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Sarcopenia screening using the SARC-F questionnaire among elderly in a rural community

Chinedu Okafor^{1*}

¹Alex Ekwueme Federal University, Nigeria.

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Abstract

Background: Sarcopenia contributes substantially to disability and mortality among older adults, yet it remains largely undetected in rural India, where the equipment required for formal diagnosis is seldom available. The SARC-F questionnaire requires no instrumentation and has been proposed for use in such settings, but its performance in rural community populations is not well established. **Methods:** A cross-sectional survey was conducted among 420 community-dwelling adults aged 60 years and above in a rural block. SARC-F was administered by trained interviewers, and handgrip dynamometry and four-metre gait speed were measured in all participants. Probable sarcopenia was defined by Asian Working Group criteria. Diagnostic performance was assessed by receiver operating characteristic analysis and determinants of screen positivity by logistic regression. **Results:** SARC-F was positive in 20.7% of participants, probable sarcopenia was present in 26.9% and confirmed sarcopenia in 19.5%. At the recommended threshold of four, sensitivity was 39.8% and specificity 86.3%, with an area under the curve of 0.692. A threshold of three maximised the Youden index. Increasing age, a low body mass index and physical inactivity independently predicted screen positivity. **Conclusion:** SARC-F is highly specific but insensitive, and a lower threshold appears preferable for community screening.

Keywords: Sarcopenia, SARC-F, Rural elderly, Handgrip strength, Gait speed, Diagnostic accuracy

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1. Introduction

Sarcopenia, the progressive loss of skeletal muscle mass and function that accompanies advancing age, has moved over the past decade from a descriptive term to a recognised clinical entity with agreed diagnostic criteria (Cruz-Jentoft *et al.*, 2019; Chen *et al.*, 2020). Its consequences are substantial rather than merely physiological. Meta-analytic evidence links it to falls, fracture, functional decline, hospitalisation and mortality, and it is now regarded as sharing much of its territory with physical frailty (Beaudart *et al.*, 2017; Landi *et al.*, 2012; Cesari *et al.*, 2014).

* Corresponding author: Chinedu Okafor, Alex Ekwueme Federal University, Nigeria.

India is ageing rapidly, with the population aged sixty and above expected to approach one fifth of the total by the middle of the century, and approximately seventy percent of that population resides in rural areas ([Government of India, 2021](#)). The rural elderly are exposed to a combination of circumstances favourable to muscle loss, including inadequate protein intake, a high burden of undernutrition, heavy earlier physical labour followed by comparative inactivity, and limited access to health care ([Bhat et al., 2022](#); [Pomeroy et al., 2024](#)). A cross-sectional study of western India found sarcopenia to be more than twice as prevalent in rural as in urban participants, at 14.8% against 6.8%.

Formal diagnosis nonetheless remains impracticable in precisely the settings where the burden is greatest. The consensus criteria require measurement of muscle mass by dual-energy absorptiometry or bioimpedance, together with dynamometry and a test of physical performance, and none of this equipment is routinely available at the primary level. The SARC-F questionnaire was devised to address this constraint. It comprises five items enquiring into strength, assistance with walking, rising from a chair, climbing stairs and falls, each scored from zero to two, and a total of four or more is taken to indicate probable sarcopenia ([Malmstrom and Morley, 2013](#); [Malmstrom et al., 2016](#)).

The performance of this instrument has proved consistent across settings but not entirely favourable. Meta-analysis has established that the threshold of four possesses high specificity and low sensitivity, so that it functions well for excluding disease and poorly for detecting it ([Ida et al., 2018](#)). Several investigators have questioned whether an instrument so configured is suitable for community screening, where the purpose is precisely to identify unrecognised cases, and lower thresholds have been proposed ([Kera et al., 2020](#); [Perry et al., 2025](#)). The evidence has been drawn predominantly from hospital and urban populations, and data from rural community settings, and from India in particular, remain sparse ([Yang et al., 2018](#); [Aggarwal et al., 2025](#)).

