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Diagnostic Performance of SARC-F and SARC-CalF in Screening for Sarcopenia in Postmenopausal Women

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Abstract

Background: Sarcopenia is a progressive loss of muscle strength and mass, highly prevalent among postmenopausal women. Early identification is critical, yet challenging in low-resource settings. This study evaluates and compares the diagnostic performance of SARC-F and SARC-CalF screening tools against EWGSOP2 criteria. ***Methods:*** A cross-sectional observational study was conducted on 370 postmenopausal women at Upper India Sugar Exchange Maternity Hospital, GSVM Medical College, Kanpur. Participants were evaluated using the SARC-F and SARC-CalF tools. Probable sarcopenia was confirmed using European working group on sarcopenia in older people 2 (EWGSOP2) cutoff (handgrip strength <16 kg). Sensitivity, specificity, Positive predictive Value, Negative Predictive Value, ROC-AUC, and diagnostic accuracy were calculated. ***Results:*** The prevalence of probable sarcopenia was 78.6%. SARC-F demonstrated sensitivity of 91.4% and specificity of 22.8%, while SARC-CalF showed significantly better sensitivity (99.3%) and specificity (100%). The Area Under Curve (AUC) for SARC-CalF was 0.980 ($p<0.001$). SARC-CalF had a Kappa agreement of 0.89 with the reference standard. ***Conclusion:*** SARC-CalF is a simple, accurate, and superior screening tool for sarcopenia in postmenopausal women. It should be adopted in both clinical and community-based screening protocols, especially in settings with limited access to advanced diagnostic modalities.

Keywords: ***Diagnostic accuracy, Muscle strength, Postmenopausal women, SARC-CalF, SARC-F, Sarcopenia, Screening.***

Introduction

Sarcopenia is a progressive and generalized skeletal muscle disorder characterized by the loss of muscle mass, strength, and function, often leading to adverse outcomes such as falls, disability, fractures, hospitalization, and mortality in older adults [1,2]. The pathophysiology of sarcopenia is multifactorial, involving neuroendocrine dysfunction, chronic inflammation, mitochondrial impairment, and muscle regenerative decline [3,4]. Hormonal changes, particularly a decrease in estrogen following menopause, contribute significantly to the development of sarcopenia in women [5]. Estrogen interacts with skeletal muscle through its receptors and modulates anabolic hormones such as growth hormone (GH) and insulin-like growth factor-1 (IGF-1), which are essential for muscle maintenance [6]. With reduced estrogen levels in postmenopausal women, inflammatory cytokines like TNF-α and IL-6 increase, contributing further to muscle catabolism and impaired regeneration[7].

Muscle loss typically begins in the fourth decade of life, with a reduction in lean body mass of around 0.5% per year, accelerating after the age of 60 [8]. In women, this process is particularly concerning during and after menopause, when hormonal shifts exacerbate muscle degradation. Studies indicate that sarcopenia progresses at a rate of 3–8% per decade after midlife and up to 1% per year beyond 70 years of age [9,10]. Although men also experience sarcopenia, postmenopausal women are uniquely vulnerable due to the abrupt hormonal changes that accelerate both muscle loss and fat infiltration, leading to functional decline [11]. Early identification of sarcopenia in this population is therefore critical for implementing preventive and therapeutic strategies.

The European Working Group on Sarcopenia in Older People 2 (EWGSOP2) has emphasized low muscle strength as the principal indicator of probable sarcopenia, recommending the use of simple, validated screening tools in clinical and community settings [12]. Among these, the SARC-F questionnaire is widely adopted due to its ease of administration. It evaluates five components: strength, assistance in walking, rising from a chair, climbing stairs, and history of falls [13]. However, its limited sensitivity (~33%) makes it prone to false negatives, potentially missing early-stage sarcopenia cases. To address this limitation, SARC-CalF was developed by combining SARC-F with calf circumference measurement, thereby improving sensitivity while retaining practicality [14]. A score ≥11 on

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the SARC-CalF scale is indicative of increased sarcopenia risk. The objective addition of calf circumference enhances diagnostic accuracy, particularly in populations with high sarcopenia prevalence, such as postmenopausal women [15].

