

Sarcopenia prevalence and its correlations with age-related disorders among community-dwelling Palestinian older adults

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Background & aims. Sarcopenia is an age-related disorder characterized by gradual loss of muscle mass and strength. It has considerable prevalence and health implications among older adults. This study aims to determine the prevalence of Sarcopenia and its correlation with age-related disorders among community-dwelling older adults in two rural areas in Hebron city, Palestine.

Methods. A cross-sectional survey design was utilized to analyze data collected from 145 participants (72 males and 78 females) aged ≥ 60 years old. The EWGSOP criteria were used to define Sarcopenia, and the anthropometric measurements, body composition and Mini-Nutritional Assessment were used to assess participants' nutrition status. The functional status assessment was done based on daily living activities and instrumental activity of daily living; the cognitive function was assessed using the validated Arabic version of MoCA-B; and screening for depressive symptoms was done using the Arabic version of GDS-15.

Results. Sarcopenia prevalence was 26.9%, significantly higher among men 35.7% compared to women 18.7%. Sarcopenia was associated with higher BMI, lower cognitive function, lower functional status, and a higher score of depressive symptoms ($p < 0.05$).

Conclusions. Sarcopenia has a considerable prevalence among the study sample, and it is associated with nutritional status, impaired functional status and cognitive status. The study recommends further research utilizing different study designs (quantitative and qualitative) to determine the prevalence of Sarcopenia, causes and risk factors in other areas of Palestine.

Key words: sarcopenia, prevalence, Palestinian older adults, age-related disorders

INTRODUCTION

Age demographic shift is a current global challenge. The world population is aging in both developed and developing countries at different rates. The global projections indicate an expected increase in ≥ 65 year older adults from 9% in 2018 to 16% by 2050¹. Hussein and Ismail (2017) have reported an inverted demographic pyramid with a rate growing faster in developing regions including Middle East and North Africa (MENA) than developed

regions; with an expectation that some of MENA countries will have more older people than children by the end of 2050². This change in age structure has important implications of age-related disorders such as frailty, Sarcopenia and cognitive impairment, which are associated with serious health ramifications including a higher risk of falls, increased morbidities and dependencies due to disabilities and an increased in mortality rate³.

Sarcopenia is one of the main age-related conditions characterized by involuntary loss of skeletal muscle mass, strength and physical performance⁴, and often accompanied by other changes in body composition like increase in body fat. It is also linked to increased risk of falls, morbidity and low physical activity leading to lower quality of life in addition to other adverse health outcomes such as disability, a longer stay in hospitals and mortality⁵. In other words, Sarcopenia has primary and secondary risk factors. The former affect muscle protein turnover, physiological changes affecting the number of muscle satellite cells and motor neurons, decreased secretion of hormones like (human growth hormone, testosterone and ghrelin), reduced appetite leading to anorexia and increased production of inflammatory markers⁶. The secondary risk factors are predominantly nutrition and lifestyle-related like physical inactivity leading to muscle hypotrophy, vitamin D deficiency and low intake of branched-chain amino acids that affect the muscle function⁷.

The geriatric literature has reported physical frailty and Sarcopenia as geriatric syndromes which both of them are defined by the decline in muscle mass and muscle performance and fatigue⁸. While cognitive frailty which is the cognitive decline among older adults can be a reason or complication of physical frailty, as both of them can be a cause for each other⁸. Another important age-related syndrome is described as Sarcopenic-obesity, which is the presence of Sarcopenia in combination with obesity due to biological changes favoring fat deposition and loss of muscle mass⁹. Other links between Sarcopenia and age-related disorders (cancer, COPD, Sarco-osteoporosis and Alzheimer disease) were found. These interrelationships could be due to their similar risk factors (i.e. increased inflammation state, hormonal and metabolic changes, physical inactivity and malnutrition¹⁰).

It is worth to highlight that global prevalence rates of Sarcopenia greatly vary due to many factors including different population characteristics, assessment methods, different definitions and different cut-off points used in the diagnosis process⁴. In recent meta-analysis, the overall Sarcopenia prevalence was 10% in both men and women¹¹. Using two different definitions of Sarcopenia in same population, the prevalence rates were different and ranged from 1 to 29%¹². In another

study among community older adults the prevalence of Sarcopenia was 17.4%, but the prevalence was 32.8% among institutionalized persons from the same country, which means the sample characteristics affect the prevalence rate¹³.

Though Palestine is considered as a young population in general, aging rates are increasing, with the current elderly population reaching 3.2% of which 3.6% are living in West Bank and 2.8% in Gaza strip¹⁴. Furthermore, research in the field of geriatrics is a deficit in the Middle East in general and especially in Palestine. This shows the need to study the determinants of health for this age group to find the basis for future interventional studies that help reduce the co-morbidities. Therefore, this study aims to determine the Sarcopenia prevalence and its correlation with age-related disorders among community-dwelling older adults in two rural areas in Hebron city, Palestine.