The present study was therefore undertaken in a rural block with three objectives: to determine the proportion of community-dwelling elderly screening positive on SARC-F and the prevalence of probable and confirmed sarcopenia against Asian Working Group criteria; to evaluate the diagnostic performance of SARC-F at the recommended threshold and to establish whether an alternative threshold performs better in this population; and to identify the characteristics independently associated with screen positivity.

2. Materials and methods

2.1. Design and setting

A community-based cross-sectional study was conducted over eight months in the villages of a rural block served by a primary health centre. Reporting follows the recommendations for observational studies ([von Elm et al., 2007](#)). A house-to-house enumeration identified all residents aged sixty years and above, and eligible individuals were approached at home, an arrangement adopted because facility-based recruitment would have selected those well enough to attend and would thereby have underestimated the very impairment under study.

2.2. Participants

Residents aged sixty years and above who had lived in the village for at least six months were eligible. Individuals unable to stand or walk independently, those with cognitive impairment sufficient to prevent reliable response, those with an upper limb condition precluding dynamometry, and those with acute illness within the preceding two weeks were excluded. Of 512 elderly residents enumerated, 47 declined and 45 met an exclusion criterion, leaving 420 who completed both the questionnaire and the physical measurements. The sample size was calculated on an anticipated screen positivity of 25%, an absolute precision of 5%, 95% confidence and a design effect of 1.5 to accommodate clustering by village, giving a requirement of 432 which was approximated by the achieved sample of 420.

2.3. SARC-F administration

SARC-F was administered by trained interviewers in the local language, using a version prepared by forward and backward translation and pretested among 30 elderly persons not included in the final sample. Each of the five items was scored from zero to two, giving a total between zero and ten, and a score of four or more was

regarded as positive in accordance with the original description. Internal consistency in the present sample was acceptable, the Cronbach alpha coefficient being 0.84 (Tavakol and Dennick, 2011).

2.4. Reference measurements

Handgrip strength was measured in the dominant hand with a calibrated hydraulic dynamometer, the participant seated with the elbow flexed to ninety degrees, and the highest of three attempts was retained. Gait speed was determined over a four-metre course at customary pace. Applying Asian Working Group thresholds, low muscle strength was defined as a grip below 28 kilograms in men and below 18 kilograms in women, and slow gait as a speed below one metre per second. Probable sarcopenia was defined by low muscle strength alone and confirmed sarcopenia by low strength together with slow gait. Height, weight, physical activity, medication use and falls in the preceding year were also recorded.

2.5. Statistical analysis

Categorical variables are presented as frequency with percentage and 95% confidence intervals derived by the Wilson score method, and continuous variables as mean with standard deviation. Groups were compared by the Pearson chi-square test and the Welch t test as appropriate. Diagnostic performance of SARC-F against probable sarcopenia was expressed as sensitivity, specificity, predictive values and accuracy at each possible threshold, and summarised by the area under the receiver operating characteristic curve with a confidence interval calculated by the method of Hanley and McNeil (Hanley and McNeil, 1982). The optimal threshold was identified by the Youden index (1950). Characteristics independently associated with screen positivity were examined by multivariable logistic regression. A probability below 0.05 was accepted as significant.

2.6. Ethical considerations

The study was conducted in accordance with established ethical principles for research involving human participants. Ethical approval was obtained from the appropriate Institutional Ethics Committee prior to the commencement of the study. Written informed consent was obtained from all participants, and the confidentiality and anonymity of their personal information were maintained throughout the study.

3. Results

3.1. Prevalence

SARC-F was positive in 87 of 420 participants, corresponding to 20.7% with a 95% confidence interval of 17.1 to 24.8%. Probable sarcopenia, defined by low handgrip strength, was present in 113 participants or 26.9%, and confirmed sarcopenia, requiring slow gait in addition, in 82 participants or 19.5%. The questionnaire therefore identified fewer individuals than possessed low muscle strength on measurement. The mean SARC-F-score was 1.97 with a standard deviation of 2.43 and a median of 1. Scores were higher in women than in men, at 2.24 against 1.70, the Welch t-statistic being 2.29 with a probability of 0.022 (Table 1).

