Original Article

Factors Associated with Sarcopenia among Older Patients Attending a Geriatric Clinic in Nigeria

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Abstract

Context: Aging is characterized by progressive and generalized loss of skeletal muscle mass and strength called sarcopenia which causes poor health and disability. There is paucity of data on this syndrome of public health importance among older Nigerians. **Aim:** This study determined the prevalence and factors associated with sarcopenia among persons aged 60 years and above at a geriatric center in Nigeria. **Materials and Methods:** A cross-sectional study of 642 persons aged ≥60 years who attended the geriatric center between March and July 2014. Sarcopenia was diagnosed using the European Working Group on Sarcopenia in Older People criteria. Bivariate and multivariate analyses were carried out using SPSS 20. Alpha was set at 0.05. **Results:** The mean age ± standard deviation of the respondents was 69.1 ± 7.2 years, and 378 (60.6%) were females. The point prevalence of sarcopenia was 5.4% which was significantly higher among the females compared with the males (7.1% vs. 2.8%) $P = 0.02$. Low muscle mass and low gait speed were found in 10.9% and 36.1%, respectively. Logistic regression analysis showed age (odds ratio [OR] =1.090; 95% confidence interval [CI] =1.034–1.149, $P = 0.01$), having no formal education (OR = 2.810; 95% CI = 1.043–7.573, $P = 0.04$), malnutrition (OR = 5.817; 95% CI = 1.471–23.434, $P = 0.01$), and female gender (OR = 3.068; 95% CI = 1.068–8.817, $P = 0.04$) to be the predictors of sarcopenia. **Conclusion:** Older people in this setting are at risk of developing sarcopenia, especially the females. Healthcare workers should address the social and health-related factors which could lead to sarcopenia.

Keywords: *Geriatric clinic, Nigeria, older patients, sarcopenia*

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Introduction

The Human body experiences a myriad of physiological changes with increasing age, and this includes the physiological decline in homeostasis termed homeostenosis.[1] This process also involves the continual breakdown of muscle, bone, and fat which are characteristic features of sarcopenia, cachexia, frailty, and starvation.[1,2] These four conditions are overlapping without clear-cut distinctions.[1] This has made the operational definition of sarcopenia difficult and subject to debate.

Sarcopenia (Greek sarx or flesh + penia or loss) as a terminology was first proposed by Irwin Rosenberg in 1989.[1,2] The European Working Group on Sarcopenia in older people (EWGSOP) defined sarcopenia as a syndrome characterized by progressive loss of muscle mass and strength with a risk of adverse outcomes.[1,2] Furthermore, sarcopenia was classified as a geriatric syndrome which is common, complex, and a costly state of impaired health in older individuals.[1] Sarcopenia is an impaired state of health which is associated with high morbidity and mortality. Sarcopenia causes mobility disorders, increased risk of falls and fractures, impaired ability to perform activities of daily living, functional disabilities, and loss of independence.[1]

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Sarcopenia can be primary or secondary. Sarcopenia is considered primary (or age related) when no other cause is evident but aging itself, while it is considered secondary when one or more causes other than the aging process are readily identified. The subclasses of secondary sarcopenia are disuse-related sarcopenia, disease-related sarcopenia, and starvation-related sarcopenia. Secondary sarcopenia develops over the life course from early life developmental influences, eating less than optimal diet, prolonged bed rest or sedentary lifestyle, the presence of chronic diseases, and certain drug treatments.[2,3]

Globally, the prevalence of sarcopenia is high with far-reaching consequences on the health of older persons. Its effects on health can be measured in term of morbidities, high cost of healthcare, and mortality.[1] Despite these, the awareness of sarcopenia is very low among healthcare workers in Nigeria managing older patients. Sarcopenia is a health condition which has assumed a public health impact in developed countries. The health cost of managing sarcopenia-related illnesses in the United States of America (USA) in the year 2000 was $18.5 billion.[4,5] This cost is more than the annual budget of most developing countries, especially in the sub-Saharan Africa. The Nigerian health sector is fragile and already overburdened; knowledge and appreciation of the magnitude and factors associated with sarcopenia will help in early institution of preventive measures for sarcopenia.

