ORIGINAL RESEARCH

BODY COMPOSITION PROFILING OF SARCOPENIA IN ELDERLY RETIRED NIGERIAN SOLDIERS

https://doi.org/10.60787/ajrmhs.v3i1.60

Ajuonuma O. Fidelis[1]*, Giaze S. Tijani[1]

[1]Department of Family Medicine, Nigerian Army Reference Hospital Kaduna. Kaduna State, Nigeria

***Correspondence:** Ajuonuma O. Fidelis; **Email:** fkatchydr@yahoo.com

Abstract

Background: Sarcopenia, a condition characterized by the loss of skeletal muscle mass and strength, is a significant health concern among the elderly population. Body composition parameters may play a crucial role in the development and progression of sarcopenia. This study aimed to investigate the body composition profiles of sarcopenic and non-sarcopenic elderly retired soldiers in North-western Nigeria to compare and identify the parameters that are significantly associated with sarcopenia in this elderly population.

Methodology: This study employed an analytical cross-sectional design. The study population consisted of 327 elderly retired soldiers. Data on Sarcopenia (presence or absence), Total body water (%), Bone mass (Kg), Total body fat (%), Muscle mass index (Kg/m^2), and Visceral fat rating were collected. Frequency tables were used to summarize these body composition parameters. The Chi-square test compared these parameters between sarcopenic and non-sarcopenic participants. Multivariate logistic regression analysis identified the parameters that were significantly associated with sarcopenia.

Result: Body composition profile was significantly different with respect to total body water, total body fat, muscle mass index and visceral fat rating but similar in bone mass. Multivariable logistic regression analysis showed thatmuscle mass index and total body water were independent predictors of sarcopenia among the participants.

Conclusion: The body composition of elderly sarcopenic and non sarcopenic retired Nigerian Soldiers is largely not similar. Muscle mass index and total body water can predict sarcopenia among this unique population. Routine body composition analysis should be incorporated into the care of the elderly for a more objective approach towards their care.

Key words: Sarcopenia, Elderly, Retired Soldiers, Body composition, Nigeria.

Cite as: ***Ajuonuma OF, Giaze ST. Body Composition Profiling of Sarcopenia in Elderly Retired Soldiers in Northwest Nigeria. AJRMHS. 2025;3(1):42-48***

Sarcopenia is a muscle disease which primarily develops with age-associated progressive loss of skeletal muscle mass, coupled with decreases in muscle strength and function, which in turn can significantly contribute to the progression of disability, impairment of quality of life, and mortality.[1,2] The elderly according to United Nations definition are those 60 years and above.[2]The number of individuals developing sarcopenia is expected to be on the increase globally as the global population over 60 will surpass two billion by 2050.[3] Due to the public health implications of this muscle disease, a lot of research effort has been dedicated to its study in the past decade. Body composition studies have shown that parameters such as total body water, bone mass, muscle mass index, total body fat, and visceral fat rating may play a crucial role in the development and progression of sarcopenia.[4,5] Body composition studies have been made easier especially in the developing countries by the introduction and validation of the bioelectrical Impedance analysis (BIA) technology.[6,7] Few studies in Nigeria have utilized the BIA technology to evaluate some elderly populations for sarcopenia based on the European working group on sarcopenia in older people (EWGSOP) consensus criteria.[2,8,9] Earlier prevalence studies done in Southwest Nigeria in a geriatric centre found 5.4% prevalence while another study done among community dwelling older adults in Northern Nigeria found 36.2% prevalence.[8,9] However the body composition profiling of these elderly populations have never been done. This study aims to investigate the body composition profiles of sarcopenic and non-sarcopenic elderly retired soldiers in North-western Nigeria to compare the following parameters (total body water, bone mass, total body fat, muscle mass index and visceral fat rating) between sarcopenic and non-sarcopenic elderly retired soldiers and identify the parameters that are significantly associated with sarcopenia in this elderly population. This study will provide valuable insights into the body composition profiles of sarcopenic and non-sarcopenic elderly retired soldiers. The findings will contribute to the development of effective strategies for the prevention and management of sarcopenia in this population.