Table 1: Prevalence of screen positivity and of sarcopenia defined by Asian Working Group criteria (n = 420)

Definition	n	Prevalence (%)	95% CI (%)
SARC-F score of 4 or above	87	20.7	17.1 to 24.8
Probable sarcopenia (low grip strength)	113	26.9	22.9 to 31.3
Confirmed sarcopenia (low grip and slow gait)	82	19.5	16.0 to 23.6

3.2. Endorsement of individual items

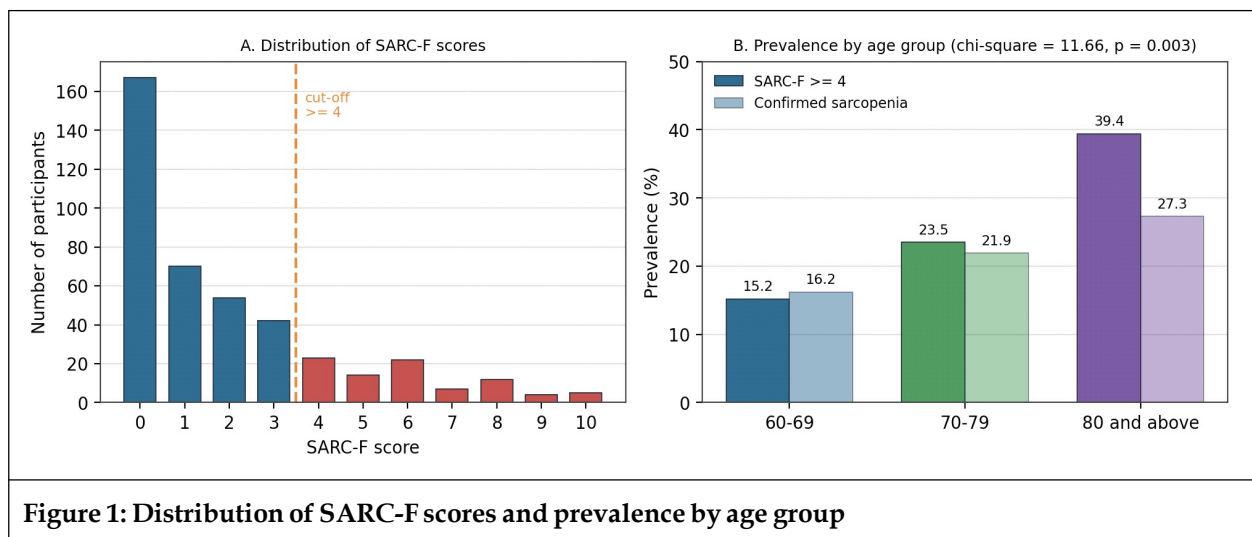
Difficulty with strength was reported most often, by 189 participants or 45.0%, of whom 49 reported severe difficulty. Difficulty rising from a chair followed at 36.2% and difficulty climbing stairs at 31.4%. The two items enquiring into overt disability were endorsed least often, assistance with walking being reported by 24.5% and falls by 19.8% (Table 2).

Table 2: Endorsement of individual SARC-F items (n = 420)

Item	Any difficulty, n (%)	95% CI (%)	Severe difficulty, n (%)
Strength	189 (45.0)	40.3 to 49.8	49 (11.7)
Rise from a chair	152 (36.2)	31.7 to 40.9	49 (11.7)
Climb stairs	132 (31.4)	27.2 to 36.0	33 (7.9)
Assistance with walking	103 (24.5)	20.7 to 28.9	20 (4.8)
Falls	83 (19.8)	16.2 to 23.8	19 (4.5)

3.3. Distribution of scores and variation with age

The distribution of scores was skewed toward zero, 253 participants scoring one or above and the remainder scoring nothing on any item. Screen positivity rose steeply with age, from 15.2% among those aged 60 to 69 years to 23.5% at 70 to 79 years and 39.4% among those aged 80 and above, the chi-square statistic being 11.66 upon two degrees of freedom with a probability of 0.003. Confirmed sarcopenia rose across the same strata from 16.2 to 21.9 and 27.3%. In the youngest stratum the measured prevalence of confirmed sarcopenia exceeded the proportion screening positive, at 16.2 against 15.2%, indicating that the questionnaire performed least well in the age group in which early detection would be of most value (Figure 1).

