Frailty syndrome and sarcopenia among rural older adults in West Bengal, India: a cross-sectional study

ORIGINAL ARTICLE

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ABSTRACT

Background. Frailty is a multidimensional syndrome. Sarcopenia plays an essential role in the early diagnosis and prevention of frailty syndrome. Therefore, we examined the association of frailty syndrome with sarcopenia among community-dwelling rural older adults in West Bengal.

Methods: This cross-sectional survey was conducted between October 2018 and January 2020 in 510 (230 men and 280 women) older adults aged ≥ 60 years who had lived for >10 years in the selected villages of Pancharul Gram Panchayat, Udaynarayanpur Block of Howrah District, West Bengal, India. Participants were assessed for frailty syndrome and sarcopenia as well as cognitive impairment, social support, history of fall, and nutritional status by a single investigator. Frailty syndrome was assessed using the modified Physical Frailty Phenotype Scale. Frailty is defined as a display of ≥ 3 of five physiological deficits: low weight, low gait speed, reduced muscle strength, exhaustion, and low physical activity. Sarcopenia was assessed using the Asian Working Group on Sarcopenia 2014 consensus by measuring dominant hand grip strength, gait speed, and skeletal muscle mass index.

Results: Of the 510 participants, 44 (8.6%) were both frail and sarcopenic, 88 (17.3%) were frail only, 16 (3.1%) were sarcopenic only, and 362 (71.0%) were non-frail and non-sarcopenic. The prevalence of frailty syndrome was 25.9%, whereas the prevalence of sarcopenia was 11.8%. Compared with non-frail participants, frail participants were six times (adjusted OR=6.42, $p<0.01$) more likely to be sarcopenic after adjusting for age, marital status, educational level, occupational work, cognitive impairment, social support, history of fall, and nutritional status.

Conclusion: Sarcopenia affects the development of frailty syndrome.

Key words: Aged; Frailty; India; Rural population; Sarcopenia

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BACKGROUND

Population ageing is a major public health concern. The increase in life expectancy contributes to the decline of quality of life.¹ The developing countries will see the greatest change in the numbers of the aged.² From 2013 to 2100, half of the world's

population increase will occur in Nigeria, India, Tanzania, Congo, Uganda, and Ethiopia.³ In 2011, 8.6% of India's population was >60 years, and the percentage is expected to reach 20% by 2050.⁴ In India, 71% (>73 million) of the older populations live in rural areas.⁴ Demographic changes affect the health system, socio-economic development,

cultural norms, and political contexts of India.⁵

Frailty syndrome is a multidimensional geriatric syndrome associated with the loss of physical and/or psychosocial functions resulting in cognitive decline, disability, falls, hospitalisation, and even death.⁶ India has the highest incidence of frailty syndrome among the six low- and middle-income countries (China, Ghana, Mexico, Russia, and South Africa).⁷ Residents of West Bengal have the highest mean frailty score than do the residents of other Indian states, and rural residents of West Bengal are at significantly higher risk of frailty than are their urban counterparts.⁸ Frailty syndrome can be reversed, especially in mild stages.⁹

Sarcopenia is defined as an age-related decrease of muscle mass and considered a precursor syndrome or the physical manifestation of frailty.^{10,11} In 2010, the European Working Group on Sarcopenia in Older People defined sarcopenia as a geriatric condition characterised by progressive and generalised loss of skeletal muscle mass, strength, and function.¹² The prevalence of sarcopenia is highest in India among the countries considered (China, Ghana, Mexico, Poland, Russia, South Africa, and Spain).¹³ Therefore, the present study aims to determine the association of frailty syndrome with sarcopenia among community-dwelling rural older adults in West Bengal.

METHODS

This cross-sectional study was approved by the ethics committee of Indian Statistical Institute, Kolkata, India (reference: ISI-IEC/2018/10/02) and was conducted between October 2018 and January 2020. Written informed consent was obtained from each participant. We approached 623 older adults aged ≥ 60 years who had lived for >10 years in the selected villages of Pancharul Gram Panchayat, Udaynarayanpur Block of Howrah District, West Bengal, India. Those with physical or mental disability were excluded, as were those whose age could not be verified. Of them, 510 (230 men and 280 women) participants were included. Participants' age, sex, marital status, family pattern, education level, and occupational work were recorded. Participants were assessed for frailty syndrome and sarcopenia as well as cognitive impairment, social support, history of fall, and nutritional status by a single investigator.