METHODS

Study Design

This cross-sectional analytical study was carried out at the Retirees Unit of the General Out-Patient Clinic of 44 Nigerian Army Reference Hospital Kaduna (44NARHK), the sole Military Reference Hospital in the North-Western geo-political zone of Nigeria. The hospital provides primary, secondary and tertiary care to both serving and retired military personnel and their families as well as the general public. The study population comprised of all the elderly retired soldiers aged (60 years and above) both males and females who attended the retirees unit from November 2022 to March 2023. The sample size was calculated using the Kish Leslie formula for cross-sectional studies. A sarcopenia prevalence of 30.7% from our pilot study in a sister military facility was used in this calculation.

Sample Size

n = z pq/d Where n = sample size when population is > 10,000 Z = Z-score was set at 1.96 which corresponds to 95% confidence level. p = Proportion in the target population estimated to have particular characteristics (retired elderly soldiers with sarcopenia) q = 1-p Prevalence rate of 30.7% was used as the proportion of retired elderly soldiers with sarcopenia. p = 0.307 q = 1.0 – p = 1.0 – 0.307 = 0.693 d = (the degree of accuracy) = 5% = 0.05 2 2 Therefore n = (1.96) (0.307) (0.693)/(0.05) = 326.8 = 327 (minimum sample size).[2]

Study Population

The study participants included all those who consented to the study. Exclusion criteria were severely sick, those with deformity, implants, recent surgery, disability, or severe cognitive impairment. A total number of 327 participants were recruited for this study following a systematic sampling method.[2]

Data Collection

The data for this study were collected using a structured questionnaire, anthropometric measurements, and bioelectrical impedance analysis (BIA). The parameters of interest include- Diagnosis of sarcopenia using the EWGSOP2 criteria as previously published.[2] Total body water (%), Bone mass (Kg), Total body fat (%), Muscle mass index (Kg/m^2), and Visceral fat rating (%). The InnerScan™ body composition monitor Model BC-543 manufactured by TANITA Corporation, Tokyo, Japan which is an ISO 9001 certified instrument was used. To ensure accuracy of the readings, all participants had to remove their shoes and stockings and be sure that their soles were clean. They then stood erect on the machine with the soles correctly touching with the electrodes. The readings were taken and recorded for analysis.

Data Analysis

The statistical package for social sciences SPSS (version

23.0, IBM Corp., Armonk, New York) was used for the data entry, cleaning and analysis. There were no missing data. Data were analysed using descriptive and inferential statistics. Frequency tables are used to summarize the body composition parameters, which were categorized as "low", "healthy", and "high".[6] The chi-square test was used to compare these parameters between sarcopenic and non-sarcopenic participants. Multivariate logistic regression analysis was used to identify the parameters that were significantly associated with sarcopenia. Confidence level was set at 95% and P-value of < 0.05 was considered as significant.

Ethical Consideration

The ethical clearance [44NARHK/G1/300/20] was obtained from the ethical and research committee of 44 NARHK. Informed written consent was also obtained from participants after being duly informed about the study. The data was handled with utmost confidentiality.

RESULTS

The study participants included 327 elderly retired soldiers whose age range was (60-103) years. The mean age was 73.18 ±7.45 years. They comprised 317 (96.9%) males and 10 (3.1%) females.

Table 1: Demographic Characteristics of Participants

Variables	Category	Frequency (N=327)	Percent (%)
Age	60-74	202	61.8
	75-84	105	32.1
	85-105	20	06.1
Sex	Female	10	03.1
	Male	317	96.9

The study findings showed that 69 (21.1%) had sarcopenia, almost half of the participants 161 (49.2%) had healthy total body fat, 258 (78.9%) had healthy muscle mass index, 202 (61.8%) had healthy total body water and excess visceral fat level. Almost all the participants 295 (90.2%) had low bone mass. [Table 2]

Table 2: Frequency of Assessed Body Composition Parameters in the Study population

Parameter		Frequency (N=327)	Percentage (%)
Sarcopenia Status	Present	69	21.1
	Absent	258	78.9
Total Body Fat	Under Fat	17	5.2
	Healthy	161	49.2
	Over Fat	90	27.5
	Obese	59	18.0
Muscle Mass Index	Low	69`	21.1
	Healthy	258	78.9
Total Body Water	Low	118	36.1
	Healthy	202	61.8
	High	7	2.1
Bone Mass	Low	295	90.2
	Healthy	32	9.8
Visceral Fat	Healthy Level	125	38.2
	Excess Level	202	61.8

These body composition parameters - total body fat, total body water, muscle mass index and visceral fat rating were found to be significantly different ($P < 0.001$) in those that had sarcopenia and those that had no sarcopenia. There bone mass did not show any significant difference ($P = 0.731$).

