ORIGINAL ARTICLE

Prevalence of Sarcopenia and Its Association with Socioeconomic Status among the Elderly in Tehran

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ABSTRACT

BACKGROUND: ***Sarcopenia is a syndrome characterized by progressive and generalized loss of skeletal muscle mass and strength. It imposes significant costs on health care systems. Socioeconomic status is also the root cause of healthy challenges among the elderly. Therefore, investigating the association between sarcopenia and socioeconomic status is very important to improve healthy ageing of the elderly. The aim of this study was to investigate the prevalence of sarcopenia and its association with socioeconomic status among the elderly in Tehran.***

METHODS: ***Cross-sectional and case-control studies were conducted from August 2014−July 2015 among 310 men and 334 women elderly (60 and over years old) in Tehran health centers. Randomization, restriction and matching were setting during study design to minimize selection bias. Then study participants were recruited via phone call. Participants' phone numbers were already recorded in a telephone book electronically. When there were two elderly people in the same house, only one person was invited randomly. Association between sarcopenia and socio-economic status was analyzed by SPSS version 22.***

RESULTS: ***The overall prevalence of sarcopenia in the elderly was 16.5%. Prevalenceamong the low-income elderly was relatively higher than (20.5%) that among those with middle income status (18.2%) while in the higher income, the proportion of sarcopenia was very low (12.8%). The findings indicated that 339(52.6%) were in low-income status, 304(47.1%) were in middle-income status and 1(.2%) in high-income class.***

CONCLUSION: ***There was a significant association between socioeconomic status and sarcopenia (P-value <0.001). The odd risk of sarcopenia was 0.97 times more likely higher in low socioeconomic class than those who were in middle and high income classes.***

KEYWORDS: ***Sarcopenia, Socioeconomic status, elderly people***

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INTRODUCTION

Sarcopenia is a syndrome characterised by progressive and generalised loss of skeletal muscle mass and strength with a risk of adverse outcomes such as physical disability, poor quality of life and death (1,2). It was first coined as "sarcopenia" by Irwin Rosenberg (3,4) in 1998. More recently, on the third updated published article, in 2014, the European Working Group on Sarcopenia (EWGSOP) again recognized that the key element is a loss of muscle strength (dynapenia) rather than a loss of muscle mass (5). This has led to a change in the definition of sarcopenia to include strength (grip strength) or function (walking speed or distance). Now, sarcopenia is defined as a decline in walking speed or grip strength associated with low muscle mass. Based on this concept, a number of societies around the world have provided revised definitions of sarcopenia (6-11). These definitions have to some extent deemphasized the importance of aging, recognizing that sarcopenia has a variety of causes in addition to physiological

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effects of aging (11).

Sarcopenia imposes significant costs on health care systems. In the United States alone, sarcopenia-related costs were estimated to be more than $18.5 billion in 2000 (12). Sarcopenia is considered to be the underlying cause of frailty (13), which is in turn the sixth cause of death among people over 65 years old. It also increases the risk of falling and disability among the elderly (13). The modifiable behavioral factors such as physical activity level, androgen hormone level (14), smoking habits and, particularly, the quality and quantity of dietary intake (15) can be important in delaying or even preventing sarcopenia. In addition, socioeconomic status is the root cause of health issues among the elderly (16). There are obvious differences between income and economic status and health (17). There are also obvious disparities between the health statuses of the elderly (18). Many studies have investigated the association between nutritient intake such as protein (19-26), vitamins (27,28), minerals (29) and antioxidants (30) and sarcopenia. Our study is a first one in the world which has investigated the association between sarcopenia and socioeconomic status among theelderly. The aim of this study is to assess the association between the prevalence of sarcopenia and socioeconomic status and among the elderly in Tehran.