Sarcopenia is prevalent among older persons, but most often, it is not recognized because most healthcare workers especially in developing countries like Nigeria do not look for it due to lack of awareness and knowledge of this condition. It has been estimated that up to 15% of people older than 65 years and as many as 50% of people older than 80 years have sarcopenia.[4] In the USA, 35% of the older population were diagnosed with moderate sarcopenia and 10% with severe sarcopenia.[5]

Nigeria is experiencing an exponential increase in the population of elderly people as in other developing countries.[6] Nigeria is estimated to have an elderly population of 15 million by the year 2025.[6] To the best of our knowledge, there is no published study in Nigeria on the prevalence and risk factors of sarcopenia among elderly patients. This may be due to the recent recognition of this condition in Nigeria and lack of consensus on the diagnostic criteria of sarcopenia. In addition, the "silent" nature of sarcopenia and its overlap with other geriatric syndromes make it difficult to be easily recognized by health-care workers. This study has determined the point prevalence and the factors associated with sarcopenia among older patients presenting in Ibadan, Nigeria.

Materials and Methods

This was a cross-sectional study which was carried out at the Chief Tony Anenih Geriatric Centre (CTAGC), University College Hospital (UCH), Ibadan. Ibadan is the capital city of Oyo State in the south-western area of Nigeria and has a population of 3.6 million inhabitants according to the Nigerian 2006 census.[7] CTAGC is a purpose-built facility for the care of older patients in Nigeria established on November 17, 2012. CTAGC has facilities for out- and in-patient care in addition to theater, physiotherapy, dietetics, ophthalmology, old age psychiatry, and dental care.

All newly registered male and female patients aged 60 years and above who presented consecutively at CTAGC between March and July 2014 were included in the study. Their ages were determined by direct recall and the use of Ajayi-Igun's table of historical landmarks in Nigeria.[8] None consenting older patients and those who were too ill to participate in the study were excluded.

The 624 respondents were interviewed with a structured questionnaire which was pretested before use. Information on the respondents' sociodemographic characteristics such as their age, sex, marital status and number of children, educational attainment, income, past occupation, living arrangement, lifestyle habits, financial and social support. Information on the previous outpatients' visits, previous hospitalization, healthcare utilization pattern, and medication use in the past 1 year was obtained.

Mini-Nutritional Assessment-Short Form was used to screen for malnutrition.[9-11] Score of 0–7 is ascribed to "Malnutrition;" 8–11 as "at risk of malnutrition;" and 12–14 as "No malnutrition".[9,11]

Diagnosis of sarcopenia

The EWGSOP diagnostic criteria for sarcopenia is the documentation of low muscle mass and low muscle strength or low physical performance.[1] In this study, a combination of low muscle mass and low physical performance was used for the diagnosis of sarcopenia in the respondents.

Low muscle mass

The muscle mass of the respondents was measured using the Bio-Impedance Analyzer (BIA) InnerScan™ body composition monitor Model BC-543 manufactured by TANITA Corporation, Tokyo, Japan which is ISO 9001 certified. BIA is noninvasive, quick, inexpensive, easy to use, readily reproducible and appropriate for both ambulatory and bedridden patients which estimate the volume of fat and lean body mass.[12] BIA measurement

techniques have been studied for more than a decade and it was found to correlate well with magnetic resonance imaging predictions (r = 0.93).[12] Prediction equations have been validated for multiethnic adults and reference values established for older persons making BIA a good and portable alternative to dual-emission X-ray absorptiometry (DEXA).[12]

The BIA machine was placed on a hard and flat surface to minimize vibration, ensure safety, and allow for accurate measurement. The soles of the feet of the respondents were checked and ensured that they are clean and dry. They were made to stand in an erect position (without bending the knees) with their arms slightly abducted from the trunk and their legs slightly separated to fit the measuring platform (where the electrodes will make contact with the soles) on the machine.

Low muscle mass was taken as a reduced muscle mass equal or >2 standard deviation (SD) below mean of percentage of muscle mass in young adults.[1] We measured the muscle mass of 15 male and 15 female undergraduate students (age 19–30 years) as our reference after obtaining their informed consent. The mean muscle mass ± 1 SD was 52.6 ± 4.9 kg for the males and 40.7 ± 3.0 kg for the females. Thus, a cutoff (≤2 SD) of 42.8 kg and 34.7 kg was used for the male and female respondents, respectively. The skeletal muscle mass index (SMI) was calculated by dividing muscle mass by height in meter squared (muscle mass/ [height] ^{2}).[2]

Low physical performance

We used the EWGSOP recommended clinical measures of low physical performance (low gait speed of <0.8 m/s in the 4-m walking test).[1]

The British Registrar-General was used to allocate respondents into social classes.[13] Cognition was assessed using the "six-item screener for cognitive impairment."[14] This is a brief and reliable instrument for identifying subjects with cognitive impairment, and its diagnostic properties are comparable to the full Mini Mental State Examination (sensitivity 95.2 and specificity 86.7).[14] The questionnaire was administered in English and Yoruba languages (after back translation) and the interview took about 45 min.