MATERIALS AND METHODS

STUDY DESIGN

This cross-sectional study was carried out in two villages: *Se'ar* and *Bani Na'em*, Hebron governance, in the south of the West Bank, Palestine. It was conducted between February and April 2019. The random sampling procedure was used to recruit 130 participants using Cochran's (1963) equation for prevalence studies. The prevalence of Sarcopenia was taken from similar previous study¹⁵ who found Sarcopenia prevalence (15.5%). The sample size was increased to 150 participants considering the possible drop out. However, 5 were excluded due to missing data, and finally 145 participants (72 men and 78 women) were included in the final analysis with a 96% response rate.

The inclusion criteria were individuals aged 60 or above, living in the selected areas and agreed to take part in the study. Whereas the exclusion criteria were the presence of acute illness on the days of data collection, current fractures of extremities, having medical conditions that may limit their ability to perform the tests (such as patients with cachexia, sever edema or ascites) and dementia. The researcher verbally informed all the participants about the objectives of the study and gave them written informed consents. Only the participants who signed the consent form included in the study.

COLLECTED DATA AND STUDY INSTRUMENTS

The research team used a pretested, structured questionnaire to collect the data from the participants face to face. The collected data included participants' sociodemographic (i.e. gender, marital status, educational

level, monthly income, working status, living status, medical history included the self-reported presence of 15 chronic diseases in addition to previous surgery and fall history, nutritional status assessment, functional status assessment, cognitive function, and mental health. Sarcopenia was defined using the revised EWGSOP (European Working Group on Sarcopenia in Older People), where Sarcopenia diagnosis depends on low muscle mass and either low muscle strength or low physical performance. The cut-off points of skeletal muscle index, handgrip and gate speed were used as reported by Cruz-Jentoft and his colleagues (2018) ¹⁶. The nutritional status assessment was done using anthropometric measurements, body composition, diet intake and screening for malnutrition risk. Anthropometric indices including (weight, height, mid-upper arm circumference (MUAC), waist circumference (WC), hip circumference (HC) and calf circumference (CC) were used to examine the nutritional status of the subjects according to the standard anthropometric procedures described by Lee & Nieman (2007) ¹⁷. The height measure was performed using a measuring tape. Body weight was measured using a calibrated electronic sensor scale. Body mass index was calculated as (body in kilogram divided by height squared in meter (kg/m^2)).

Waist and hip circumferences were measured using a flexible, non-extensible measuring tape. Mid upper arm circumference (MUAC) was measured on the right hand and used to identify subjects with muscle wasting due to malnutrition according to the following cut-off points: < 23 cm for men, and < 22 cm for women. Calf circumference was measured using a measuring tape; and muscle wasting was defined using the following cut-off points: < 30.1 cm for men, and < 27.3 cm for women ¹⁷. Body composition analysis was performed using full-body sensor BIA (OMRON HBF-514C) to obtain fat mass, fat percentage, fat-free mass, soft lean mass, skeletal muscle mass, and basal metabolic rate. Physical function assessment was performed by functional status assessment using ADL and IADL. Physical fitness was done using senior fitness tests. The senior fitness test is one of the tools being used in standard fitness assessment for older adults. It is a comprehensive assessment instrument that provides continuous scale measures. In this study the following tests were chosen for physical fitness assessment of the participants: handgrip for upper body strength; 30 seconds chair stand test for lower body strength; back scratch test for upper body flexibility; set and reach for lower body flexibility; 8-ft time up and go for balance; 2-minute step test to assess cardiovascular fitness and endurance; and gait speed. The activity of daily living was assessed using the Katz index scale; and instrumental activity of daily living was assessed using the Lawton scale.

To assess depressive symptoms, a 15-item Geriatric Scale for Depression (GDS-15) was used. This scale was validated with 84% sensitivity and 95% specificity ¹⁸. The Arabic version of Montreal Cognitive Assessment – Basic (MoCA-B) developed to facilitate the detection of mild cognitive impairment in illiterate and lower educated subjects was used. The MoCA-B assesses similar cognitive domains as the original MoCA including executive functions, language, orientation, calculations, conceptual thinking, memory, visual-perception, attention, and concentration. It is a 30-point score scale where a score below 24 suggests mild cognitive impairment.