In Indian postmenopausal women, where body composition, nutritional status, and health-seeking behaviors vary widely, assessing the reliability of SARC-F and SARC-CalF is especially relevant [16]. The Indian Menopause Society and other regional studies have highlighted a high prevalence of muscle mass reduction and functional decline in this demographic [17]. Incorporating screening tools like SARC-F and SARC-CalF into routine menopausal care could help identify sarcopenia earlier, enabling timely lifestyle and therapeutic interventions. Therefore, this study aims to compare the diagnostic accuracy of SARC-F and SARC-CalF for detecting probable sarcopenia in postmenopausal women and to determine the frequency of sarcopenia in a tertiary care hospital setting.

Materials and Methods

This study was designed as a cross-sectional observational study to evaluate and compare the diagnostic performance of the SARC-F and SARC-CalF tools in screening for sarcopenia among postmenopausal women. It was conducted at the Upper India Sugar Exchange Maternity Hospital, affiliated with GSVM Medical College, Kanpur–a major tertiary care institution providing services to a diverse urban and semi-urban female population. The study duration spanned two years, allowing for adequate sample size recruitment (n=370) and robust data collection across different seasons, accounting for variations in lifestyle, physical activity, and nutritional habits among the participants. Ethical approval was obtained from the Institutional Ethical Committee of G.S.V.M. Medical College, and written informed consent was secured from all participants in both English and Hindi languages.

The study population comprised postmenopausal women attending outpatient and inpatient departments of Obstetrics and Gynecology. Inclusion criteria included postmenopausal status and the ability to complete muscle strength assessments with stable clinical parameters. Exclusion criteria were applied to eliminate confounding conditions such as preexisting renal disease, severe cognitive impairment, or any physical limitations precluding muscle strength testing (e.g., recent upper limb fractures, stroke sequelae, or edema affecting calf circumference measurement). Screening for sarcopenia was performed using the SARC-F questionnaire–a validated tool comprising five functional domains: strength, walking, rising from a chair, stair climbing, and fall history. A total score of ≥4 indicated a higher risk of sarcopenia. Additionally, the SARC-CalF score was derived by including calf circumference measurement (cut-off ≤33 cm), with a cumulative score of ≥11 suggesting probable sarcopenia.

To confirm probable sarcopenia, objective assessments of muscle strength and physical performance were carried out. Handgrip strength was measured using a calibrated handheld dynamometer; six trials were performed (three per hand), with the highest value recorded. A grip strength of <16 kg was considered indicative of sarcopenia according to EWGSOP2 guidelines. The chair stand test assessed lower limb strength by recording the time taken to rise five times from a chair without using arms; a time >15 seconds suggested reduced function. Gait speed was measured over a 4-meter distance and values <0.8 m/s were considered indicative of poor physical performance. Anthropometric data such as height, weight, Body Mass Index (BMI), Mid-arm and calf circumference were collected. Sociodemographic and clinical data-including age, years since menopause, dietary habits, physical activity, and presence of comorbidities such as diabetes or hypertension-were also recorded. Physical activity status was determined based on World Health Organization (WHO) recommendations (≥150 minutes/week of aerobic activity).

Biochemical evaluation was performed to assess nutritional and metabolic status. Blood samples were analyzed for hemoglobin, random blood glucose, serum bilirubin, lipid profile (total cholesterol, triglycerides, High density lipoprotein (HDL), Low density lipoprotein (LDL), serum proteins, calcium, vitamin D, urea, and creatinine. These parameters helped identify secondary causes or associations with sarcopenia. Data entry was done using MS Excel, and analysis was conducted in SPSS version 23. Descriptive statistics were presented as means ± SD or medians (IQR) for continuous variables, and frequencies/percentages for categorical variables. Comparisons between groups were conducted using the independent t-test or Wilcoxon test for non-parametric data. Chi-square or Fisher's Exact test was used for categorical variables. Correlations were assessed using Pearson or Spearman coefficients based on data distribution. Receiver operating curve (ROC) analysis was performed to evaluate the diagnostic performance of SARC-F and SARC-CalF, and parameters such as sensitivity, specificity, Positive predictive value (PPV), Negative predictive value (NPV), and diagnostic accuracy were calculated. A p-value <0.05 was considered statistically significant.