Ethical considerations

the study received approval from the University of Ibadan/UCH Institutional Review Board (UI/EC/12/0390). Informed consent of each respondent was obtained before the interview. All consenting and nonconsenting older patients were given health education and treated for their morbidities.

Data analysis

Data entering, cleaning, and analysis were carried out using SSPS (version 20, IBM Corp., Armonk, New York). Descriptive statistics was used to describe sociodemographic characteristics and an appropriate chart was used to illustrate categorical variables. Chi-square statistics was used to assess association between categorical variables and Student's t-test to test associations between continuous variables. Logistic regression analysis was used to explore relationships between significant variables and sarcopenia. The value of significance was set at $P < 0.05$.

Results

We interviewed 246 (39.4%) male and 378 (60.6%) female older patients. Their mean age was 69.1 ± 7.2 years (60–100 years) with a median income of 20,000 Naira ($121) interquartile range (IQR) 5000–35,000 Naira ($30.3–$212). The majority of the men were currently married (85.4%) while majority of the females were widowed (51.6%). The median number of children alive had by the respondents was 5 (IQR 4–6). Few respondents were living alone (4.0%) and were self-supporting financially (17.0%) and socially (1.3%) [Table 1].

The mean muscle mass of the respondents was 40.9 ± 6.7 kg (24.9–68.1 kg) which was significantly higher among the males compared with the females ([46.1 ± 6.1 kg vs. 37.6 ± 4.7 kg] t = 18.686, $P < 0.001$). The respondents mean gait speed was 1.05 ± 0.29 meters/second (m/s). The men had slower mean gait speed (1.05 ± 0.31 m/s)