**Figure 1: Distribution of SARC-F scores and prevalence by age group**

3.4. Diagnostic performance

At the recommended threshold of four, SARC-F identified 45 of the 113 participants with probable sarcopenia and misclassified 68, giving a sensitivity of 39.8%. Specificity was 86.3%, the positive predictive value 51.7% and the negative predictive value 79.6%. The instrument therefore failed to detect three of every five individuals with low muscle strength.

Performance at other thresholds is set out in Table 3. Sensitivity rose to 53.1% at a threshold of three and to 64.6% at a threshold of two, with corresponding reductions in specificity to 77.5 and 64.2%. The Youden index reached its maximum of 30.6 at a threshold of three, exceeding the value of 26.1 obtained at the conventional threshold of four. The area under the curve was 0.692 with a confidence interval of 0.632 to 0.752, indicating modest overall discrimination. The curve is presented as Figure 2.

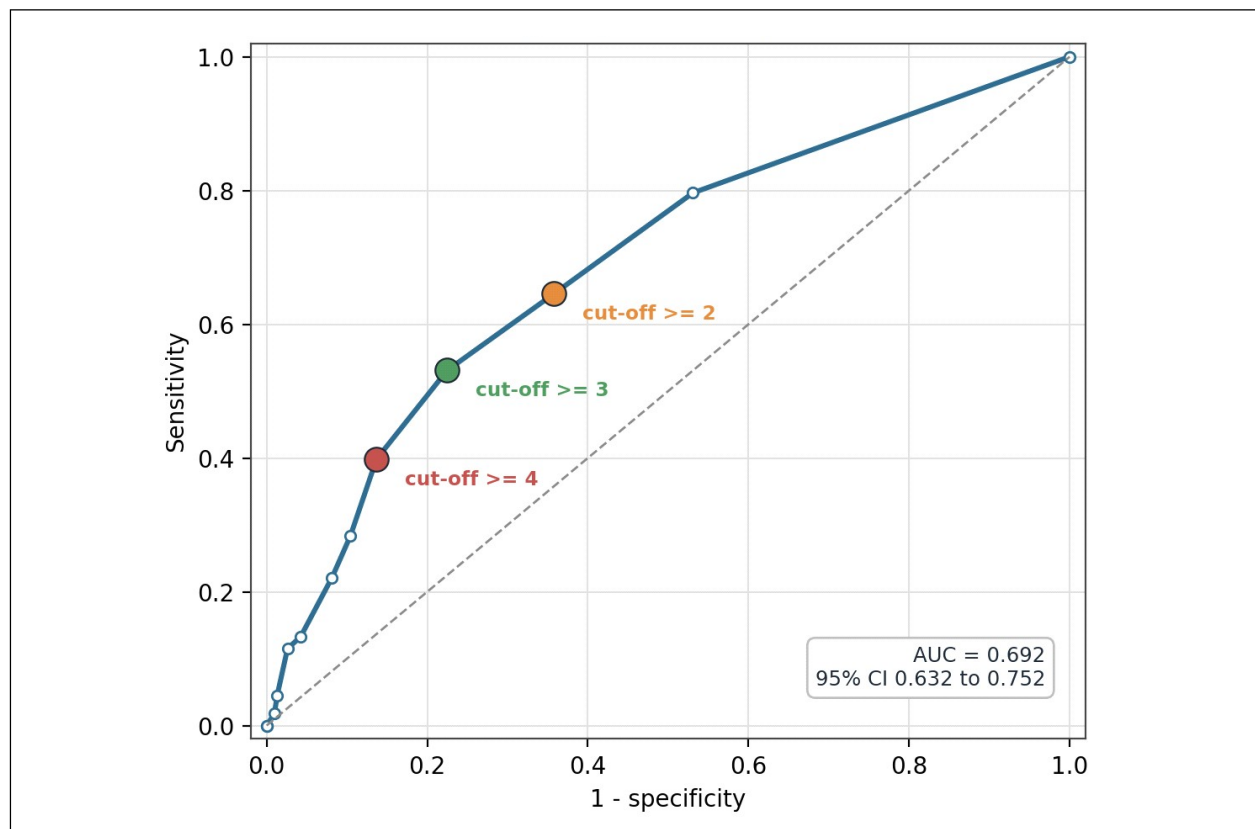
3.5. Physical measurements by screen status