Table 3: Chi-square test showing the Differences in body composition Parameters between Sarcopenia Present and Sarcopenia Absent Participants

Physiological Parameter		Sarcopenia		X^2	*P* Value
		Present	Absent		
Total Body Fat	Under Fat	12 (3.7%)	5 (1.5%)	51.347	**< 0.001***
	Healthy	47 (14.4%)	114 (34.9%)		
	Over Fat	9 (2.8%)	81 (24.8%)		
	Obese	1 (0.3%)	58 (17.7%)		
Total Body Water	Low	6 (1.8%)	112 (34.3%)	31.618	**< 0.001***
	Healthy	59 (18.0%)	143 (43.7%)		
	High	4 (1.2%)	3 (0.9%)		
Muscle Mass Index	Low	63 (19.3%)	6 (1.8%)	258.893	**< 0.001***
	Healthy	6 (1.8%)	252 (77.1%)		
Bone Mass	Low	63 (19.3%)	232 (70.9%)	0.118	0.731
	Healthy	6 (1.8%)	26 (8.0%)		
Visceral Fat Rating	Healthy Level	44 (13.5%)	81 (24.8%)	24.161	**< 0.001***
	Excess Level	25 (7.6%)	177 (54.1%)		

- *P* Value < 0.05 is significant

Logistic regression analysis showed that total body fat and total body water were positively associated with sarcopenia, while muscle mass index and visceral fat rating were negatively associated with sarcopenia. Also, total body water (p = 0.002) and muscle mass index (p < 0.001) were found to be independent predictors of sarcopenia in this study population.

Table 4: Multivariable Logistic Regression Analysis of Significant Physiological Parameters

Physiological Parameter	B	*P* Value	EXP(B) (OR)	95% CI for EXP(B)	
				Lower	Upper
Total Body Fat	.215	.620	1.239	.531	2.891
Total Body Water	2.082	**.002***	8.017	2.089	30.761
Muscle Mass Index	-6.551	**.000***	.001	.000	.006
Visceral Fat	-1.164	.119	.312	.072	1.347
Constant	6.582	.003	722.095		

- *P* Value < 0.05 is significant

DISCUSSION

The age grouping here reflect the British Geriatric Society old age classification into youngest-old (60-74), middle-old (75-84), and oldest-old (85 and older).[10] The mean age of our study participants is 73.18 ± 7.45 years such that majority 61.8% belong to the youngest-old age group and the males comprised 96.9%. The prevalence of sarcopenia in the study population is 21.1%, this study compared the body composition parameters of this group with the rest that did not have sarcopenia. Assessment of the total body fat (TBF) separated the participants into the four phenotypes – under fat, healthy, over fat and obese. Majority 161 (49.2%) had healthy TBF% while only 17 (5.2%) were under fat. Our findings showed that the TBF% amongst the two groups were significantly different (χ^2 =51.347, P < 0.001). Although TBF% was not found to be a predictor of sarcopenia in this study, it had a positive association with an OR 1.239 at 95% CI [0.531-2.891]. The participants who are over fat and obese are more likely to develop sarcopenia as they age. This observation led to the establishment of the concept of sarcopenic-obesity which presents when sarcopenia and obesity coexist.[11] Studies have shown that during ageing, adipose inflammation leads to the redistribution of fat to the intra-abdominal area (visceral fat) and fatty infiltrations in skeletal muscles, resulting in decreased overall strength and functionality.[12]It has also been found to be associated with the pathogenesis of other diseases like diabetes and metabolic syndrome.[13]This ability to practically measure TBF has offered a more reliable method of risk assessment to identify over fat and obesity better than body mass index BMI.[14] We highly recommend it especially in the care of the elderly.