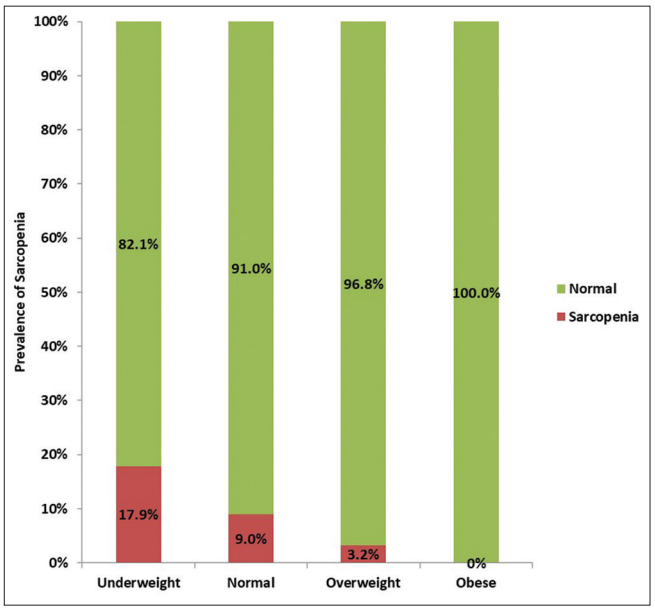

Figure 1: The body mass index by the prevalence of sarcopenia

Table 1: Sociodemographic characteristics of respondents

	Males (*n*=246), *n* (%)	Females (*n*=378), *n* (%)	Total (*n*=624), *n* (%)
Age groups (years)			
60-69	115 (46.7)	227 (60.1)	342 (54.8)
70-79	102 (41.5)	118 (31.2)	220 (35.3)
≥80	29 (11.8)	33 (8.7)	62 (9.9)
Marital status			
Married	210 (85.4)	178 (47.1)	388 (62.2)
Widowed	33 (13.4)	195 (51.6)	228 (36.5)
Separated	2 (0.8)	3 (0.8)	5 (0.8)
Divorced	0	2 (0.5)	2 (0.3)
Single	1 (0.4)	0	1 (0.2)
Highest educational attainment			
No formal education	50 (20.3)	167 (44.2)	217 (34.8)
Primary school	41 (16.7)	68 (18.0)	109 (17.5)
Secondary school	74 (30.1)	79 (20.9)	153 (24.5)
Tertiary school	81 (32.9)	64 (16.9)	145 (23.2)
Social class			
I	10 (4.1)	0	10 (1.6)
II	18 (7.3)	4 (1.0)	22 (3.5)
III	98 (39.8)	83 (22.0)	181 (29.0)
IV	67 (27.2)	23 (6.1)	90 (14.4)
V	53 (21.6)	268 (70.9)	321 (51.5)
Living arrangement			
Alone	8 (3.3)	17 (4.5)	25 (4.0)
With spouse	209 (85.0)	184 (48.7)	393 (63.0)
With children/grandchildren	26 (10.5)	157 (41.5)	183 (29.3)
With relatives/friends	3 (1.2)	20 (5.3)	23 (3.7)
Financial support			
Self-supporting	54 (22.0)	52 (13.8)	106 (17.0)
Spouse	13 (5.3)	9 (2.4)	22 (3.5)
With children/grandchildren	178 (72.3)	309 (81.7)	487 (78.1)
With relatives/friends	1 (0.4)	8 (2.1)	9 (1.4)
Social support			
Self-supporting	5 (2.0)	3 (0.8)	8 (1.3)
Spouse	150 (61.0)	126 (33.3)	276 (44.2)
With children/grandchildren	89 (36.2)	243 (64.3)	332 (53.2)
With relatives/friends	2 (0.8)	6 (1.6)	8 (1.3)

compared with the women (1.06 ± 0.29 m/s) without statistical difference (t = −1.301, P = 0.19). The mean SMI was 16.5 ± 1.9 kg/m^2 with the men having a significantly higher mean SMI compared with the females ([17.3 ± 1.9 kg/m^2] vs. [16.0 ± 1.8 kg/m^2], t = 8.528, P < 0.001).

Low muscle mass (presarcopenia) defined as <2 SD muscle mass in young adults was found in 68 (10.9%) respondents (18 [7.3%] males and 50 [13.2%] females). Low gait speed (<0.8 m/s) was seen in 225 (36.1%) respondents (84 [34.1%] males and 141 [37.3%] females). The point prevalence of sarcopenia was 34 (5.4%), which was significantly higher among the females (7.1%) compared with the males (2.8%) P = 0.02. Other factors that were significantly associated with sarcopenia were increasing age (P < 0.001), not currently married (P = 0.03), no formal education (P < 0.001), and receiving financial support from others such as spouse, children, relatives, and friends (P < 0.001) [Table 2].

The prevalence of sarcopenia was higher among respondents who received treatment in places other than clinics (such as chemists and traditional settings) and who were admitted into hospital after the age of 60 years without statistical significance. The significant health-related factors associated with sarcopenia were sedentary lifestyle (P = 0.01), being on regular medication in the past 1 year (P = 0.03), malnutrition (P < 0.001), poor self-rated health (P = 0.03), and cognitive impairment (P = 0.01) [Table 3]. The median number

Table 2: Sociodemographic characteristics by prevalence of sarcopenia

	Sarcopenia		Total (*n*=624), *n* (%)	χ^2	*P*
	Present (*n*=34), *n* (%)	Absent (*n*=590), *n* (%)			
Sex					
Males	7 (2.8)	239 (97.2)	246 (100.0)	5.342	0.02*
Females	27 (7.1)	351 (92.9)	378 (100.0)		
Age groups (years)					
60-69	10 (2.9)	332 (97.1)	342 (100.0)	22.509	<0.001*
70-79	13 (5.9)	207 (94.1)	220 (100.0)		
≥80	11 (17.7)	51 (82.3)	62 (100.0)		
Marital status					
Not married	19 (8.1)	217 (91.9)	236 (100.0)	4.988	0.03*
Currently married	15 (3.9)	373 (96.1)	388 (100.0)		
Educational attainment					
Had formal education	7 (1.7)	400 (98.3)	407 (100.0)	31.586	<0.001*
No formal education	27 (12.4)	190 (87.6)	217 (100.0)		
Living arrangement					
Alone	1 (4.0)	24 (96.0)	25 (100.0)	0.106	0.75#
With others	33 (5.5)	566 (94.5)	599 (100.0)		
Financial support					
Self-supporting	0	106 (100.0)	106 (100.0)	7.358	0.01
From others	34 (6.6)	484 (93.4)	518 (100.0)		
Social support					
None	0	8 (100.0)	8 (100.0)	0.467	0.49#
From others	34 (5.5)	582 (94.5)	616 (100.0)		
Social class					
Upper (Classes I-II)	1 (3.1)	31 (96.9)	32 (100.0)	0.354	0.55#
Lower (Classes III-V)	33 (5.6)	559 (94.4)	592 (100.0)		