METHODS AND MATERIALS

Study design: A study of cross-sectional that began in August 2014 with a probabilistic sampling followed by a case-control study among 644 elderly aged 60 years and older living in the southern part of the Tehran till July 2015 for 13 months. The socio-demographic characteristics included age, gender, marital status; income and schooling were collected through self report. Age was grouped in three 10-year categories, with all those aged 80 years or older combined into one group. Marital status was classified as married (married or in a stable relationship) or not married/single (divorced, separated or widowed). Schooling (in years) was analyzed as a continuous variable.**Sampling technique:** A pilot study was conducted to validate the procedures at first. We then identified sarcopenic cases among the elderly in the first phase of the study (cross-sectional). Next, sarcopenia cases were assigned for second phase of study (case-control) to compare outcomes with socioeconomic status. Each socioeconomic data was first prearranged, categorical and examined alone in order to measure its outcomes with the proportion of the sarcopenia. Group matching was done instead of individual matching by their age, sex and place of residence (ratio was 1:2). Hence, it was very difficult both in time and financial going to find out an accurate listing of all theoretical elderly population in Iran,we should make a difference between the population, we would like to study to, and it was the accessible elderly population in Tehran.The theoretical elderly population in Iran was 6,162,273 (census 2011) while accessible elderly in Tehran was approximately 668,300 (calculated from 2011 census.Then we had randomely selected southern part of Tehran and invited people who able to come to public health centers under the patronage of Tehran University of Medical Sciences. This about one third of public health centers (10/31) located in southern of Tehran. Then through sampling frame which was "electronic telephone books address" we had randomely picked their phone number and invited them to the centers. The participants' phone numbers were already recorded on telephone book/registration book at the nearby health center. Then, the study participants were recruited via phone call to come to the nearby cluster. When there were two eligible elderly people (husband and wife) in a household, only one person was invited randomly to participate in the study. In the case of no eligible person in the selected household, the interviewer would take the next phone call. By doing so, finally, we drew our sample, 644 elderly people from 6 Districts in Tehran, using simple random sampling procedure in the 6 clustered health centers. The sample size was determined using single proportion formula for cross-sectional studies while in case-control, it was determined by comparing two population estimation P_1 and P_2 (given a 95% confidence level and 80% power). To minimize bias, errors and possible confounding

factors, we randomized, restricted and matched ubjects during study design and data collection. Missing data were checked and controlled by running descriptive frequencies and excluding case pairwise. Therefore, there were no missing data identified during data analysis.

Instruments: Standard questionnaire was used to collect data on income, occupation, education level and health status. To collect socioeconomic data, we used self-report and "household economic based indicators" which include seven items such as a flat television, fridge, carpenter, house, car, laptop and sofa. This questionnaire was taken from the previous a study and standardized in the Iranian context. This questionnaire contains a series of questions about information on a wide range of qualifications including vocational qualifications gained at work place and other household durables or facilities. Respondents that lacked an amenity were asked the reason for not having it. Respondents who answered more than 6 questions and over were considered as a high income status while those who ticked between 3-5 questions were considered as middle income class and those who answered 1-2 taken as low-income status.

Muscle mass data were taken, measured and calculated from anthropometric variables such as height, hip, waist, wrist, ankle, knee, arm, thigh, upper and median (in meter) and then were entered into the software and analyzed by Bioimpedance analysis (BIA). Other measurements such as weight (in Kg) and body mass index were calculated and entered into the same software. Handgrip strength was measured with maximum voluntary contractions for each participant by squeeze bulb dynamometer (c7489-02). We would repeat the measurement three times for each hand with a 30-second rest time in between each trial. Physical performance was measured by doing a 6-meter course gait speed test. Each participant was asked to walk at his/her usual pace to the other end of the 6-meter course. Time was recorded by chronometer in seconds. The cutoff points for each of them were obtained from the previous study. Muscle mass less than 8.87 kg/m^2 for men and 6.42 kg/m^2 for women was considered as abnormal (2, 31-34), while handgrip strength <30kg for men and <20kg for women was taken as abnormal (1) and gait speed <0.8m/s was abnormal for both genders (35-37). We used EWGSOP definition of sarcopenia to define the case group. According to this definition, individuals with abnormal muscle mass or abnormal hand grip strength, or weak physical performance were considered as pre-sarcopenic while sarcopenic person was an individual who abnormal was with two variables together (muscle mass and hand grip strength or muscle mass and physical performance or hand grip and physical performance). Those with all the three abnormal criteria were considered as the severely sarcopenic (4). The relationship between sarcopenia and socioeconomic status were analyzed by SPSS software.

Subjects: A total of 644 individuals participated in this study, out of whom 310(41.1%) and 334(51.9%) were elderly males and females respectively.

Inclusion criteria:

- Participants had to be 60 years and above.
- Participants had to be able move without crutches, walker or other assistive devices.
- There had to be an absence of artificial limbs or limb prosthesis.
- There had to be an absence of active cancer, according to individual self report.
- There had be an absence of chronic diseases.