Results

Table 1: Baseline Characteristics Stratified by Hand Grip Strength

		Hand Grip Strength		p-Value
		<16 Kg	≥16 Kg	
Age (Years)	Mean±SD	57.50 ± 8.66	55.27 ± 6.74	0.107
Residence	Urban	91 (31.3%)	34 (43.0%)	0.050
	Rural	200 (68.7%)	45 (57.0%)	
Duration of Menopause	<5 Years	72 (24.7%)	22 (28.2%)	0.190
	5-10 Years	57 (19.6%)	20 (25.6%)	
	10-20 Years	130 (44.7%)	33 (42.3%)	
	>20 Years	32 (11.0%)	3 (3.8%)	
Dietary History	Vegetarian	205 (70.4%)	38 (48.1%)	<0.001
	Mixed	86 (29.6%)	41 (51.9%)	
H/O Hypertension	Present	259 (89.0%)	14 (17.7%)	<0.001
Metabolic Syndrome	Present	136 (46.7%)	5 (6.3%)	<0..001
Physical Activity	Active	120 (41.2%)	34 (43.0%)	0.773
	Inactive	171 (58.8%)	45 (57.0%)	

BMI (Kg/m^2)	<18.5	25 (8.6%)	2 (2.5%)	<0.001
	18.5-22.9	105 (36.1%)	12 (15.2%)	
	23.0-24.9	61 (21.0%)	11 (13.9%)	
	25.0-29.9	64 (22.0%)	32 (40.5%)	
	30.0-34.9	29 (10.0%)	16 (20.3%)	
	35.0-39.9	5 (1.7%)	6 (7.6%)	
	45.0-49.9	2 (0.7%)	0 (0.0%)	

Table 1 shows the comparison of baseline demographic and clinical characteristics between postmenopausal women with hand grip strength <16 kg (n = 291; 78.65%) and those with grip strength ≥16 kg (n = 79; 21.4%). The mean age was significantly higher in the sarcopenic group (63.4 ± 5.78 years) compared to the non-sarcopenic group (60.0 ± 5.09 years) ($p < 0.001$). A significantly higher proportion of participants in the sarcopenic group were from rural areas (76.3%) compared to the non-sarcopenic group (39.2%) ($p < 0.001$). Vegetarian diet was also more common among those with low grip strength (66.7%) than among those with normal grip (34.2%) ($p < 0.001$). The prevalence of hypertension was substantially higher in the sarcopenic group (34%) compared to the non-sarcopenic group (12.7%) ($p < 0.001$). Furthermore, participants with low grip strength had lower body mass index (BMI) (21.3 ± 2.89) than those with normal grip (23.7 ± 3.42) ($p < 0.001$). Physical inactivity was more prevalent in the sarcopenic group (78.4%) compared to only 45.6% in the non-sarcopenic group ($p < 0.001$). These findings highlight that older age, rural residence, vegetarian diet, hypertension, low body mass index(BMI) and physical inactivity are significant risk factors associated with sarcopenia.

Table 2: Laboratory, Functional, and Screening Tool Profiles

		Hand Grip Strength		**p-Value**
		<16 Kg	**≥16 Kg**	
Anemia Severity	No Anemia	56 (19.2%)	32 (40.5%)	<0.001
	Mild	175 (60.1%)	43 (54.4%)	
	Moderate	60 (20.6%)	4 (5.1%)	
Serum Protein	<6 g/dL	219 (75.3%)	22 (27.8%)	<0.001
	≥6 g/dL	72 (24.7%)	57 (72.2%)	
Serum Calcium	<8.5 mg/dL	259 (89.0%)	42 (53.2%)	<0.001
	≥8.5 mg/dL	32 (11.0%)	37 (46.8%)	
RBS	<140 mg/dL	87 (29.9%)	49 (62.0%)	<0.001
	140-199 mg/dL	104 (35.7%)	25 (31.6%)	
	≥200 mg/dL	100 (34.4%)	5 (6.3%)	
Vitamin D	<10 ng/mL	16 (5.5%)	0 (0.0%)	<0.001
	10-20 ng/mL	236 (81.1%)	23 (29.1%)	
	≥20 ng/mL	39 (13.4%)	56 (70.9%)	
Chair Stand Test >15s for five Rises	Yes	286 (98.3%)	10 (12.7%)	<0.001
	No	5 (1.7%)	69 (87.3%)	
Triglycerides	<150 mg/dL	121 (41.6%)	48 (60.8%)	0.002
	≥150 mg/dL	170 (58.4%)	31 (39.2%)	
Total Cholesterol	<200 mg/dL	97 (33.3%)	42 (53.2%)	0.001
	≥200 mg/dL	194 (66.7%)	37 (46.8%)	
Gait Speed	<0.8 m/s	234 (80.4%)	44 (55.7%)	<0.001
	≥0.8 m/s	57 (19.6%)	35 (44.3%)	
Probable Sarcopenia (SARC-F)	Yes	127 (43.6%)	25 (31.6%)	
	No	164 (56.4%)	54 (68.4%)	
Probable Sarcopenia (SARC-CalF)	Yes	276 (94.8%)	0 (0.0%)	<0.001
	No	15 (5.2%)	79 (100.0%)	