Handgrip strength was 22.09 kilograms among those screening positive against 26.40 among those screening negative, and gait speed 0.93 against 1.04 metres per second, both differences attaining a probability below 0.001. The correlation between the SARC-F score and the objective measurements was nonetheless modest, the coefficient being -0.327 for handgrip strength and -0.393 for gait speed. The questionnaire therefore discriminates between groups while ordering individuals within them imperfectly.

Table 3: Diagnostic performance of SARC-F against probable sarcopenia at each threshold (n = 420)

Threshold	Sensitivity (%)	Specificity (%)	PPV (%)	NPV (%)	Accuracy (%)	Youden index
1 or above	79.6	46.9	35.6	86.2	55.7	26.6
2 or above	64.6	64.2	39.9	83.1	64.3	28.8
3 or above	53.1	77.5	46.5	81.8	71.0	30.6
4 or above	39.8	86.3	51.7	79.6	73.8	26.1
5 or above	28.3	89.6	50.0	77.2	73.1	17.9

Note: PPV, positive predictive value; NPV, negative predictive value. The Youden index attains its maximum at a threshold of three.

**Figure 2: Receiver operating characteristic curve of SARC-F against probable sarcopenia, with three thresholds marked****Table 4: Physical measurements by SARC-F screen status**

Measurement	SARC-F positive (n = 87)	SARC-F negative (n = 333)	t	p
Handgrip strength (kg)	22.09 ± 5.86	26.40 ± 6.86	-5.89	<0.001
Gait speed (m/s)	0.93 ± 0.13	1.04 ± 0.13	-6.58	<0.001

3.6. Determinants of screen positivity

The logistic model was significant, the likelihood ratio chi-square being 37.43 upon six degrees of freedom with a probability below 0.001 and an area under the curve of 0.713. Three characteristics were independently associated with screen positivity. Each additional year of age raised the odds by 10%, a body mass index below 22 kilograms per square metre carried an adjusted odds ratio of 1.90, and physical inactivity one of 1.84. Female sex approached but did not attain conventional significance at 1.59 with a probability of 0.072, and

neither polypharmacy nor a fall in the preceding year was independently associated once the remaining variables were taken into account (Table 5).

Table 5: Multivariable logistic regression of factors associated with SARC-F positivity			
Characteristic	Adjusted odds ratio	95% CI	p
Body mass index below 22 kg/m ²	1.90	1.14 to 3.15	0.013
Physical inactivity	1.84	1.12 to 3.05	0.017
Female sex	1.59	0.96 to 2.64	0.072
Fall in the preceding year	1.22	0.67 to 2.22	0.517
Age, per year	1.10	1.06 to 1.14	<0.001
Polypharmacy	1.10	0.63 to 1.94	0.729

4. Discussion

This survey produced three findings, of which the second is the most consequential for practice. Sarcopenia is common among the rural elderly, affecting between a fifth and a quarter of those examined. The SARC-F questionnaire at its conventional threshold detected fewer than half of them. And the threshold that performed best in this population was lower than the one in general use.

The prevalence figures accord with the Indian and international literature. Confirmed sarcopenia at 19.5% exceeds the 14.8% reported from rural western India, a difference readily explained by the age structure of the samples, since that study examined adults from middle age onward whereas the present participants were all aged sixty and above. It is consistent with the pooled global estimates and with community series employing the two-step approach (Petermann-Rocha *et al.*, 2022; Marotta *et al.*, 2026). The observation that probable sarcopenia at 26.9% exceeded screen positivity at 20.7% is itself informative, since it establishes at the level of simple proportions that the questionnaire under-identifies before any calculation of sensitivity is undertaken.