Total body water (TBW) which comprises of both the intracellular and the extracellular waters of the body constitutes one of the most vital body composition parameters that is very essential for living. In normal-weight subjects of both sexes, the TBW% decreased after the age of 60 years.[15]This is due to increasing body fat with aging and decreasing fat free mass, fatty tissue contains less water hence the TBW% reduces. Our findings showed that 202 (61.8%) had healthy TBW%, 118 (36.1%) had low TBW% while the rest 7 (2.1%) high TBW%. Total body water percentage was similarly significantly different in the two groups (χ^2 =31.618, P < 0.001). It was positively associated with sarcopenia in this study population and also an independent predictor P= 0.002, OR = 8.017 95% CI [2.089-30.761]. This suggests that older adults with higher than healthy TBW% are > 8 times more likely to have sarcopenia. The import of this is to consider TBW% in the screening of older adults for sarcopenia. Park et al. 2021, also had similar finding and recommended incorporating ECW/TBW as one of the valid tools in evaluating for sarcopenia.[16]

Muscle mass index (MMI) defined as muscle mass divided by the square of height (Kg/m^2) is one of the sarcopenia defining components and a predictor of longevity in older adults.[17] Our finding showed that 258 (78.9%) had healthy MMI while the remaining 69 (21.1%) with sarcopenia had low MMI. There is also a significant difference between the two groups (χ^2 =258.893, P < 0.001). The inverse or negative association of MMI with sarcopenia as well as its predictive value was also established P< 0.001, OR = 0.001 95% CI [0.000-0.006]. The mechanisms that fuel the progressive loss of muscle mass with age is well documented in literature.[1,18]

Visceral fat rating (VFR) is a measure of the amount of visceral fat in the abdominal cavity. It is typically expressed as a rating from 1 to 59 which is calculated with the BIA device.[6] Majority of the study participants 202 (61.8%) had excess level while the rest 125 (38.2%) had a healthy level of VFR. This supports the fact that advancing age promotes body fat redistribution in favour of the abdominal cavity.[12]Further, this study also found a significant difference in VFR amongst the two groups (χ^2 =24.161, P < 0.001). It showed a negative association with sarcopenia but not an independent predictor P=0.119, OR =0.312 95% CI [0.072-1.347]. This is contrary to other studies that used visceral fat area (VRA) and visceral adiposity index (VAI) and found a positive association.[19,20] This difference as should be further studied may be due to racial differences.

Most of the participants 295 (90.2%) had low bone mass (BM), only 32 (9.8%) had healthy BM. There is no significant difference in BM between the two groups (χ^2 =0.118, P =0.731). Bone as other body tissues are

generally affected by the aging process leading to progressive osteopenia. Presence of sarcopenia increases the vulnerability of the bone tissue hence the associated greater risk of falls, fractures and disability.[21,22]

Limitation: This study is limited by the cross-sectional design which took only a snapshot on the population of elderly retired soldiers, which may not be representative of the general population.

CONCLUSION

This study investigated the body composition profiles of sarcopenic and non-sarcopenic elderly retired soldiers in North-western Nigeria. They had significant differences in total body fat, total body water, muscle mass index and visceral fat rating but similar in bone mass. Total body water and muscle mass index were found to be independent predictors of sarcopenia in this unique elderly population. The introduction of body composition analysis using a portable BIA device as part of office procedure in care of the elderly is highly recommended. Apart from muscle mass index, total body water should be considered in sarcopenia screening.

