tool.

Key-words: : Muscle strength, Aged, Sarcopenia.

RESUMO

Introdução: Além de grande prevalente na população idosa, a sarcopenia tem se tornado precursora do declínio funcional nessa população. Torna-se necessário encontrar meios alternativos para rastreio. **Objetivos:** O objetivo do presente estudo foi avaliar a sensibilidade e especificidade do instrumento de rastreio da sarcopenia SARC-F. **Métodos:** A amostra foi constituída por 153 idosos de ambos os sexos. O screening da sarcopenia foi avaliado pelo questionário SARC-F. Para diagnóstico da sarcopenia avaliou-se força, função e massa muscular através do protocolo adaptado do *European Working Group on Sarcopenia in Older People* (EWGSOP). A sensibilidade e especificidade do questionário foram avaliadas por meio da curva ROC. **Resultados:** 13,72% dos idosos avaliados foram classificados como sarcopênicos. Os parâmetros mais relacionados com a sarcopenia foram maior idade e falta de prática de exercícios físicos. O sexo não foi um parâmetro que teve relação na classificação. A sensibilidade foi de 60,0% e especificidade de 80,92% com uma área sobre a curva de 0,70. **Conclusão:** Nossos dados apoiam o uso do SARC-F como uma ferramenta de rastreio que pode ser usada em ambientes comunitários e hospitalares como ferramenta de triagem rápida.

Palavras-chave: Força muscular, Idoso, Sarcopenia.

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Introduction

Life expectancy has raised since the nineteenth century causing global ageing in the world population. A doubled elderly population is projected worldwide, ranging from 11% to 22% of the population in 2050. Sarcopenia is a multifactor syndrome that has become increasingly prevalent among the elderly population compromising strength levels, muscle mass and function as a consequence of cellular processes underlying the syndrome development and progress [1]. Since the creation of the term Sarcopenia, in 1989, a lot of researches have been developed in order to find general agreement on test standardization and in elaborating interventions [2]. The sarcopenia importance has been emerging as a key factor in negative outcomes such as frailty, fall and hospitalization that lead to a functional decline of the elderly. Besides it has been associated with death in elderly patients [3].

Tools such as electrical bioimpedance, ultrasound, magnetic resonance and physical tests like the hand force and walking time may be useful in sarcopenia diagnosis, once they evaluate the muscle mass, strength and function and it is possible to track the harmful processes of this syndrome as well as its prognosis. However, some of these methods have become unfeasible due to lack of access and costs of equipment [4]. Guidelines have been elaborated in order to look into better ways of screening, diagnosis and management of the syndrome which affect elderly people [5,6], and the SARC-F questionnaire is one of these options. Recently, its reliability has been elucidated and current guidelines make this instrument important and essential ally to health.

The clinical relevance of sarcopenia has increased as its negative outcomes began to get more known. By the high cost and the importance of early diagnosis, it is important to search alternative means to diagnose sarcopenia [7-9]. The known sarcopenia outcomes to elderly health and the importance of this population be periodically tracked have motivated this investigation. The aim of the present study was to evaluate the sensitivity and specificity of the screening tool SARC-F for Sarcopenia.

Methods

Participants

We evaluated 443 elderly during the screening phase, responding to the SARC-F questionnaire. From these, 128 did not show interest in taking EWGSOP protocol, 162 were unable to perform physical exercise. The group of participants consisted of 153 elderly from both sexes by a convenience sample. The elderly were interviewed in their own houses, being accompanied by the community health agents.

Measures

Sarcopenia screening was evaluated by SARC-F questionnaire, proposed by Malmstrom and Morley [10], composed by 5 questions which indicate a decrease in physical performance on the strength, walking, raising a chair, climbing stairs and falls. The reference score for sarcopenia was a sum equal or higher 4 (Box 1).

Box 1. Simple five-item questionnaire (SARC-F)

Component	Question	Scoring
Strength	How much difficulty do you have in lifting and carrying 10 pounds?	None = 0 Some = 1 A lote or unable = 2
Assistance in walking	How much difficulty do you have walking across a room?	None = 0 Some = 1 A lot, use aids, or unable = 2
Rise from a chair	How much difficulty do you have transferring from a chair or bed?	None = 0 Some = 1 A lot, use aids, or unable = 2
Climb stairs	How much difficulty do you have climbing a flight of 10 stairs?	None = 0 Some = 1 A lot, use aids, or unable = 2
Falls	How many times have you fallen in the past year?	None = 0 1-3 falls = 1 4 ou more falls = 2

For sarcopenia diagnosis, the adapted protocol from the European Working Group on Sarcopenia in Older People (EWGSOP) was used and the following parameters were evaluated: a) muscle mass by the anthropometric equation proposed by Baumgartner *et al.* [11]; b) muscle strength by hand press by the dynamometer (SAEHAN) with 0,1 N accuracy and, c) muscle function measured by the 4,57m walking tests.