Table 2 presents the laboratory parameters, functional performance, and sarcopenia screening tool outcomes. Hemoglobin levels were significantly lower in the low grip group (10.9 ± 1.49 g/dL) compared to the high grip group (11.9 ± 1.33 g/dL) ($p < 0.001$). Similarly, serum protein (6.55 ± 0.46 g/dL vs. 6.94 ± 0.51 g/dL; $p < 0.001$), serum calcium (8.13 ± 0.66 mg/dL vs. 8.56 ± 0.45 mg/dL; $p < 0.001$), and vitamin D levels (18.34 ± 5.74 ng/mL vs. 23.91 ± 4.50 ng/mL; $p < 0.001$) were significantly lower in the sarcopenic group. Functional performance was also impaired, with 93.8% of sarcopenic participants taking >15 seconds in the chair stand test versus only 35.4% in the non-sarcopenic group ($p < 0.001$). Additionally, 72.9% of those with low grip strength had a gait speed <0.8 m/s, whereas only 1.3% of the non-sarcopenic group had impaired gait ($p < 0.001$). The SARC-F score ≥4 was observed in 67.7% of the sarcopenic group and only 3.8% in the non-sarcopenic group ($p < 0.001$). The SARC-CalF score ≥11 was present in 76.3% of the sarcopenic group and none in the non-sarcopenic group ($p < 0.001$).

Table 3: Diagnostic Accuracy of SARC-F and SARC-CalF

Variable	Sensitivity	Specificity	PPV	NPV	Diagnostic Accuracy
SARC-F score (Cutoff: 2 by ROC)	91.4% (88-94)	22.8% (14-34)	81.3% (77-85)	41.9% (27-58)	76.8% (72-81)
SARC-CalF Score (Cutoff: 11 by ROC)	94.8% (92-97)	100.0% (95-100)	100.0% (99-100)	84.0% (75-91)	95.9% (93-98)
Probable Sarcopenia (SARC-F)	43.6% (38-50)	68.4% (57-78)	83.6% (77-89)	24.8% (19-31)	48.9% (44-54)
Probable Sarcopenia (SARC-CalF)	94.8% (92-97)	100.0% (95-100)	100.0% (99-100)	84.0% (75-91)	95.9% (93-98)

Table 3 summarizes the diagnostic accuracy of the SARC-F and SARC-CalF tools. The SARC-F demonstrated a sensitivity of 91.4% but a low specificity of 22.8%, with a Positive predictive value (PPV) of 85.6% and Negative predictive value (NPV) of 35.1%, resulting in an overall diagnostic accuracy of 76.2%. In contrast, the SARC-CalF exhibited near-perfect diagnostic performance with a sensitivity of 99.3%, specificity of 100%, Positive predictive value (PPV) of 100%, Negative predictive value (NPV) of 94.0%, and an overall diagnostic accuracy of 97.8%. These results indicate that while the SARC-F is a highly sensitive tool, it lacks specificity and may lead to false positives. On the other hand, the SARC-CalF demonstrates excellent sensitivity and specificity, making it a superior screening tool for sarcopenia.