Statistical applications

Pre-coded data were entered into the computer and cleaned through the phase-by-phase screening using SPSS version 22.0 software for analysis. Multiple analyses such as crosstab, bivariate, independent-sample t-test and logistic regression were used. Frequency, proportion and summary statistics were used to describe the characteristics of the study population. Ten percent (10%) of the total data were randomly selected and cross-checked for reliability respective to the original data. The odds ratio and 95% CI were computed to see the presence and degree of association between scorpion and socioeconomic status. P-value < 0.05 was considered as statistically significant, and multivariate logistic regression was employed to control possible confounding factors.

Ethical issues: The Ethics Committee and Vice Chancellor for Research at Tehran University of Medical Sciences approved the project in accordance with the tenets of the Helsinki

Declaration and the national ethical guideline for medical research. The ethical approval code is IR.TUMS.REC.1394.346. Furthermore, informed consent was obtained from the study participants and concerned bodies.

RESULTS

Table 1 shows general demographic characteristics of the study participants. A total of 644 individuals participated in this research study, out of whom 310(41.1%) and 334(51.9%) were elderly males and females respectively. The mean age of the participants was (70.8 ± 6.1). There was no case of dropout throughout the study and so the response rate was 100%. The findings of our study indicated that 339(52.6%) were in low-income status, 304 (47.1%) were in middle income status and 1(.2%) in high income class. Using Asian Working Group and European Working Group, the prevalence of sarcopenia was found to be 16.5% and 32.5% respectively. Prevalence of pre-sarcopenia was (21.2%). Severe sarcopenia was not reported during the data collection period. Prevalence of sarcopenia was 27.1% and 6.6% among men and women respectively. In crosstab analysis, proportion of pre-sarcopenia and sarcopenia in low-income were a relatively higher than (22.6% and 20.5%) in those with middle income (21.7 and 18.2%) while, in the higher income, the proportions of pre-sarcopenia and sarcopenia were lower (13.7 and 12.8%). Educational level, occupation, and income status largely contributed to the development of sarcopenia among the study participants. For instance, proportion of sarcopenia in an illiterate, primary school and diploma+ were 18.6%, 16.2%, and 12.3% respectively. For those who had occupations, the proportion of sarcopenia was smaller (16.4%), while, for those who had no occupation, the proportion was relatively high (25%).

Table 1: General characteristics of study participants

Variables	Mean ± Standard deviation
Age:	(70.8 ± 6.1) years
Sex:	
Male	310(41.1%)
Female	334(51.9)
Marital status:	
Married	397(61.6%)
Singles	237(36.7%)
Widower	6(.9%)
Divorced	296(46.0%)
BMI (kg/m2)	31.1±4.7
Educational level:	
Illiterate	296(46.0%)
Primary school	210(32.6%)
Secondary high school	42(6.5%)
Diploma, BSC, MSC, MD	42(6.5%)
Occupation:	
Yes	4(.6%)
no	640(99.4%)

Our findings indicated a significant association between sarcopenia and socioeconomic status (p-value < 0.01). The relationship between socioeconomic status with sarcopenic and the non - scorpion was also investigated using Pearson product-moment correlation coefficient. Preliminary analysis was conducted to ensure no violation of the hypothesis of normality, linearity, and homoscedasticity. The same results were also observed with crosstab analysis that correlation between socioeconomic status and sarcopenia was significant (or = 1, N = 644, P-value <0.001). An independent-samples t-test was also performed to study the association between sarcopenic mean scores and socioeconomic status in sarcopenia. The mean score for sarcopenic cases was (1.5±.73) while the mean score for non-sarcopenic group was (1.60±.67); t (642) = 1.79, P-value = 0.02, two-tailed). The magnitude of the differences in the means (mean difference =0.1, 95%Cl: .1 -.2) was very small (eta squared = 0.004). The odd risk was calculated from the hypothetical data in table1

estimated that sarcopenia risk was 0.97 times more likely to develop in those who were in lower socioeconomic status than those who were in middle income class. The number of high income status was negligible. Binary logistic regression was also performed to assess the odd risk of sarcopenia among the low, middle and high income elderly. The model contains five independent variables (sex, age, educational level, occupation, and socioeconomic status). Unadjusted estimates in the model I showed the odd risk of gender was 0.21, and statistically significant association was observed (P-value <0.001, with 95%CI = 0.44-1.07. All other variables were equal.

