Association of obesity and sarcopenia among adult Filipinos

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ABSTRACT

Objective: Studies on the association of obesity and sarcopenia are conflicting. Some studies showed that obesity is associated with muscle loss and frailty while others showed that lower body mass index (BMI) is associated with increased sarcopenia. To date, there is paucity of data on sarcopenia and obesity among Filipinos. This study aims to determine the association of obesity and sarcopenia among Filipinos.

Methods: This is a cross sectional analytic study comparing sarcopenic versus nonsarcopenic in terms of obesity as measured by BMI and waist circumference (WC). Filipinos older than 40 years were included. Obesity was defined using the World Health Organization (WHO) cutoff for BMI and WC. Sarcopenia was defined as low muscle mass and low muscle strength or physical performance. Population-specific cutoff points were used to define low muscle mass, strength, and performance.

Results: A total of 164 participants were included. The mean age is 60.33 years. Ten (6.1%) were sarcopenic and 4 (40%) of them were obese. Regression analysis showed that obesity is not significantly associated with increased sarcopenia (incidence risk ratio [IRR], 14.62; 95% confidence interval [CI], 0.96 – 221.92; P = 0.05). However, age (IRR, 1.15; 95% CI, 1.09 – 1.21; P < 0.01), WC (IRR, 0.92; 95% CI, 0.85 – 0.99; P = 0.02), smoking (IRR, 3.17; 95% CI, 1.11 – 9.03; P = 0.03), and alcoholic beverage drinking (IRR, 3.71; 95% CI, 1.26 – 10.89; P = 0.02) were found to be significant predictors of sarcopenia.

Conclusions: There is no statistically significant association between obesity and increased risk of sarcopenia among participants, however, older age, smaller WC, smoking, and alcoholic beverage drinking were significant predictors of sarcopenia.

1. Introduction

Sarcopenia is an age-related progressive decline in muscle mass and function that contributes to increased physical disability, morbidity, and mortality among the elderly [1]. The European Working Group on Sarcopenia in Older People (EWGSOP) defined sarcopenia as the presence of both low muscle mass and low muscle function based on normative values that must be population-specific to account for the differences in muscle mass and composition due to race or ethnicity and environmental factors such as physical activity and food intake [2,3]. Critical in the definition of sarcopenia is the availability of population-specific normative values. Several studies in Asia have already determined their own normative values and have investigated sarcopenia in their respective countries [4]. Recently, Tee et al. [5] defined the normative values for the determination of sarcopenia among Filipinos. The study enrolled healthy 20- to 40-year-old individuals to determine the cutoff points for low muscle mass using bioimpedance analysis, low muscle strength, and low physical performance.

The prevalence of obesity is steadily increasing worldwide. In the Philippines, the number of obese adults increased from 16.6% to 31.1% in the span of 10 years [6]. Obesity is associated with increased risk of cardiovascular disease and higher all-cause mortality [7]. Several studies have investigated the association of obesity with sarcopenia [8–14]. Aging is associated with increasing body fat mass and changes in the deposition of fat from subcutaneous to central and ectopic parts such as in the muscles. Central adiposity increases level of inflammatory cytokines and insulin resistance [15]. One of the underlying mechanisms of age-related loss of muscle mass is low-grade inflammation [8]. By virtue of

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the pro-inflammatory milieu of obesity and fat replacement of muscle with aging, it is hypothesized that obesity increases the risk of sarcopenia. However, studies on the association of obesity and sarcopenia are conflicting. A multicontinent study (Asia, Europe, Africa, and USA) noted that a higher percent body fat is associated with lower skeletal muscle index [9]. A higher intramuscular adipose tissue is associated with decreased muscle strength and mobility as obesity is likewise associated with frailty [10–12]. Other studies have shown that lower body mass index (BMI) (<24 kg/m²) is associated with sarcopenia [13,14].

To date, there is paucity of local studies on sarcopenia and its relationship with obesity among Filipinos. With the recent establishment of sarcopenia definition among Filipinos, we can now determine the prevalence and association between sarcopenia and obesity. Knowledge on the association of obesity and sarcopenia will strengthen the significance of determining muscle mass and function in addition to body mass index and waist circumference (WC) which could further lead to intensified preventive measures and early intervention. Hence, this study aims to determine the prevalence of sarcopenia and its association with obesity among adult Filipinos.