STATISTICAL ANALYSIS

The Statistical Package for the Social Sciences SPSS TM, version 21 was used to analyze the collected data, 5% alpha level and 80% power were considered in all of the statistical tests. Descriptive analysis including the means and the standard deviations were used to analyze the continuous data. The categorical data were described by percentages. The Independent Samples t-test was used to determine the significant differences in the mean scores of nutritional status, cognitive function and physical function variables between males and females. The prevalence of Sarcopenia was presented in percentages. The association between Sarcopenia and independent categorical variables (i.e. gender, marital status, educational level and medical history) was carried out using the Chi-square test. The independent samples t-test was conducted to examine the relationship between participants with Sarcopenia with normal participants in the following variables: body mass index, body composition indices and physical function tests. Further analysis was done using hierarchical binary logistic regression between Sarcopenia as the dependent variable and socio demographic variables (medical history and nutritional status) to determine if these variables are significant predictors of Sarcopenia. The variables with significant p value (i.e. age, gender and malnutrition) were included in multivariate analysis using binary logistic regression.

RESULTS

The study participants were selected from two villages in Hebron district, namely *Sa'er* and *Bani Na'em*. One hundred and forty five (145) participants out of 150 were included in the final analysis. Five ⁵ were excluded due to missing of primary data as shown in Figure 1. The mean age was 69.5 ± 5.7 years, ranged from 60-90 years old.

Table I shows the participants' demographic information presented in numbers and percentages. The

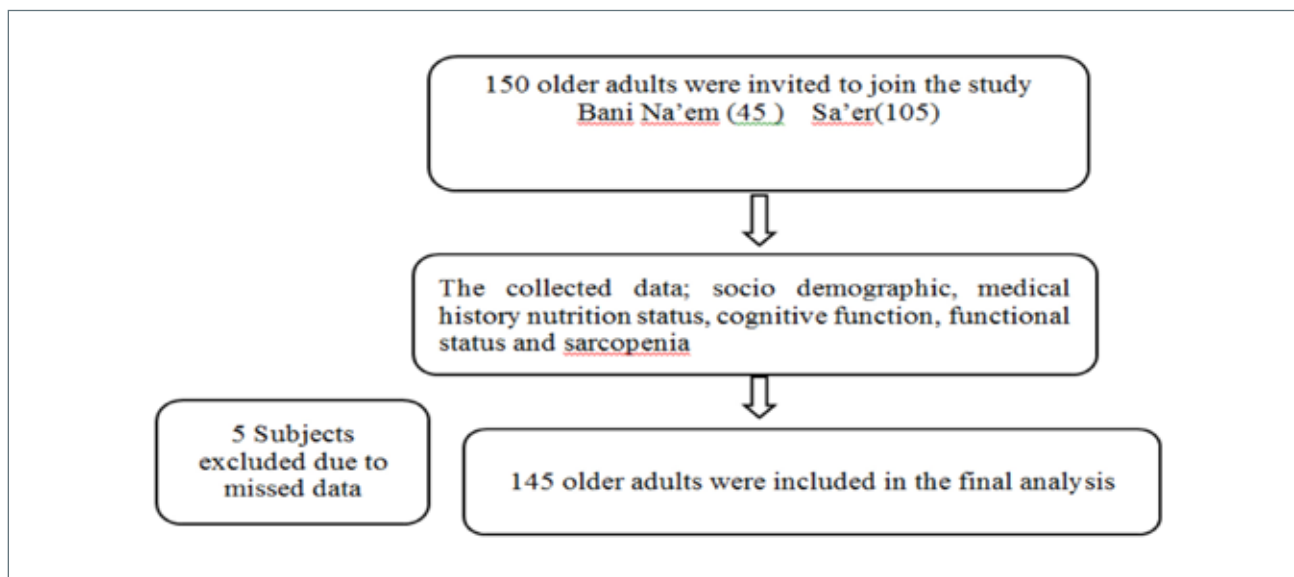


Figure 1. Subjects recruitment flow-chart.

Table I. Subjects characteristics presented in numbers and percentages.

Demographic characteristics	Value	Total number (n)	Percentage (%)
Gender	Male	70	48.3
	Female	75	51.7
Age	< 70 years	95	65.5
	> 70 years	50	34.5
Marital status	Single	22	15.2
	Married	102	70.3
	Widow	21	14.5
Level of education	Primary	65	44.8
	Secondary	25	17.2
	Diploma	3	2.1
	University	9	6.2
	Others	43	29.7
Living status	Live with family	140	96.6
	Live alone	5	3.4
Work status	Working full time	30	20.7
	Working part time	28	19.3
	Not working	80	55.2
	Retired	7	4.8
Income	500-1500	55	35.9
	1501-3000	79	51.6
	3001-5000	16	10.5

females composed the majority of the study sample (78%). The majority were married (70.3%); primary educated (64%); does not work (84%); and non-smoker (66%); and living with family (96.6%). Around half of the participants (57.7%) were able to read; (51.2%) to write and (51%) able to calculate. The results of the medical

history revealed a considerable prevalence of cardiovascular diseases among the participants (46.5% with Hypertension and 28.7% with diabetes) as shown in Figure 2.