REFERENCES

1. Lu Y, Karagounis LG, Ng TP, Carre C, Narang V, Wong G, et al. Systemic and Metabolic Signature of Sarcopenia in Community-Dwelling Older Adults. *Journals Gerontol Ser A*. 2020;75(2):309–17.
2. Ajuonuma FO, Ibrahim BY, Dabo Zubairu H, Butawa NN. Sarcopenia among elderly retired soldiers attending the retiree's clinic in an army reference hospital in Kaduna, northwestern, Nigeria. *PAMJ-cm*. 2024;16(7):1–10.
3. Khan SS, Singer BD, Vaughan DE. Molecular and physiological manifestations and measurement of aging in humans. *Aging Cell*. 2017;16(4):624–33.
4. Da Costa Teixeira LA, Soares LA, da Fonseca SF, Gonçalves GT, dos Santos JM, Viegas ÂA, et al. Analysis of body composition, functionality and muscle-specific strength of older women with obesity, sarcopenia and sarcopenic obesity: a cross-sectional study. *Sci Reports.* 2024;14(1):1–9.
5. Lee K, Shin Y, Huh J, Sung YS, Lee IS, Yoon KH, et al. Recent Issues on Body Composition Imaging for Sarcopenia Evaluation. *Korean J Radiol*. 2019;20(2):205–17.
6. TANITA Corporation. Body Composition Guide for InnerScan www.tanita.asia [Internet]. 2015 [cited 2025 Jan 13]. Available from: www.tanita.asia.
7. Sanca L, Byberg S, Có C, Da Costa G, Indami M, Rama L, et al. Body composition analysis using bioelectric impedance in Bissau: reproducibility and level of agreement between two available devices. *Pan Afr Med J*. 2024;48(80):1–13.
8. Adebusoye L, Ogunbode A, Olowookere O, Ajayi S, Ladipo M. Factors associated with sarcopenia among older patients attending a geriatric clinic in Nigeria. *Niger J Clin Pract.* 2018;21(4):443–50.
9. Awotidebe AW, Bala A, Abdulkarim K. Prevalence estimates of sarcopenia in community-dwelling older adults in Northern Nigeria according to revised European and Asian reference criteria. *Physiother Q*. 2022;30(4):65–71.
10. Escourrou E, Laurent S, Leroux J, Oustric S, Gardette V. The shift from old age to very old age: an analysis of the perception of aging among older people. *BMC Prim Care.* 2022 ;23(3):1–10.
11. Benz E, Pinel A, Guillet C, Capel F, Pereira B, De Antonio M, et al. Sarcopenia and Sarcopenic obesity and mortality among older people. *JAMA Netw Open.* 2024;7:e243604.
12. Li C wei, Yu K, Shyh-Chang N, Jiang Z, Liu T, Ma S, et al. Pathogenesis of sarcopenia and the relationship with fat mass: descriptive review. *J Cachexia Sarcopenia Muscle*. 2022;13(2):781–94.
13. Sun L, Fu J, Mu Z, Duan X, Chan P, Xiu S. Association between body fat and sarcopenia in older adults with type 2 diabetes mellitus: A cross-sectional study. *Front Endocrinol* (Lausanne). 2023;14:1094075.
14. Potter AW, Chin GC, Looney DP, Friedl KE. Defining Overweight and Obesity by Percent Body Fat Instead of Body Mass Index. *J Clin Endocrinol Metab.* 2024;00(1):1–5.
15. Lu H, Ayers E, Patel P, Mattoo TK. Body water percentage from childhood to old age. *Kidney Res Clin Pract.* 2023;42(3):340–8.
16. Park KS, Lee GY, Seo YM, Seo SH, Yoo J Il. The relationship between extracellular water-to-body water ratio and sarcopenia according to the newly revised Asian Working Group for Sarcopenia: 2019 Consensus Update. *Aging Clin Exp Res.* 2021 ;33(9):2471–7.
17. Srikanthan P, Karlamangla AS. Muscle mass index as a predictor of longevity in older adults. *Am J Med.*

2014;127(6):547–53.
18. Amarya S, Singh K, Sabharwal M. Ageing Process and Physiological Changes. In: *Gerontology. IntechOpen;* 2018 [cited 2025 Jan 15]. p. 1–23.
19. Kim TN, Park MS, Ryu JY, Choi HY, Hong HC, Yoo HJ, et al. Impact of Visceral Fat on Skeletal Muscle Mass and Vice Versa in a Prospective Cohort Study: The Korean Sarcopenic Obesity Study (KSOS). *PLoS One*. 2014;9(12):e115407.
20. Li J, Lin Y, Deng H, Su X, Feng W, Shao Q, et al. Association of visceral adiposity index with sarcopenia based on NHANES data. *Sci Reports* 2024 141. 2024;14(1):1–8.
21. Maurel DB, Jähn K, Lara-Castillo N. Muscle-bone crosstalk: Emerging opportunities for novel therapeutic approaches to treat musculoskeletal pathologies. *Biomedicines.* 2017 ;5(4):1–18.
22. Go SW, Cha YH, Lee JA, Park HS. Association between Sarcopenia, Bone Density, and Health-Related Quality of Life in Korean Men. *Korean J Fam Med*. 2013 ;34(4):281–8.