*Significant at 5% level of significance; #Yates corrected for linearity

Table 3: Health-related factors and the prevalence of sarcopenia

	Sarcopenia		Total (*n*=624), *n* (%)	χ^2	*P*
	Present (*n*=34), *n* (%)	Absent (*n*=590), *n* (%)			
Have you been hospitalized before?					
Never	19 (5.0)	362 (95.0)	381 (100.0)	0.419	0.81
Before attaining the age of 60 years	8 (6.0)	125 (94.0)	133 (100.0)		
After attaining the age of 60 years	7 (6.4)	103 (93.6)	110 (100.0)		
Where did you receive treatment in the past 1 year?					
Clinics	26 (5.3)	465 (94.7)	491 (100.0)	0.105	0.75
Others (chemist and traditional)	8 (6.0)	125 (94.0)	133 (100.0)		
Were you on regular medications in the past 1 year?					
Yes	8 (3.1)	253 (96.9)	261 (100.0)	4.948	0.03*
No	26 (7.2)	337 (92.8)	363 (100.0)		
Cognitive impairment					
Yes	13 (11.5)	100 (88.5)	113 (100.0)	9.822	0.01*
No	21 (4.1)	490 (95.9)	511 (100.0)		
Physical activity					
Physically active	26 (4.6)	539 (95.4)	565 (100.0)	10.261	0.01*
Sedentary	8 (15.1)	45 (84.9)	53 (100.0)		
Nutritional status					
Malnourished	7 (50.0)	7 (50.0)	14 (100.0)	66.679	<0.001*
At risk of malnutrition	18 (8.8)	186 (91.2)	204 (100.0)		
Normal	9 (2.2)	397 (97.8)	406 (100.0)		

*Significant at 5% level of significance

Table 4: Logistic regression analysis of significant variables associated with sarcopenia

	β	*P*	OR	95% CI for OR	
				Lower	Upper
Age (years)	0.086	0.01*	1.090	1.034	1.149
Sex (female)	1.121	0.04*	3.068	1.068	8.817
Being on regular medications	0.772	0.09	2.164	0.881	5.312
Self-rated health	0.221	0.64	1.247	0.491	3.166
Malnutrition	1.770	0.01*	5.871	1.471	23.434
Sedentary lifestyle	−0.125	0.84	0.883	0.268	2.912
Cognitive impairment	0.124	0.81	1.132	0.419	3.057
Not self-supporting financially	−17.359	0.99	0.000	0.000	0.000
Having no formal education	1.033	0.04*	2.810	1.043	7.573
Not currently married	−0.055	0.90	0.946	0.394	2.273
Obesity	−18.548	0.99	0.000	0.000	0.000
Constant	−12.534	0.00	0.000		

*Significant at 5% level of significance. OR=Odds ratio; CI=Confidence interval

of outpatient visits by the respondents in the past 1 year was four times (IQR 2–5 times).

Figure 1 shows a significant inverse relationship between the BMI and prevalence of sarcopenia. Respondents who were underweight had the highest prevalence of sarcopenia (17.9%) while none of the obese respondents had sarcopenia ($P < 0.001$).

Logistic regression analysis carried out on variables which showed significant association with sarcopenia. The logistic model was statistically significant, χ^2 (11) = 82.57, $P < 0.001$. The model explained 36.1% (Nagelkerke R^2) of the variance in sarcopenia and correctly classified 95.1% of cases. Age (odds ratio [OR] = 1.090; 95% confidence interval [CI] = 1.034–1.149, $P = 0.01$), having no formal education (OR = 2.810; 95% CI = 1.043–7.573, $P = 0.04$), malnutrition (OR = 5.817; 95% CI = 1.471–23.434, $P = 0.01$), and female gender (OR = 3.068; 95% CI = 1.068–8.817, $P = 0.04$) were found to be the predictors of sarcopenia [Table 4].