2. Methods

2.1. Study population

Adult Filipinos older than 40 years of age consulting at the Outpatient Department of the Philippine General Hospital were included in the study. The Philippine General Hospital was selected for this study as this is the national university hospital of the Philippines catering to patients from all regions of the country. Therefore, it can be assumed that the participants are representative of the entire population. Patients who are pregnant, bedridden, with metabolic or endocrine disorders (such as acromegaly, Cush- ing’s syndrome, untreated hyper- or hypothyroidism) known to affect the musculoskeletal system, with systemic lupus erythematosus, rheumatoid arthritis, and active soft tissue rheumatisms were excluded. Prosthetic and metal implants interfere with bio-impedance analysis, hence, patients with such devices were also excluded.

Approval of the hospital ethical committee was obtained prior to initiation of the study (Registration number 2017–0452 obtained from the Research Ethics Board, Philippine General Hospital, University of the Philippines Manila). Informed consent was obtained from all participants. Good clinical practice guidelines were observed. Case report forms were kept in a safe and secured locked place and access was exclusive to the primary investigator. Participants were allowed to withdraw from the study at anytime regardless of their reasons. Results of the evaluation for sarcopenia and obesity were relayed to the participants on the same day they were examined and appropriate advice and intervention were given if found to have sarcopenia.

2.2. Obesity

The World Health Organization BMI classification was used in this study. Obesity was defined as a BMI of ≥30 kg/m² or a WC of ≥102 cm and ≥88 cm for men and women, respectively.

2.3. Sarcopenia

Sarcopenia was defined using the EWGSOP definition of low muscle mass and either low muscle strength or low physical performance [2]. Cut off points specific for Filipinos were used [5].

(1) Low muscle mass is a lean tissue index of <12.50 kg/m² for male and <8.33 kg/m² for female using the Fresenius Body Composition Monitor.

(2) Low muscle strength is defined as a grip strength of <24.54 kg and <16.10 kg for the males and females, respectively. This was evaluated using a grip strength dynamometer (JAMAR dynamometer). This was taken while the participant was sitting with the elbow bent. Measurements were repeated thrice with 30 seconds rest in between. The maximum reading was recorded in kg.

(3) Low physical performance was evaluated with the Usual Gait Speed and Timed Get Up and Go.

(a) Usual Gait Speed was evaluated using the 4-m walk test. This gait speed was assessed with distance for acceleration and deceleration phases. The subjects were instructed to walk 4 m at their usual pace. The time (seconds) required to walk 4 m on each of the 2 trials was recorded and the better trial was used for scoring. Values <0.55 m/sec and <0.65 m/sec for males and females, respectively was considered as low physical performance.

(b) For the Timed Get Up and Go, subjects were asked to rise from sitting on a standard arm chair, walk 3 m, turn, walk back to the chair, and sit down. The time (seconds) for each subject to do this was measured. The best of 3 trials was recorded. Results that are >8.31 seconds and >8.74 seconds for males and females, respectively, were considered low physical performance

2.4. Other variables

Factors that are known to coexist with obesity and sarcopenia [9,13,14,16] were also determined. These are smoking history, alcohol intake, presence of comorbidities such as hypertension and diabetes.

(1) Smoking history (Center for Disease Control and Prevention classification of smoking)

(a) Smoker is a person who has smoked 100 or more cigarettes (or the equivalent amount of tobacco) in his or her lifetime.

(b) Nonsmoker is a person who either has never smoked at all or has smoked less than 100 cigarettes (or the equivalent amount of tobacco) in his or her lifetime

(2) Alcoholic Intake (Substance Abuse and Mental Health Services Administration)

(a) Binge drinker - 5 or more alcoholic drinks for males or 4 or more alcoholic drinks for females on the same occasion (i.e., at the same time or within a couple of hours of each other) on at least one day in the past month

(b) Heavy drinker - binge drinking on 5 or more days in the past month

(c) Moderate drinker - 1 drink per day for women and up to 2 drinks per day for men

One drink is equivalent to 120 mL of wine, 30 mL of liquor, or 260 mL of beer.