The nutritional status, physical and cognitive function profile based on gender is presented in Table II and Table III. Generally, (32.3%) had normal weight; (34.7%) were overweight; whilst (37.3%) were obese. According to Mini nutrition assessment MNA, (2%) were malnourished; (17.3%) were at risk of malnutrition; whilst the majority (80%) were well-nourished.

Overall, Sarcopenia prevalence was (26.9%), with a significantly higher prevalence among men (35.7%) compared to women (18.7%). Among the sociodemographic variables, only male gender was associated with Sarcopenia [OR = 1.91 (95%, CI= 1.1-3.3, $p < 0.05$)] (Fig. 3). The mean age of Sarcopenic participants (70.8 ± 6.4) which was significantly higher compared with the mean age of normal participants (68.3 ± 5.3), $p < 0.05$ using the independent samples t-test.

NUTRITIONAL STATUS AND SARCOPENIA

The results of the nutritional status profile based on Sarcopenia are presented in Table IV. The means of BMI and PBF were significantly higher in participants with Sarcopenia compared to normal ones ($p < 0.05$). These values were different according to gender; only females with Sarcopenia showed significant higher means of BMI and PBF. On the other hand, BMR showed a significant difference among the groups. The participants with Sarcopenia scored BMR lower means compared to normal males only. Table V also showed Sarcopenia

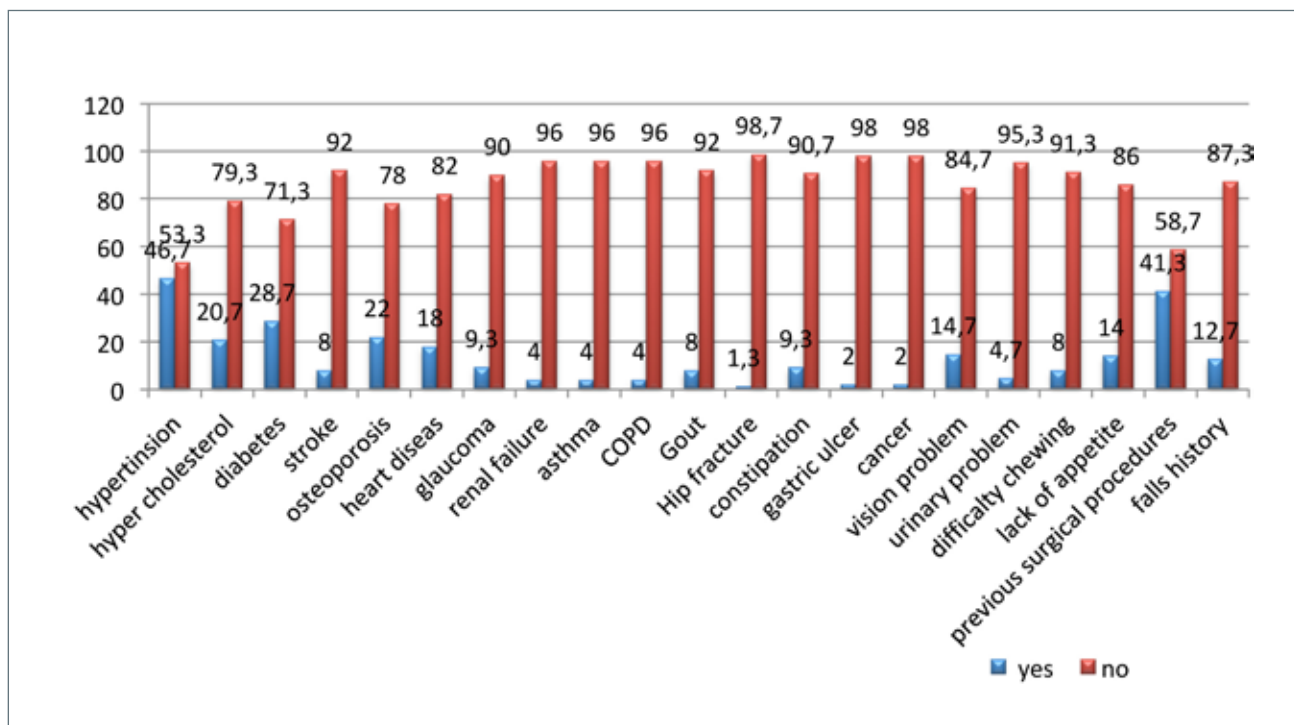


Figure 2. Medical history of the participants.

Table II. Participants nutritional status, cognitive and physical function profile according to gender.