The reference scores adopted were: a) low muscle mass: ≤ 6,37 kg/m² for women and ≤ 8,90 kg/m² for men; b) decrease of hand press force: 20 kg for women and 30kg for men; c) reduction of walking speed when time is over 7.6 s for height ≤ 1.54 and 6.6s for height > 1.54 for women. Time over 6,3s for height >1.68 and 7s for height ≤ 1.68 for men (Table I).

Table I - Protocol adopted by European Working Group on Sarcopenia in Older People (EWGSOP).

	Evaluation instrument	Cutting point
Muscle mass	(0.2487 x weight) + (0.0483 x height) – (0.1584 x waist circ) + (0.0732 x strength) + (2.5843 x sex) + 5.8828	Women: MM ≤ 5.08 kg/m² Men: MM ≤ 6.28 kg/m²
Muscle strength	Hand grip by dinamometer (SAEHAN) accuracy of 0.1N	Women: 20 kgf Men: 30 kgf
Muscle function	Walking Test 4.57m	Women: T >7.6s - est. ≤1.54 6.6s - est >1.54. Men: 7s - est. ≤1.68 T>6,3s - est.>1.68

Circ = circunference; MM = massa muscular; T = time.

On this study, the sarcopenia classification was based on 3 criteria: 1) non-sarcopenic: no score in muscle mass, strength and function; 2) sarcopenic: score in muscle mass and strength or muscle function; 3) severe sarcopenic: scores in muscle mass, strength and function (Table II).

Table II - Sarcopenia classification.

Classification	Score criteria
Non-sarcopenic	No score in muscle mass, strength and function
Sarcopenic	Score in muscle strength and mass or muscle function
Severe sarcopenic	Score in muscle mass, strength and function

Procedures

It is an observational study, elaborated on data from a population and residential basis research named: "Screening, diagnosis and frailty rehabilitation and sarcopenia among elderly people in Rio Pomba, MG".

Ethics procedures

This study was approved by the Ethics Commitee (CAE 67925317.8.0000.5089). All procedures and potential risks were cleared to the participants and their consent was signed before the evaluations.

Statistical treatment

Data were tabulated on Microsoft Office Excel Program (2016) and analysed on SPSS 21® (SPSS Inc., EUA) statistic program. The sample features were described by mean and standard deviation or percentage, according to the variable characteristic. The ROC (Receiver Operating Characteristic) curve and the area under the curve (AUC) were used to compare the diagnosed accuracy of the instrument and analyze the sensitivity and specificity.

For all variables, the differences were statically significant for $p < 0.05$.

Results

The sample features identified according to the sarcopenic status are described in table III.

Table III - Features of a sample according to the sarcopenic status.

Variables	Total (n=153)	Non Sarcopenic (n= 131)	Sarcopenic (n= 21)	p
Age (years old)	70.79 ± 7.72	70.06 ± 7.41	75 ± 8.35	0.003
BMI (kg/m2)	27.86 ± 5.36	28.09 ± 5.41	26.47 ± 5.04	0.203
WHR	0.90 ± 0.074	0.90 ± 0.07	0.91 ± 0.08	0.645
Female (n)	118	102	16	0.697
Male (n)	35	29	6	
Strength (Kgf)	24.58 ± 9.20	25.63 ± 9.32	18.52 ± 5.43	0.001
Walking test(s)	5.11 ± 2.83	4.56 ± 1.21	8.38 ± 6.14	0.000
Lean body mass index	10.02 ± 284	10.47±2.69	7.38±2.22	0.000
Physical exercise				
- Pratice (n)	72	68	3	0.003
- No pratice (n)	81	63	18	

BMI = Body mass index; WHR= waist/hip ratio.

The mean population age of the study was 70.79 ± 7.72 years old and 77.12% were female (n = 118). The BMI mean was 27.86 ± 5.36 kg/m² and the ratio waist/hip mean was 0 90 ± 0,074.

When the low criteria of muscle strength function and mass were combined following the EWGOSP protocol, 13.72% of the elderly were classified as sarcopenic.

The most related parameters with sarcopenia were higher age (75 ± 8.35 - p=0,003) and lack of physical exercise (p = 0,003). Sex was not a parameter related in the classification (p = 0,697).