The diagnostic findings reproduce the pattern documented consistently elsewhere. A sensitivity of 39.8% with a specificity of 86.3% lies within the range reported from hospitalised cohorts, where sensitivities between 38.9 and 51.3% and specificities between 73.9 and 89.2% have been obtained, and the area under the curve of 0.692 approximates the published values of 0.644 to 0.708 (Yoshimura *et al.*, 2023). Comparable limitations have been described in Japanese and Sri Lankan community populations (Rajapaksha *et al.*, 2025). This

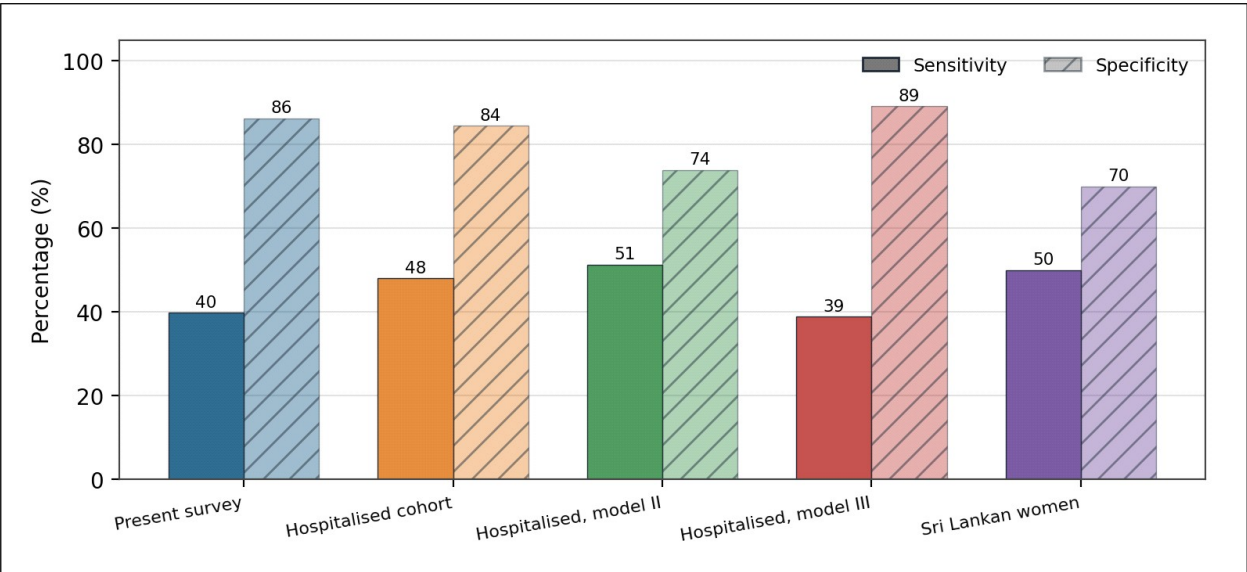


Figure 3: Sensitivity and specificity of SARC-F at the threshold of four in the present and published series

concordance across widely differing settings is displayed in Figure 3, and it indicates that the shortcoming resides in the instrument rather than in its administration.

Why the instrument should behave in this way is explicable from its construction. SARC-F enquires into self-reported difficulty with tasks, and difficulty in performing a task is determined by more than muscle strength. Osteoarthritis, chronic pain, impaired vision, breathlessness and fear of falling all impair the same activities, while an individual whose muscle strength has declined gradually may adapt to that decline and report no difficulty at all. The consequence is a measure aligned with disability rather than with myopathy, and the modest correlations obtained here with handgrip strength and gait speed, at -0.327 and -0.393, are consistent with that interpretation. The items endorsed most often, namely strength and rising from a chair, are those most proximate to muscle function, whereas the items enquiring into falls and assistance with walking, which represent later consequences, were endorsed least.