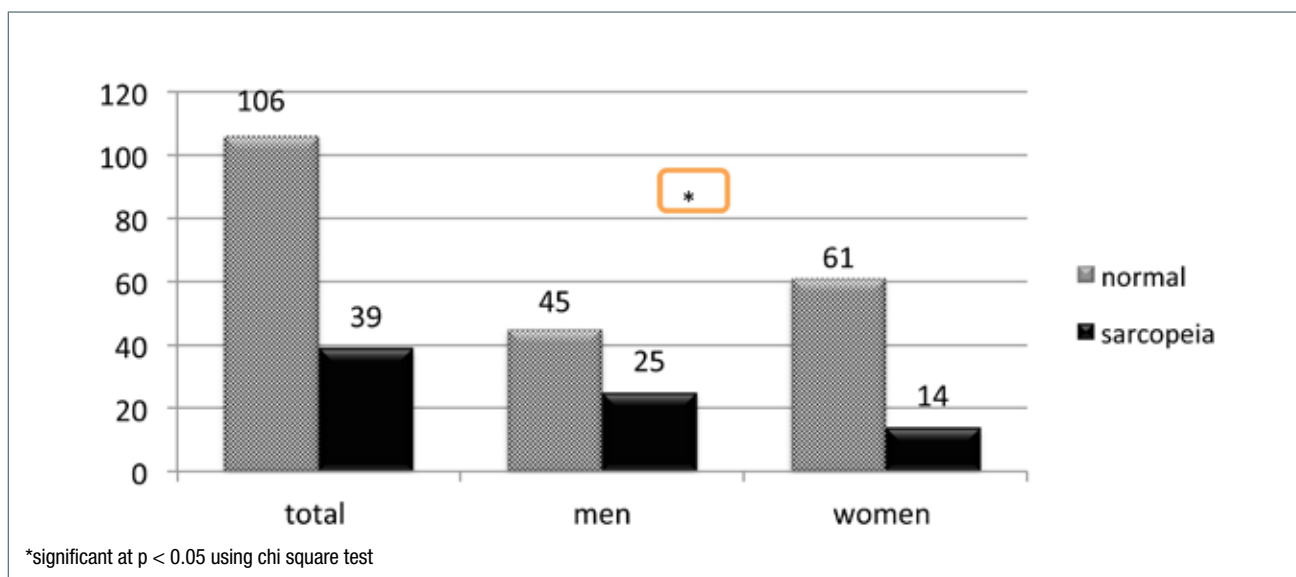
		Male (n = 70)	Female (n = 75)	P-value
Nutritional status	BMI	27.5 ± 4.4	30.6 ± 7.52	0.004
	MUAC	34.5 ± 3.4	34.8 ± 3.4	0.123
	W: Hip ratio	1.1 ± 1.03	0.98 ± 0.1	0.234
	Calf circumference	33.1 ± 5.3	33.6 ± 6.7	0.324
	No of meals/day	4.2 ± 1.04	3.8 ± 1.24	0.073
Body composition	Percentage of body fat	39.8 ± 7.3	41.5 ± 5.10	0.78
	Skeletal muscle mass	17.4 ± 5.4	14.5 ± 2.9	0.001*
	BMR	1700 ± 200	1600 ± 220	0.047*
	MNA	-	-	-
Cognitive function	MOCA	17.7 ± 3.5	14.5 ± 2.6	0.001*
Depression symptoms	GDS	5 ± 3.14	5 ± 2.57	0.865
Functional status	ADL	2.1 ± 2.69	1.8 ± 2.51	0.521
	IADL	5.4 ± 1.37	5.5 ± 2.09	0.774
Physical fitness	2 min step test	126.4+38.7	98.1+50.6	0.001*
	TUG	15.2 + 5.9	20 + 18.8	0.044*
	Hand grip	24.7 + 10.7	18.6 + 7.02	0.001*
	Back scratch test	26.6 + 17.5	33.5 + 19.1	0.034*
	Set and reach	3.3 + 3.9	3.7 + 4.9	0.549
	Chair stand test	17.5 + 11.6	19.6 + 15.06	0.365
	Gate speed	7.06 + 5.13	8.76 + 6.9	0.097
	Rapid gate	7.7 + 3.7	8.5 + 6.1	0.331

*significant p < 0.05 using independent t-test; BMI: body mass index; MUAC: mid upper arm circumference; WC: waist circumference; HC: hip circumference; CC: calf circumference; PBF: percentage of body fat; BMR: basal metabolic rate; MOCA: Montreal cognitive assessment; ADL: activity of daily living; IADL: instrumental activity of daily living; GDS: Geriatric depression scale; 2 min.st: 2 minutes step test; TUG: time up and go; BST: back scratch test; CSR: chair set and reach test; CST: chair stand test, RP: rapid pace.