Sarcopenic patients showed a significantly lower level of force index than the non-sarcopenic ones (18.52 ± 5.43 x 25.63 ± 9.32), walking (8.38 ± 6.14 x 4.56 ± 1.21) and lean body mass (7.38 ± 2.22 x 10.47 ± 2.69).

Our data showed that SARC-F tracked 36 sarcopenic participants (23.52%) and the EWGOSP criteria diagnosed 21 (13.72%), which means a sensitivity of 60,0% and specificity of 80.92% and an area under the curve of 0.70 (Figure 1).

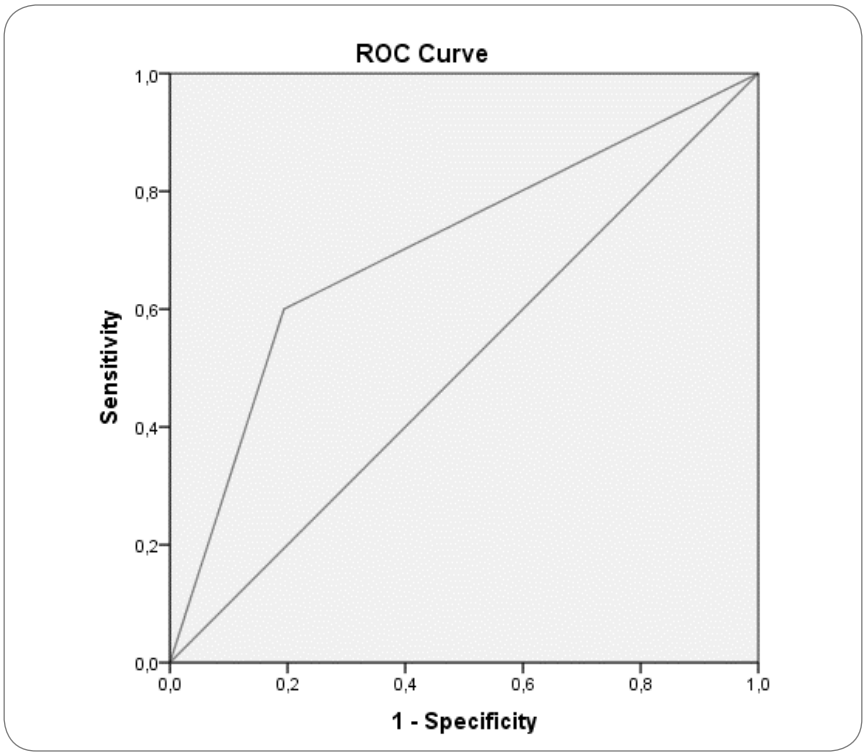

Figure 1 - ROC- Relation between sensitivity and specificity. The area under the curve value of 0.70 presents good instrument traceability.

Discussion

The objective of this study was to evaluate the sensitivity and specificity of the screening sarcopenia instrument SARC-F. The sarcopenia prevalence found in the studied populations was 13.72%. The sensitivity of SARC-F to screen sarcopenia according to EWGOSP was 60.00%, with specificity of 80.92% and AUC of 0.70. The most related sarcopenia parameters were higher age and lack of physical exercise. Sex was not a related parameter in the classification.

On the studied sample, the sarcopenia prevalence recorded by the EWGSOP algorithm was 13.72%, while the one indicated by the SARC-F was 23.52%. The sarcopenia prevalence may vary, being influenced by screening methods and diagnosis and by the studied population in several parts of the world. However, similar studies, using the EWGSOP protocol among elderly people, have estimated the sarcopenia

prevalence among people aged 60 to 70 years old between 5 to 13%, while the prevalence varies from 11 to 50% among people aged 80 years old or more [12-14]

The most related sarcopenia parameters were higher age (75 ± 8.35 years old p = 0,003) and lack of physical exercise (p = 0,003). Sex was not a related parameter in the classification (p = 0,697). On our study, the advanced age was associated to sarcopenia. These results are according to those found previously and which found sarcopenia more prevalent in older elderly [12-14]. There are events responsible for the mitochondrial quality control that keep muscle cell homeostasis. Picca *et al.* [16] reported the dysfunction of these mechanisms increases during ageing and lack of physical exercise, which causes sarcopenia.