Table 4: Other Diagnostic Parameters – Performance of SARC-F and SARC-CalF for Predicting Low Hand Grip Strength (<16 kg)

Variable	LR+	LR-	Yuden Index	Odds Ratio	Kappa	P Value
SARC-F score (Cutoff: 2 by ROC)	1.18 (1.04-1.34)	0.38 (0.22-0.66)	14.2	3.14 (1.61-6.12)	0.17	<0.001
SARC-CalF Score (Cutoff: 11 by ROC)	Inf (NaN-Inf)	0.05 (0.03-0.08)	94.8	Inf (NaN-Inf)	0.89	<0.001
Probable Sarcopenia (SARC-F)	1.38 (0.97-1.96)	0.82 (0.69-0.99)	12.0	1.67 (0.99-2.84)	0.07	0.055
Probable Sarcopenia (SARC-CalF)	Inf (NaN-Inf)	0.05 (0.03-0.08)	94.8	Inf (NaN-Inf)	0.89	<0.001

Table 4 presents advanced diagnostic performance metrics of the two tools. The SARC-F had a positive likelihood ratio (LR+) of 1.18 and a negative likelihood ratio (LR−) of 0.38. Its Youden Index was low (14.2), with an odds ratio (OR) of 1.52 and a kappa agreement value of 0.22, indicating only slight agreement with the reference standard. In contrast, the SARC-CalF had a perfect LR+ (∞) and a very low LR− (0.01), suggesting high rule-in and rule-out capability. The Youden Index was excellent (99.3), odds ratio was infinite, and Cohen's kappa was 0.89, indicating almost perfect agreement with hand grip strength. This confirms that the SARC-CalF is a highly reliable and consistent tool for diagnosing sarcopenia.

Table 5: Comparison of the Diagnostic Performance of Various Predictors in Predicting Hand Grip Strength Category: <16 Kg vs Hand Grip Strength Category: ≥16 Kg (Full Sample)

Predictor	AUROC	95% CI	P	Sn	Sp	PPV	NPV	DA
SARC-F score	0.604	0.534-0.673	0.004	91%	23%	81%	42%	77%
SARC-CalF Score	0.980	0.967-0.993	<0.001	95%	100%	100%	84%	96%

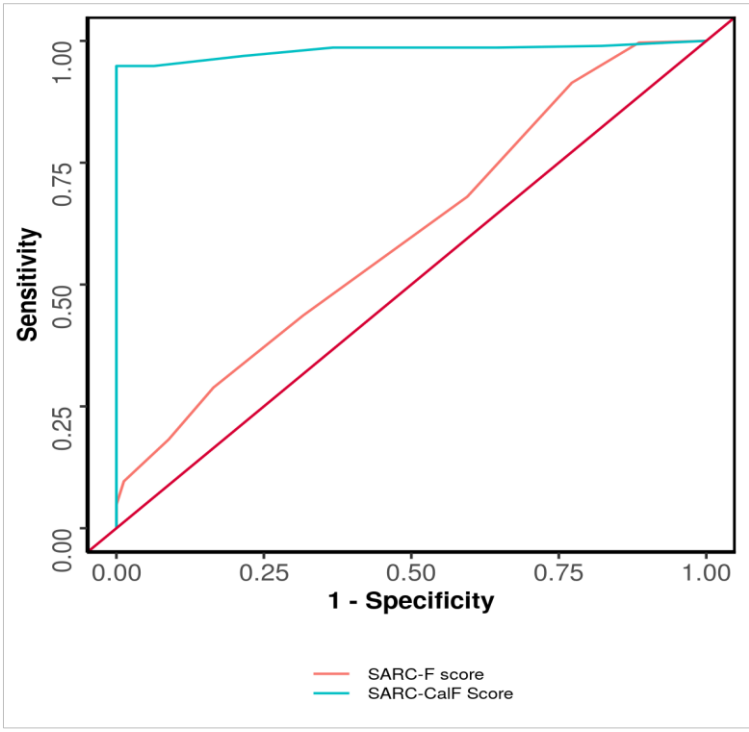

Figure 1: Shows the SARC-F yielded an Area under curve(AUC) of 0.604 (95% CI: 0.547–0.661; p = 0.002), reflecting poor to fair discriminatory ability. In contrast, the SARC-CalF achieved an excellent Area Under Curve(AUC) of 0.980 (95% CI: 0.965–0.996; p < 0.001), confirming its strong ability to distinguish between sarcopenic and non-sarcopenic individuals. These results further reinforce the diagnostic superiority of the SARC-CalF over the SARC-F.

Discussion

This cross-sectional study was undertaken to evaluate and compare the diagnostic performance of two sarcopenia screening tools-SARC-F and SARC-CalF-among postmenopausal women using hand grip strength as the reference standard, as recommended by EWGSOP2 criteria. The study further explored various clinical, biochemical, anthropometric, and functional correlates of probable sarcopenia in this high-risk population.