Table III. Differences in anthropometric measurements, body composition and basal metabolic rate according to sarcopenia status and gender (mean \pm SD).

	Women		Men		Total	
	Normal	Sarcopenia	Normal	Sarcopenia	Normal	Sarcopenia
BMI	29.64 \pm 7.29*	35.03 \pm 7.18	27.03 \pm 3.69	28.56 \pm 5.39	* 28.5 \pm 6.8	30.8 \pm 6.77 *
MUAC	35.19 \pm 10.10	34.85 \pm 2.71	33.44 \pm 2.93	35.28 \pm 3.37	35.1 \pm 3.12	34.2 \pm 3.8
WC	117.82 \pm 17.04	118.86 \pm 11.37	128.71 \pm 183.43	135.80 \pm 14.67	121.99 \pm 119.73	125.6 \pm 13.73
HC	121.64 \pm 18.11	120.50 \pm 25.87	113.51 \pm 16.85	117.88 \pm 15.37	118.18 \pm 17.96	118.82 \pm 19.49
CC	36.98 \pm 7.07	32.29 \pm 4.21	33.91 \pm 5.19	31.48 \pm 5.43	33.37 \pm 6.33	33.20 \pm 5.49
W: H ratio	0.98 \pm 0.095	1.002 \pm 0.14	1.05 \pm 1.29	1.15 \pm 0.090	1.03 \pm 0.84	1.05 \pm 0.113
PBF	38.88 \pm 10.66 **	48.72 \pm 6.04	38.77 \pm 46.20	40.18 \pm 8.74	40.25 \pm 30.98	41.96 \pm 9.33
BMR	1631.58 \pm 245.75	1618.64 \pm 150.55	1763.86 \pm 144.10 *	1630.12 \pm 182.09	1695.36 \pm 208.21	1706.10 \pm 182.09

*p < 0.05 using Mann-Whitney test; **p < 0.01 using Mann-Whitney test; BMI: body mass index; MUAC: mid upper arm circumference; WC: waist circumference; HC: hip circumference; CC: calf circumference; PBF: percentage of body fat; BMR: basal metabolic rate.

**Figure 3.** Sarcopenia prevalence.

risk factors using multivariate analysis (binary logistic regression). The results revealed that male gender, being obese, being malnourished and older age (> 70 years) were non-significant risk factor of Sarcopenia using binary logistic regression.

PHYSICAL AND COGNITIVE FUNCTIONAL PERFORMANCE BASED ON SARCOPEZIA STATUS

As shown in Table IV, all the physical function tests had significant relationships ($p < 0.05$) based on Sarcopenia status. Participants with Sarcopenia had a lower physical function performance compared to normal ones. With respect to ADL and IADL scores, the significant lower score was reported only among participants in IADL. Whereas the cognitive function, MOCA scores were higher in normal participants compared to participants

with Sarcopenia; however, the difference reached a significant level among male participants ($p < 0.05$). Finally, the male participants with Sarcopenia recorded significant higher score of depressive symptoms compared to normal ones ($p < 0.05$); whilst the difference was not significant among female participants.

DISCUSSION

Literature on Sarcopenia has reported different prevalence of Sarcopenia due to certain reasons; among them are using different cut-off points, samples' mean age and sampling methods. In the current study, Sarcopenia prevalence is 26.9%, with a significant higher prevalence for men than women (35.7 and 17.3%

Table IV. Physical and cognitive function characteristics according to sarcopenia status and gender (mean \pm SD).

	Women		Men		Total	
	Normal	Sarcopenia	Normal	Sarcopenia	Normal	Sarcopenia
MOCA	18.75 \pm 4.39	17.64 \pm 4.41	20.31 \pm 5.07 *	17.52 \pm 5.57 *	18.26 \pm 4.99	17.56 \pm 5.12
ADL	1.07 \pm 2.66	2.07 \pm 1.64	1.62 \pm 2.59	3.17 \pm 2.64	1.87 \pm 2.62	2.39 \pm 2.52
IADL	5.76 \pm 1.92	4.46 \pm 2.57 *	5.49 \pm 1.12	5.36 \pm 1.75	5.64 \pm 1.63	5.05 \pm 2.08
GDS	5.1 \pm 2.7	4.8 \pm 1.7	4.4 \pm 3.2 *	6.1 \pm 2.7	4.8 \pm 2.9	5.6 \pm 2.4
2 min.st	108.57 \pm 45.57	52.57 \pm 47.79 **	136.04 \pm 35.51	109.12 \pm 38.89 **	120.23 \pm 43.60	88.82 \pm 49.91 **
TUG	20.87 \pm 16.09	19.79 \pm 28.83	16.71 \pm 4.36	14.20 \pm 8.00	17.67 \pm 12.74	17.84 \pm 18.15
BST	31.13 \pm 18.80	43.23 \pm 17.87 *	21.74 \pm 13.29	35.25 \pm 20.89 **	26.97 \pm 17.16	38.05 \pm 20.09 **
CSR	3.54 \pm 4.87	4.71 \pm 5.12	2.84 \pm 3.62	4.31741 4.160 \pm	3.24 \pm 4.37	4.35 \pm 4.56
CST	9.82 \pm 16.45	8.64 \pm 6.40	7.91 \pm 13.26	6.92 \pm 8.190	9.09 \pm 15.14 *	7.53 \pm 7.55
RP	9.16 \pm 6.65*	6.07 \pm 1.38	7.88 \pm 3.71	7.50 \pm 3.81	8.62 \pm 5.60 *	6.97 \pm 3.19