Some studies highlighted that strength loss presents a gradual decrease from 50 years old on [17,18] and increase after 65 years old [11]. This deterioration may be from 1 to 2% per year [19]. Soares *et al.* [20] reported that a worse performance in hand press force and walking speed are associated with mortality risk. Ruiz *et al.* [21] noticed sarcopenia as a condition that appears when the patient is unable or has a functional deficit. Sarcopenia may get worse when there are comorbidities, increasing the mortality associated to its cause. Besides, Norman & Otten [22] highlighted a higher longevity led to higher frequency of sarcopenia and increasing expenses with health care which are due to complications associated to functional health declines and independence loss.

In our study, another parameter related to sarcopenia was physical inactivity. Peterson *et al.* [23] emphasized that the physical exercise acts against shape loss and muscle function. The physical exercise is largely agreed as an instrument of disease prevention and rehabilitation. It has been prescribed by health organizations, and is an important ally to health maintenance and good shape [24-25].

Michaud *et al.* [27] emphasized that, among other factors, the TNF-α increased levels are responsible for an increased muscle catabolism and oxidative stress, resulting in a physical performance decline, and in a muscle strength and mass decline. Therefore, the physical exercise acts reducing TNF-α, improving the functional capacity, acting as an efficient treatment to delay the sarcopenia as the elderly who practice physical exercise may experiment a protein synthesis improvement and neuromuscular adaptation [28]. Our results support the fact that physical inactivity makes sarcopenia get worse. Ruiz *et al.* [21] found association between mortality and low strength in elderly patients, agreeing that sarcopenia must be treated.

As far as sex is concerned, the results were the opposite to our hypothesis. Statiscally, there was no difference in the variable in the classification. However, our study supports the Christensen *et al.* [11] findings, which found the female sex was not prevalent among the sarcopenic people anymore. Nevertheless, our results are opposite to those found by Bravo-José *et al.* [14], who found a higher prevalence among female people (81.4%). It is known that female sex factors, such as menopause, increase risk of osteoporosis, as well as sarcopenia, besides a lower production of estrogen hormones [29-31].

SARC-F sensitivity to track sarcopenia according to EWGOSP was 60%. Its specificity was 80.92% and AUC was 0.70 showing moderate traceability of the instrument. Because of the clinical importance of sarcopenia to elaborate interventions that avoid health problems among the elderly, studies were conducted to clarify SARC-F reliability, validity, sensitivity and specificity [12,32,33]. Kim *et al.* [32] reported low sensitivity and high specificity in a Korean population. The authors emphasized that because it is a self-referred questionnaire, the women might have been influenced once they reported more limitations than they are actually able to perform. Woo

et al. [33] reported sensitivity of 29% and high specificity of 91% among a male population. In the same study, the authors found a sensitivity of 8.4% and specificity of 94.9% among female.

Barbosa-Silva *et al.* [12] suggested a way to improve the SARC-F. They proposed a combination of SARC-F and calf circumference, obtaining a 33.3% to 66.7% improvement in sensitivity. Woo *et al.* [33] found an area under the curve representing 0.63 to 0.76 when they compared SARC-F with the agreed groups about sarcopenia. In this study, the area under the curve was 0.70.

This study was limited. First, due to the self-managed nature of the SARC-F questionnaire, the patients could omit information to be rated in a better muscle health condition than they really present. Besides, the results might be affected by cognitive difficulties. Secondly, the ideal instrument to evaluate the body lean mass is the densitometer. However, in the current study, the anthropometric equation proposed by Baumgartner *et al.*[18] was used because there was no access to the densitometer.

Conclusion

The current study found good sensitivity and specificity on the SARC-F instrument giving knowledge on the importance of muscle health and leading to using simple and effective screening instruments to allow the elaboration of prevention and rehabilitation providing potential benefits to elderly health. This highlights the potential clinical use of this instrument and increases the current comprehension of SARC-F as a reproducible and reliable technique to track sarcopenia.

Our data support the SARC-F use as a screening tool that may be used in community environments as a quick screening instrument. Because it is an easy application tool, it has become an important option when it comes to public health and may be used when more complex diagnosis equipment is lacking or when its use is recommended.

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Potential conflict of interest
No conflicts of interest with potential potential for this article have been reported.

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Authors' contributions
Conception and design of the research: Mansur HN, Colugnati FB. Data collection: Reis NR. Analysis and interpretation of data: Reis NR, Mansur HN, Colugnati FB. Statistical analysis: Reis NR, Mansur HN, Colugnati FB. Obtaining financing: Not applicable. Writing of the manuscript: Reis NR, Mansur HN, Vianna JM. Novaes JS. Critical revision of the manuscript for important intellectual content: Reis NR, Mansur HN, Vianna JM, Novaes JS.

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