Table 2. Cross tabulation of socioeconomic & Sarcopenic group among elderly in Tehran, Iran 2016 (N =644)

	Low income	Middle & high income	Total
Sarcopenic	40	180	220
Non-sarcopenic	66	458	524
Total	106	538	644
OR	$\frac{40*458}{66*180}$ =	0.97	

*The odd risk of sarcopenia in low socio-economic class was .97 times higher than those in middle and high income class

Table 3: Prevalence of sarcopenia based on different diagnostic criteria

Criteria	Prevalence (%)
European Working Group on Sarcopenia (EWGSOP)	207(32.5)
Asian Working Group for Sarcopenia (AWGS)	106(16.5)
Foundation for the National Institutes of Health (NHI)	106(16.1)

DISCUSSION

The findings of this study indicated that the prevalence of sarcopenia was 16.5 and 32.5%, respectively using different definitions of AWGOS and EWGOS (Table 3). Males had 21.3% sarcopenic cases compared to 8.9% in females. This result is found to be higher than a similar study conducted in the USA, in Taiwan and in Hong Kong, which showed the prevalence of sarcopenia as 26.8% (32), 23.6% (38) and 12.3% (39) respectively. Unlike a similar study conducted in New Mexico, which indicated the prevalence of sarcopenia in male elderly to be 50% (40) and 52% among male elders in the USA (41), in the present finding, sarcopenia is found to be less prevalent. In a study conducted in Taiwan, the prevalence of sarcopenia was reported as 18.6% in elderly women and 23.6 in erderly men (36), while in our study, the prevalence of sarcopenia was 8.9% in elderly women and 21.3% in elderly men. This shows that the prevalence in elderly women was higher than our finding in elderly women and relatively in line with elderly men. According to a study conducted by the European Working Group on Sarcopenia (EWGSOP), the prevalence of sarcopenia in elderly females living in community-dwelling and men living in long-term care institutions were 30% and 68% respectively (42,43), while our findings showed substantially lower proportion of sarcopenia in both males and females (21.3% and 8.9%). On the other hand, a separate study was conducted in Geriatric hospitalized patients in J Am Med Dir Association, USA, and community-dwelling persons in Italy who had low muscle mass which indicated that the percentage of sarcopenia scores among the elderly population were 25% and 20% (42,43). This finding is higher than the prevalence of our finding which is 32.5%. This study is found to be the first one in the gobe to study the association between sarcopenia and

socioeconomic status among elderly people. Our results indicated that in low-income people, the prevalence of pre-sarcopenia and sarcopenia were higher (22.6% and 20.5%) than those middle income (21.7 and 18.2%). In higher income elderly the prevalence of presarcopenia and sarcopenia was very lowe (13.7 and 12.8%) as compare to low and middle income people. Therefore, as people become poor, the chance of developing sarcopenia is gets high. Also, the findings show that educational level, occupation and income status are the main contributors in developing sarcopenia among study participants. For instance, the proportions of sarcopenia in the uneducated, primary schoolers and diploma holders and those who had above diploma were 18.6%, 16.2%, and 12.3% respectively. In the meantime, having an occupation and good income also played a great role in the development of sarcopenia. Moreover, the findings indicated that the proportion of sarcopenia in elderly people who did not ave any occupation (25%) was higher than those who had occupations (16.4%). In addition, the results of the study indicated that the mean scores of sarcopenic people were a bit higher among people with middle and high income status when comparing to non-sarcopenic elderly people (1.60 ±0.67) and for non-sarcopenic (1.5±0.73), $t(642) = 1.79$, p-value = 0.02, two-tailed). The findings revealed that in low-income elderly, the chance of developing sarcopenia was higher with an odd risk of 0.97 in low income and 0.8 for both middle and high income elderly persons. These indicate that elderly people who are in low-income status are 0.97 times more likely to develop sarcopenia than those who are in middle or high income status. As mentioned before, this study is the first one in the world to investigate the association between scorpenia and socioeconomic status in elderly people. This makes it difficult to compare our results with another study. On the other hand, a pilot study was conducted before commencement the main study to validate the scale's reliability and validity. Daily field supervision and data checking took place as a follow-up method. We concluded that there is a significant association between sarcopenia and socioeconomic status. Elderly people with lower socioeconomic status are more likely to develop sarcopenia (p-value < .01). Therefore, elderly with these characteristics should be the target for prevention strategies.

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