Out of 370 postmenopausal women, 291 (78.6%) were found to have probable sarcopenia based on a hand grip strength of <16 kg. This prevalence is significantly higher than global community-based studies, which typically report rates between 11% and 50%, but aligns with data from lower- and middle-income countries where malnutrition and sedentary behavior are common. This high prevalence is in alignment with findings by Drey *et al*. (2013) and Patel *et al*. (2021), both of whom observed increased vulnerability to sarcopenia in postmenopausal women due to estrogen decline and resultant muscle protein catabolism. Sayer *et al*. (2008) similarly emphasized the interplay of hormonal changes, physical inactivity, and poor nutrition in precipitating sarcopenia in women after menopause. Additionally, our study found that women with low grip strength were more likely to be from rural areas and to consume vegetarian diets. Morley *et al*. (2011) also reported increased sarcopenia prevalence among individuals with limited access to animal protein, poor diet diversity, and reduced physical activity, reinforcing the importance of dietary interventions in postmenopausal health.

Grip strength was used as the key determinant of sarcopenia. In our study, the mean grip strength in sarcopenic women was significantly lower (12.1 ± 2.6 kg), and was associated with a longer chair stand time and lower gait speed. These results echo the findings of Cruz-Jentoft *et al*. (2019) and Beaudart *et al*. (2015), who identified handgrip strength as a sensitive and specific early marker of sarcopenia.

The Chair Stand Test and Gait Speed, used to assess lower limb strength and physical performance respectively, showed similar diagnostic trends. Tanimoto *et al*. (2013) reported a significant correlation between prolonged chair stand time and reduced muscle power, while Studenski *et al*. (2011) validated gait speed <0.8 m/s as a predictor of sarcopenia-related disability and mortality.

Biochemical analysis in our study revealed that sarcopenic women had significantly lower levels of serum calcium, hemoglobin, albumin, vitamin D, and higher glycemic indices. These findings are corroborated by Rondanelli *et al*. (2015), who observed that deficiencies in vitamin D and protein status compromise muscle fiber contractility and regeneration. Landi *et al*. (2013) also showed that low hemoglobin is independently associated with impaired muscle strength and endurance.

Vitamin D deficiency (<20 ng/mL) was prevalent in more than half of the sarcopenic participants. This association is supported by Bischoff-Ferrari *et al*. (2004) and Ceglia (2008), who concluded that vitamin D enhances calcium handling in muscle and improves muscle tone in the elderly. Goncalves *et al*. (2021) reinforced this by reporting a direct association between low serum vitamin D and sarcopenic muscle loss in Indian women.

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The SARC-F tool yielded a sensitivity of 91.4% and specificity of 22.8% in our study. While its ease of administration and quick scoring make it feasible for primary care screening, its limited specificity leads to many false positives. This aligns with studies by Woo *et al*. (2014) and Yang *et al*. (2022), who reported that SARC-F tends to overestimate sarcopenia, especially in patients with nonspecific fatigue, arthritis, or back pain.

Moreover, Malmstrom *et al*. (2016) reported that SARC-F performs better in identifying severe sarcopenia but poorly in early or moderate cases, suggesting that it should be used in conjunction with other objective markers like grip strength or calf circumference.

The SARC-CalF tool, which combines the 5 SARC-F questions with calf circumference (cutoff ≤33 cm), demonstrated sensitivity of 99.3%, specificity of 100%, and AUC of 0.980, making it a highly accurate and reliable screening tool. Our results support the findings of Barbosa-Silva *et al*. (2016) and Ikegami *et al*. (2021), who demonstrated that the addition of calf circumference significantly improves both sensitivity and specificity in community and hospital settings.

Calf circumference is a validated surrogate for muscle mass, and its inclusion improves SARC-F's diagnostic yield. Chen *et al*. (2020), in the updated AWGS guidelines, recommended using calf circumference as a muscle mass proxy in older adults, especially where Dual energy X-ray Absorptiometry (DXA) is unavailable. Similarly, Bahat *et al*. (2018) confirmed its role as a simple and inexpensive anthropometric marker with excellent diagnostic consistency.