Discussion

The prevalence of sarcopenia was 5.4% among the older persons in this study which was similar to the reports of Janssen *et al*.[15] in the USA, Patel *et al*.[16] in the UK, and Wu *et al*. (START project)[17] in Taiwan. However, it was lower than findings among the Brazilians, Japanese, and South Koreans.[18-20] Recent systematic review by Diz *et al*. put the prevalence of sarcopenia among the older men as 4.6%–21.8% and older women as 2.5%–22.1%.[21] The wide variation reported in studies could be attributed to differences in the definition of sarcopenia, peculiarities of the population studied, and the cutoff age for the older persons, especially in the developing and developed countries.[21] Our finding was most similar to that of Patel *et al*. among the older persons living in the UK possibly because the same definition of sarcopenia (EWGSOP) and cutoff age (60 years) was used.

It was not surprising that the prevalence of sarcopenia was low among the respondents compared to the Caucasians. This could be attributed to the differences in the body compositions of the Africans and the Caucasians. Older Africans have been found to have a 5%–8% higher levels of muscle mass, 7%–10% greater levels of bone mineral density, and greater skinfold thickness in greater subscapular area.[22] Early research defined sarcopenia in terms of a reduction in muscle mass and strength among older persons.[21,22] However, new knowledge has shown that muscle strength could be addressed independently of muscle mass.[21] Evidence has shown that sarcopenia which is loss of muscle mass has little influence on dynapenia (loss of strength) and the mechanisms implicated in the onset of these phenomena in old age are different.[21]

Most studies reported sex (female) to be strongly associated with sarcopenia. Women experience an increase in weight until their mid-50s, with an earlier loss of muscle mass, followed by a subsequent loss of fat mass.[23-25] Wu *et al*. in contrast found older Taiwanese men having twice the prevalence of sarcopenia compared with their female counterparts.[17] The female respondents were three times at risk of developing sarcopenia compared with the males. The increased risk of sarcopenia among older women has been attributed to (1) a decline in the number of neuromuscular junctions with resulting dropout of type-II muscle fibers which is thought to play an important role in age-related muscle decline; (2) major declines in hormones that are important in muscle mass maintenance such as insulin-like growth factor-1, dehydroepiandrosterone, testosterone, and estrogen; and (3) the inflammatory pathway activation possibly due to a variety of disease and aging causes.[26] A study by Ferrucci *et al*. demonstrated that the serum levels of the inflammatory cytokine interleukin-6 is related to a steeper decline in walking ability and a higher risk of developing physical disability in older women.[27]

The factors which predict the development of sarcopenia among the respondents aside sex (female) were increasing age, low educational status, and malnutrition. There was a 9% increase in the risk of developing sarcopenia each year after the age of 60 years. This was not surprising since age has been reported in the

literature to cause primary sarcopenia.[1-4] Respondents who had no formal education had 2.8 times the risk of developing sarcopenia. Dorosty *et al*. reported that older people with lower socioeconomic status are more likely to develop sarcopenia.[24]

Normal aging is associated with a 30%–50% decline in muscle mass among older men and women between the ages of 40 and 80 years.[2,16] This is in addition to loss of muscle protein stores and relative increases in body fat, even among those who continue to actively engage in training.[2] We found older persons with malnutrition to have 5.8 times the risk of developing sarcopenia. There was no sarcopenic obesity found among the respondents. Both malnutrition and sarcopenia are associated with substantial adverse effects in older persons, especially the "Malnutrition-Sarcopenia syndrome" which is the clinical presentation of malnutrition and accelerated age-related loss of lean body mass, strength, and/or functionality.[28] The reasons for malnutrition in older persons are multifactorial, namely physiological, pathological, sociological, and psychological.[6,28] Physiological causes include intrinsic decreases in food intake due in part to age-related decrease in taste, smell, gastric emptying, gastric acid, lean body mass, and dysregulation of satiation which is referred to as the "physiological anorexia of aging." Pathological causes include dentition problems, swallowing problems, chronic medical illnesses, certain medications, alcoholism, and dementia. Psychological factors include depression, anxiety, loneliness, and grief and sociologic causes include poverty, lack of interaction with others at meal time, and impaired activities of daily living skills.[28]

Conclusion

Sarcopenia is important because a loss of more than 40% of muscle mass is associated with death, and muscle loss can contribute to diminished strength, functional limitation, and disability in either the elderly or in those with chronic inflammatory conditions. Modifiable factors such as malnutrition and low socioeconomic status should be addressed in the older persons.

The limitations of this study include the use of the BIA instead of the DEXA machine for the assessment of the muscle mass. In our setting, DEXA machine is not readily available, affordable coupled with the dearth of qualified personnel to operate and interpret the results.

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Conflicts of interest

There are no conflicts of interest.

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