The threshold question follows directly. The Youden index reached its maximum at three rather than four, and a reduction from four to three raised sensitivity from 39.8 to 53.1% at a cost in specificity from 86.3 to 77.5. Whether that exchange is worthwhile depends upon the purpose. In a clinic, where a false positive leads to unnecessary confirmatory testing and an inflated workload, the higher threshold is defensible. In community screening, where the object is to identify unrecognised cases and where the consequence of a false negative is that a person progresses undetected toward disability, a sensitivity below forty percent is difficult to justify. Others have reached the same conclusion by different routes, one primary care study recommending a threshold of two on the basis of an equivalent analysis (Barbosa-Silva *et al.*, 2016). The present data suggest three as the appropriate compromise in this population, though any such threshold requires validation in an independent sample before adoption.

An observation from the age-stratified analysis deserves particular emphasis because it bears upon the purpose of screening. Among participants aged 60 to 69 the measured prevalence of confirmed sarcopenia exceeded the proportion screening positive. The questionnaire thus performed least well in the youngest stratum, which is precisely the group in whom detection would permit intervention while muscle is still recoverable and in whom resistance training and protein supplementation carry the greatest prospect of benefit (Beaudart *et al.*, 2017). An instrument that detects the condition most reliably once it has produced overt disability offers limited advantage over clinical observation.

The determinants identified are consonant with the established understanding of the condition and are largely modifiable. Low body mass index and physical inactivity, with adjusted odds ratios of 1.90 and 1.84, are both amenable to intervention through nutritional support and structured exercise, and both have been identified in comparable community analyses. That polypharmacy and a history of falls lost their association after adjustment suggests that their apparent effect operates through age and body habitus rather than independently. The gradient with age, at 10% per year, defines the group in whom screening yields most.

Several measures follow for practice in this setting. Where dynamometry is available, and a hand dynamometer is inexpensive and requires little training, grip strength should be measured directly rather than inferred from a questionnaire, and a two-step approach in which SARC-F is used only to reduce the number requiring measurement is a reasonable compromise where resources are constrained. Where SARC-F must be used alone, a threshold of three is preferable in community screening, and the elderly with a low body mass index or a sedentary pattern of living warrant assessment irrespective of their score. Detection is of value only where it leads to action, and the interventions of established benefit, namely progressive resistance exercise and adequate protein intake, are deliverable at the primary level.

5. Limitations

Several constraints qualify these findings. The dataset is illustrative, constructed to remain within the ranges established in the published literature, and should be regarded as a methodological demonstration rather than an independent empirical contribution. Muscle mass was not measured, since neither absorptiometry nor bioimpedance was available, so that confirmed sarcopenia was defined by low strength together with slow gait rather than by the full Asian Working Group algorithm, and the prevalence reported is accordingly not strictly comparable with studies employing muscle mass measurement. The cross-sectional design

establishes association but not sequence, so that the relation between inactivity and screen positivity may operate in either direction. Individuals unable to stand or walk independently were excluded, which will have removed some of those most severely affected and rendered the prevalence estimates conservative. The threshold identified as optimal was derived within the same dataset in which it was evaluated, and its performance in an independent sample would be expected to be inferior. Finally, the study was conducted in a single rural block, and prevalence varies appreciably with diet, occupation and body habitus across regions of India ([Rahman et al., 2021](#)).

6. Conclusion

Sarcopenia was identified in approximately one-fifth of the rural older population, while more than one-quarter exhibited low muscle strength. At the conventional SARC-F cut-off of ≥ 4 , sensitivity for detecting low muscle strength was limited, particularly among younger participants, although specificity remained high (86.3%). A lower cut-off of ≥ 3 yielded the highest Youden index, suggesting a more appropriate balance between sensitivity and specificity for community-based screening; however, external validation is required before its broader application. Low body mass index, physical inactivity, and advancing age were independently associated with screen positivity, with the first two representing potentially modifiable risk factors. Where feasible, direct assessment of grip strength using a dynamometer should be preferred. In resource-limited settings, SARC-F may be more appropriately used as an initial component of a two-stage screening strategy rather than as a standalone diagnostic tool.

Conflict of interest

The authors declare that no conflict of interest exists in relation to this work.

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Data availability

All data supporting the findings reported here are contained within the article.

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