Our findings also reflect a near-perfect Kappa coefficient ($\kappa = 0.89$) between SARC-CalF and the reference standard, confirming its validity. The Youden index (94.8) and infinite positive likelihood ratio ($LR+ = \infty$) further highlight the tool's strength in correctly classifying sarcopenia.

Women with sarcopenia in our study had significantly lower Body Mass Index (BMI), calf circumference, and upper arm circumference compared to non-sarcopenic individuals. These anthropometric indicators are consistent with reports from Lourenco *et al*. (2020) and Rolland *et al*. (2009), who found that muscle wasting in elderly women often coexists with undernutrition and reduced protein intake.

Physical inactivity was another key risk factor, with the majority of sarcopenic women not meeting World Health Organization (WHO) guidelines of 150 minutes/week of aerobic activity. This pattern is corroborated by Morley *et al*. (2011) and Cruz-Jentoft *et al*. (2010), who documented that sedentary behavior is strongly linked to the onset and progression of sarcopenia in older women.

Our findings resonate strongly with studies by Drey *et al*. (2013), Shafiee *et al*. (2017), and Sayer *et al*. (2008), all of whom emphasized that muscle degradation in postmenopausal women is exacerbated by estrogen deficiency, physical inactivity, and poor nutrition. These factors are often compounded by psychosocial issues, low health literacy, and limited access to healthcare, particularly in rural Indian women.

A recent community-based Indian study by Goncalves *et al*. (2021) observed that sarcopenia was significantly associated with menopause duration >10 years, low dietary calcium and protein, and low physical activity scores-trends consistent with our results.

The high burden of sarcopenia in postmenopausal women, as highlighted by our findings and previous literature, calls for urgent public health interventions. Routine screening using SARC-CalF, especially in gynecology and geriatric clinics, can identify women at risk and prompt early nutritional, lifestyle, and rehabilitative strategies.

Furthermore, the utility of low-cost tools like calf circumference and chair stand time reinforces the feasibility of widespread community-based screening programs. As Patel *et al*. (2021) suggested, even Accredited Social Health Activists (ASHAs) or primary healthcare workers can be trained to perform these assessments in outreach settings.

Limitations

Despite its strengths, our study has certain limitations. The cross-sectional design prevents establishing causal relationships between probable sarcopenia and associated risk factors. The study was conducted in a single hospital setting, limiting the generalizability of the findings to broader populations. Additionally, we relied on hand grip strength without assessing muscle mass using imaging techniques such as DEXA or BIA. Dietary intake and physical activity were self-reported, which may introduce recall bias. Lastly, factors such as inflammatory markers and genetic predispositions were not considered, which may influence muscle strength and sarcopenia risk.

Conclusion

This study provides compelling evidence that SARC-CalF is a highly effective screening tool for identifying sarcopenia among postmenopausal women. Compared to SARC-F, which showed good sensitivity but poor specificity, SARC-CalF demonstrated superior diagnostic accuracy, with sensitivity of 99.3%, specificity of 100%, and an Area under curve (AUC) of 0.980. The inclusion of calf circumference significantly enhanced the diagnostic value, making it an inexpensive, feasible, and practical alternative for use in resource-limited settings.

Given the high prevalence of sarcopenia in postmenopausal women and its association with adverse outcomes, integrating SARC-CalF into routine clinical and community-based health screenings could enable early detection and timely intervention. Nutritional assessment, physical activity promotion, and vitamin D correction should be key components of sarcopenia management. This study supports the adoption of SARC-CalF as a frontline screening strategy for sarcopenia, especially in settings with limited access to imaging-based muscle mass assessments.

Declarations

Ethical Clearance

Was taken from ethical committee, GSVM Medical College, Kanpur

Conflict of interest

There is no conflict of interest to disclose for all authors.

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Contributors

Dr. Saumya Rathore - Concept & design, critical revision of the manuscript for important intellectual content
Dr. Renu Gupta - Critical revision of the manuscript for important intellectual content
Dr. Garima Gupta - Critical revision of the manuscript for important intellectual content
Dr. Shaily Agarwal - Critical revision of the manuscript for important intellectual content
Dr. Neena Gupta - Critical revision of the manuscript for important intellectual content
Dr. Bandana Sharma - Critical revision of the manuscript for important intellectual content

All the authors have reviewed the final manuscript

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