Frailty syndrome was assessed using the modified Physical Frailty Phenotype Scale.⁶ Frailty is defined as a display of ≥ 3 of five physiological deficits: low weight, low gait speed, reduced muscle strength, exhaustion, and low physical activity. Low weight is defined as the lowest quintile in the body mass index (adjusted for sex). Low gait speed is defined as the lowest quintile in the 4-m walk (adjusted for sex and height). Reduced muscle strength is defined as the lowest quintile in dominant hand grip strength (adjusted for sex and body mass index) measured using a dynamometer (Jamar Hydraulic Hand Dynamometer). Exhaustion is defined as having a response of 'a little' or 'not at all' energy for daily activities when asked. Low physical activity (energy expenditure) is defined as below the cut-off of the Global Physical Activity Questionnaire.¹⁴

Sarcopenia was assessed using the Asian Working Group on Sarcopenia 2014 consensus¹⁵ by measuring dominant hand grip strength, gait speed, and skeletal muscle mass index (FIGURE). The latter is calculated by dividing the appendicular skeletal muscle mass (kg) by the square of the height (m^2). Appendicular skeletal muscle mass is calculated based on the anthropometric equation:¹⁶ $\{0.193 \times \text{weight (kg)} + 0.107 \times \text{height (cm)} - 4.157 \times \text{sex (man=1, woman=2)} - 0.037 \times \text{age (y)} - 2.63\}$.

Cognitive impairment was assessed using the Bangla Adaptation of Mini-Mental State

FIGURE. Sarcopenia is determined by measuring dominant hand grip strength, gait speed, and skeletal muscle mass index.

Examination scale.¹⁷ Social support was assessed using the Multidimensional Scale of Perceived Social Support.¹⁸ History of fall in the past 6 months was recorded. Nutritional status was assessed using the Mini Nutritional Assessment scale.¹⁹

The Chi-squared test was used to compare the frail and non-frail groups; significant variables were entered as independent variables in the multivariate

binomial logistic regression model to determine the association of frailty syndrome with sarcopenia. A p value of <0.05 was considered statistically significant. Statistical analysis was performed using SPSS (Windows version 20; IBM Corp, Armonk [NY], US).

RESULTS

Of the 510 participants, 44 (8.6%) were both frail and

TABLE 1
Characteristics of frail and non-frail participants

	Total (n=510)	Frail (n=132)	Non-frail (n=378)	p Value
Age, y				<0.001
60-69	246 (48.2)	20 (15.2)	226 (59.8)	
70+	264 (51.8)	112 (84.8)	152 (40.2)	
Sex				0.92
Male	230 (45.1)	60 (45.5)	170 (45.0)	
Female	280 (54.9)	72 (54.5)	208 (55.0)	
Marital status				<0.001
Married	283 (55.5)	55 (41.7)	228 (60.3)	
Widowed	227 (44.5)	77 (58.3)	150 (39.7)	
Family				0.57
Joint	375 (73.5)	100 (75.8)	275 (72.8)	
Single/nuclear	135 (26.5)	32 (24.2)	103 (27.2)	
Education				0.02
≥Primary	87 (17.1)	14 (10.6)	73 (19.3)	
<Primary	423 (82.9)	118 (89.4)	305 (80.7)	
Occupational work				<0.001
Yes	178 (34.9)	20 (15.2)	158 (41.8)	
No	332 (65.1)	112 (84.8)	220 (58.2)	
Social support				<0.001
High/moderate	252 (49.4)	89 (67.4)	163 (43.1)	
Low	258 (50.6)	43 (32.6)	215 (56.9)	
History of fall				<0.001
No	385 (75.5)	83 (62.9)	302 (79.9)	
Yes	125 (24.5)	49 (37.1)	76 (20.1)	
Nutritional status				<0.001
Non-malnourished	196 (38.4)	18 (13.6)	178 (47.1)	
Malnourished	314 (61.6)	114 (86.4)	200 (52.9)	
Cognitive impairment				<0.001
No	305 (59.8)	58 (43.9)	247 (65.3)	
Yes	205 (40.2)	74 (56.1)	131 (34.7)	
Sarcopenia				<0.001
Yes	60 (11.8)	44 (33.3)	16 (4.2)	
No	450 (88.2)	88 (66.7)	362 (95.8)	

sarcopenic, 88 (17.3%) were frail only, 16 (3.1%) were sarcopenic only, and 362 (71.0%) were non-frail and non-sarcopenic. The prevalence of frailty syndrome was 25.9%, whereas the prevalence of sarcopenia was 11.8%. Frailty syndrome was associated with age, marital status, educational status, occupational work, cognitive impairment, social support status, history of fall, nutritional status, and sarcopenia (**TABLE 1**). 44 (33.3%) of 132 frail participants were sarcopenic, whereas 16 (4.2%) of 378 non-frail participants were sarcopenic ($p<0.001$). Frail syndrome was more prevalent in those aged ≥ 70 years (odds ratio [OR]=8.3, $p<0.001$), widowed (OR=2.13, $p<0.001$), with less than primary education (OR=2.02, $p=0.024$), with low social support (OR=0.366, $p<0.001$), without occupational work (OR=4.02, $p<0.001$), malnourished (OR=5.64, $p<0.001$), with cognitive impairment (OR=2.41, $p<0.001$), and with a history of at least one fall in the past 6 months (OR=2.35, $p<0.001$) [**TABLE 2**]. In multivariate binary logistic regression analysis, compared with non-frail participants, frail participants were six times (adjusted OR=6.42, $p<0.001$) more likely to be sarcopenic after adjusting for age, marital status, educational level, occupational work, cognitive impairment, social support, history of fall, and nutritional status (**TABLE 2**).