*p < 0.05 using Mann-Whitney test; **p < 0.01 using Mann-Whitney test; MOCA: Montreal cognitive assessment; ADL: activity of daily living; IADL: instrumental activity of daily living; GDS: Geriatric depression scale; 2 min.st: 2 minutes step test; TUG: time up and go; BST: back scratch test; CSR: chair set and reach test; CST: chair stand test; RP: rapid pace.

Table V. Sarcopenia risk factor - multivariate analysis.

Factors	P-value	Exp (B)	CI	P-value
Male gender	0.028	1.1	(1.09-7.19)	0.227
Age > 70	0.065	1.2	(0.85-1.19)	
Being obese (BMI > 30)	0.073	1.001	(1.22-3.84)	
Malnourished	0.17	1.98	(0.27-1.89)	

Not significant using binary logistic regression analysis.

respectively). This is consistent with other studies where prevalence ranged from 20 to 30%. For instance, Yamada et al. (2013) reported a prevalence of 21.8% in men and 22.1% in women, with men showing higher prevalence with increasing age in Japan¹⁹. A prevalence of 18.6% in elderly women and 23.6% in elderly men was reported in Taiwan²⁰, and 24.3% in Berlin, Germany²¹. In order to compare the prevalence of Sarcopenia across countries, participants' age is a considerable covariant because each country has different life expectancy (older participants). Similarly, the definition of older adults may vary from country to country. In Western countries, for instance, 65 years old and above consider as older adults²², while in other Eastern countries it is 60 years old²³. Therefore, Sarcopenia prevalence is expected to have higher prevalence in European countries as they have longer life expectancy²².

The current study evaluated participants' nutritional status with Sarcopenia using different means including Anthropometric measurements, body composition analysis, and MNA-SF. The analyses showed, first, only 2% were malnourished according to the MNA-SF. Second, Sarcopenia was significantly associated with higher BMI and PBF only in female participants indicating the possible presence of Sarcopenic obesity. Third, Sarcopenic males were more likely to have lower BMR

levels. The prevalence of malnutrition among elderlies varies in different research papers due to many factors including using different cut-off points, assessment malnutrition tools, study population and setting²⁴. A study conducted in Lebanon reported malnutrition rates 2.8% and risk of malnutrition 45.5%⁶; whereas in Iran level of malnutrition 9.2% was reported²⁵ though both studies used the same assessment tool (MNA-SF). The globally malnutrition prevalence among older adults ranged from 2-38%²⁴.

Age is associated with changes in body composition for both males and females. These changes affect fat mass (FM) and fat-free mass (FFM)⁵, and lead to reduction in height that may affect the results of BMI²⁶. In the current study, Sarcopenia was significantly associated with higher BMI and PBF levels in female participants suggesting Sarcopenic obesity, which is linked to numerous health and physical disabilities²⁷. He et al. (2018) reported the same finding. Another finding documented in this study is the significant association between Sarcopenia and lower BMR rates in male participants. This could be explained by the physiological changes resulting in lower FFM in addition to other metabolic changes (Henry, 2000), accompanied with changes in lifestyle activities²⁸. The ability to carry out daily activities and live independently are important factors to improve the quality

of life for older adults and can predict adverse health outcomes and mortality²⁹. Both physical and cognitive impairment were studied in the light of their relationship with low muscle mass and low muscle function. A self-reporting American study in 2011 indicated that 2.6 million older adults reported dual impairment in both cognitive and physical function³⁰.