DISCUSSION

Frailty syndrome and sarcopenia are two associated but distinct conditions that share common sociodemographic, physical, social, and cognitive covariates. Frailty is associated with ageing.^{7,20,21} Those with frailty are more likely to be widows and less educated.^{22,23} Lower level of education is associated with less income and wealth, which are correlated with poorer health. Lack of companionship negatively affects health and well-being. Active participation in occupational work and having social support play an important role among community-dwelling older adults. Fall is a common cause of injury and associated with frailty syndrome.²⁴ Under-nutrition is associated with frailty and sarcopenia.²⁵ Cognitive impairment is associated with frailty syndrome.²⁶

Among elderly nursing home residents in Belgium, the prevalence of sarcopenia was 47% among those who were frail.²⁷ In a German university hospital, 19% of patients aged ≥ 70 years

TABLE 2
Association of frailty syndrome with sarcopenia

	Odds ratio (confidence interval)	p Value
Sarcopenia		<0.001
Yes	11.31 (6.10-20.98); 6.42 (3.10-13.30)*	
No	Reference	
Age, y		<0.001
70+	8.33 (4.96-13.98)	
60-69	Reference	
Marital status		<0.001
Widow	2.13 (1.42-3.18)	
Married	Reference	
Education		0.024
<Primary	2.02 (1.10-3.71)	
$\geq$ Primary	Reference	
Occupational work		<0.001
No	4.02 (2.40-6.75)	
Yes	Reference	
Social support		<0.001
Low	0.366 (0.24-0.56)	
High/ moderate	Reference	
History of fall		<0.001
Yes	2.35 (1.52-3.62)	
No	Reference	
Nutritional status		<0.001
Malnourished	5.64 (3.30-9.64)	
Non-malnourished	Reference	
Cognitive impairment		<0.001
Yes	2.41 (1.61-3.60)	
No	Reference	

* After adjusting for age, marital status, education, working, social support, history of fall, nutritional status, and cognitive impairment

had both frailty and sarcopenia.²⁸ In our West Bengal rural community-dwelling participants, 4.2% of non-frail participants had sarcopenia, 33.3% of frail participants had sarcopenia, and 8.6% of participants had both frailty and sarcopenia. Compared with non-frail participants, frail participants were six times more likely to be sarcopenic after adjusting for confounding factors. Among Japanese community-dwelling older women aged ≥ 65 years, frail individuals were more likely to have sarcopenia (OR=19.1, 95% confidence interval [CI]=3.73-98.0) than non-frail individuals.²⁹ In the Toledo Study of Healthy Aging, among community-dwelling older

adults aged ≥ 65 years, frailty was associated with sarcopenia according to the European Working Group on Sarcopenia in Older People criteria (OR=1.67, 95% CI=0.95-2.96), the Foundation for the National Institutes of Health (FNIH) criteria (OR=10.61, 95% CI=5.8-19.4), and the standardised FNIH criteria (OR=6.63, 95% CI=3.5-12.53).³⁰

As frailty syndrome is associated with sarcopenia, early diagnosis and prevention of sarcopenia is needed for better management of frailty syndrome, particularly in West Bengal where its prevalence of frailty syndrome is the highest among Indian states.⁸ However, studies with a larger sample size are warranted to validate our findings in different communities and to develop community-specific strategies for healthy ageing in India. The Fried frailty criteria and the Asian Working Group for Sarcopenia criteria are widely used and allow us to compare our results with other studies.

CONCLUSION

Sarcopenia affects the development of frailty syndrome.

CONTRIBUTORS

All authors designed the study, acquired the data, analysed the data, drafted the manuscript, and critically revised the manuscript for important intellectual content. All authors had full access to the data, contributed to the study, approved the final version for publication, and take responsibility for its accuracy and integrity.

CONFLICTS OF INTEREST

All authors have disclosed no conflicts of interest.

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DATA AVAILABILITY

All data generated or analysed during the present study are available from the corresponding author on reasonable request.

ETHICS APPROVAL

The study was approved by the ethics committee of Indian Statistical Institute, Kolkata, India (reference: ISI-IEC/2018/10/02). The patients were treated in accordance with the tenets of the Declaration of Helsinki. The patients provided written informed consent for all treatments and procedures.

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