This study reported lower scores of Sarcopenic participants in physical function performance; however, only IADL showed a significant relationship with Sarcopenia ($p < 0.05$). This finding is not in accordance with previous studies. Tanimoto et al. (2013) reported in a two-year cohort study that Sarcopenia was significantly associated with physical disabilities and higher dependency in ADL in both men and women³¹. While in Turkey almost different findings were reported, they found no correlation between Sarcopenia and ADL or IADL; however, there was a weak correlation between IADL and FFM in male participants³². These inconsistent results may be explained by the findings from a study conducted by Alexandre et al. (2014) who studied comprehensively the relationship between Sarcopenia and functional status. They reported that Sarcopenia is a risk factor of dependency. From physiological point of view, loss of muscle mass and function lead to a decrease in functional status, which will lead to some level of dependency according to the degree of muscle loss. Meaning that, the non-significant relationship between Sarcopenia and ADL or IADL may indicate presence of level of functional impairment without reaching the significant level. The type of statistical analysis and the cut-off points used define the dependency are also different in studies³³. This study reported the mean difference between Sarcopenia with ADL and IADL total score. The result might differ if another cut-off point was used; and if the ADL and IADL were treated as categorical variables and different analyses were used.

The results of this study also showed a significant relationship between Sarcopenia and cognitive function, evidenced by lower MoCA score among Sarcopenic male participants compared to normal ones. It was reported that sarcopenic subjects were found six times more likely to have cognitive and physical impairment³⁴. On the other hand, a study conducted in France found no clear association between Sarcopenia and cognitive impairment in women³⁵. The significant relationship between Sarcopenia and impaired cognitive function can be extrapolated from the relationship between cognitive function and low fitness level. It was reported that low gait speed is associated with cognitive impairment and the decrease in the physical function is parallel to the decrease in cognitive function in aging³⁶. Considering Sarcopenia definition as muscle function loss indicated by low gait speed and low hand grip, it is expected that

Sarcopenia is associated with cognitive impairment.

Gender disparities with cognitive decline in advanced age were documented in different studies. Some showed that females had a significantly better cognitive performance³⁷ while others showed absence of gender differences³⁸. To better understand these results, it is stressed to use the same inclusion criteria and standardized assessment methods. The different results between males and females in the present study may be explained by the small sample size of participating males, and the mean age for males older than the females'.

Depression is a wide spectrum disorder that ranges in severity and duration. Globally recognized as a single largest contributor to non-fatal health loss according to WHO. It is characterized by signs and symptoms like poor appetite, sadness, loss of interest, low self-satisfaction and disrupted sleep³⁷. Our findings revealed a significant relationship between male Sarcopenic participants and a higher score of depressive symptoms. This result is similar to previous cross-sectional studies in China³⁷ and Turkey³⁹ using the same assessment tools. These consistent results suggest a similar underlying mechanism; however, the causal relationship has not yet fully understood. Different theories are proposed to explain the relationship between depressive symptoms and sarcopenia; like the presence of pro-inflammatory markers like cytokines, interleukin-6 and tumor necrosis-alpha which were associated with increased depressive symptoms, decreased muscle mass and strength⁴⁰. Previous studies have not highlighted gender differences with depressive symptoms in Sarcopenic populations; nonetheless, our results showed only males to have a significant association between depressive symptoms and Sarcopenia. This may be attributed to the small sample size, or other confounding factors affecting males in particular like higher smoking levels.

CONCLUSIONS AND RECOMMENDATIONS

The present study reported 26.9% Sarcopenia prevalence in community-dwelling older adults, with significant association with male gender. Sarcopenia is also associated with reduced physical function and increase in the percentage of body fat. This study recommends enhancing the physical function of the older adults through life style educational programs that promote exercise habits and healthy body weight. Similar research could be carried out on larger sample size, and other researches utilizing the longitudinal design to determine cause and effect relationship between sarcopenia, nutrition and other age related disorders. There is a need to validate local cut-off points for Sarcopenia definition among the Palestinian population.

LIMITATIONS

The findings of this study should be seen in light of its limitations that could be addressed in future research. First, the cross-sectional survey design is often used to determine relationships, not to determine cause and effect. The sample size is not balanced between males and females and is limited to one geographical area in Palestine (i.e. two villages in Hebron City). Therefore, results cannot be generalized. In addition, using of the European cut-off points (skeletal muscle, hand grip and gait speed) may over or under estimate the prevalence of Sarcopenia.

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AVAILABILITY OF DATA AND MATERIALS

The dataset used and analyzed in this study is available from corresponding author on reasonable request.

AUTHOR CONTRIBUTIONS

The authors have contributed in the manuscript as follows; Manal Badrasawi, the principle investigator, has written the study proposal and protocol and drafted the research paper. Alma Irshaid has the responsibility for the research data management and final manuscript writing. Alaa Zaheera and Razan have helped in the proposal writing, data collection, data entry, data analysis and written the literature review. All authors have read and approved the final manuscript.

ETHICS APPROVAL AND CONSENT TO PARTICIPATE

This project acquired an ethical approval from the Deanship of Scientific Research Ethical Committee in Palestine Polytechnic University. Informed written and verbal consents have been collected from all participants prior to data collection.

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