2.5. Sample size, sampling, and data analysis

Using the formula for sample size computation for analytic studies comparing proportions, confidence level at 95%, 10% error or difference from the true proportion and the prevalence of
sarcopenia, which is 9.8% [17], the computed sample size for this study is 136. Non probability sampling was employed. Descriptive statistics using frequencies and proportion were used to describe categorical variables. On the other hand, continuous variables were described using mean and standard deviation (SD). Initially, logistic regression was planned but Poisson regression was used since sarcopenia was found to be rare in the sampled population. Univariate Poisson regression analysis was done to compare the demographic data and clinical characteristics of nonsarcopenic and sarcopenic patients. T-test and cross-tabulation analysis either by chi-square test or Fisher test were used to compare clinical characteristics of sarcopenic and nonsarcopenic participants. Multivariate Poisson regression analysis was done to measure the association between sarcopenia and obesity after controlling for possible confounders. Confounders were identified using the 10% change in coefficient criterion. The final model was identified after backward elimination of variables. Significance level was set at $P < 0.05$ for all statistical analysis. Data analysis was done using Stata 13 (StataCorp LP., College Station, TX, USA).

3. Results

3.1. Study population and prevalence of sarcopenia

A total of 164 patients were included and 10 (6.10%) were identified as sarcopenic (Table 1). The mean age of patients is 60.33 years (SD, 0.74). Majority are female (77.44%), nonsmokers (81.71%), and nonalcoholic drinkers (78.66%). About 47.56% of participants are obese by WC while only 14.02% are obese by BMI classification.

Most participants have comorbidities such as hypertension (32.32%) and both hypertension and type 2 diabetes mellitus (30.49%).

3.2. Association of obesity and sarcopenia

Table 2 shows the comparison of clinical characteristics of nonsarcopenic and sarcopenic patients. Sarcopenic participants were significantly older than nonsarcopenic subjects. There is also a significant difference in the proportion of males and females between nonsarcopenic and sarcopenic patients. Sarcopenic participants have higher BMI compared to nonsarcopenic participants, although this is statistically not significant. Table 3 shows that none
Table 3
Sarcopenia among obese and nonobese participants.

| Variable by waist circumference | Nonsarcopenic (n - 154) | Sarcopenic (n - 10) | P-value |
|---------------------------------|-------------------------|-------------------|---------|
| Nonobese                        | 78 (50.65)              | 6 (60.00)         | 0.57    |
| Obese                           | 76 (49.35)              | 4 (40.00)         |         |
| BMI classification               |                         |                   |         |
| Normal                           | 68 (44.16)              | 5 (50.00)         |         |
| Overweight                       | 55 (35.71)              | 3 (30.00)         | 0.69    |
| Obese                            | 23 (14.94)              | 0 (0.00)          | <0.01   |
| Underweight                      | 8 (5.19)                | 2 (20.00)         | 0.16    |

Values are presented as number (%).

BMI, body mass index.

of the obese participants by BMI were sarcopenic-finding that is statistically significant compared to those with normal BMI. Multivariate regression analysis (Table 4) showed that obesity is not significantly associated with sarcopenia after controlling for confounders. However, older age, smoking history, alcoholic drinking, and lower WC are identified as significant predictors of sarcopenia.

4. Discussion

The prevalence of sarcopenia in this study (6.10%) is relatively lower than the published international data of 5%–13% (average of 10%) using the EWGSOP criteria [16]. Varying age of inclusion in the studies might account for the different prevalence data on sarcopenia. This study included relatively younger patients (>40 years old) to account for the effect of obesity on sarcopenia even in younger patients and to have an opportunity for early intervention. A study by Kim et al. [17] similarly included younger patients (>40 years old) with a prevalence of sarcopenia of 6.30% for men and 4.10% in women. All of the participants with sarcopenia in this study were more than 60 years of age, an expected finding based on the natural course of the disease and previous studies.

Obesity is defined in this study using either the BMI classification or the WC cutoff. Looking at BMI and WC individually, this study showed that obesity by BMI classification is significantly associated with lower prevalence of sarcopenia (Table 3). Multivariate analysis, on the other hand, showed that higher WC was found to be associated with lower incidence of sarcopenia. This relationship of BMI and sarcopenia is similar to what is seen in osteoporosis in which obesity is actually protective of this condition. This finding was also seen in studies among Chinese and Europeans in which higher BMI is associated with lower incidence of sarcopenia. These findings still need to be validated in larger, multicenter studies on sarcopenia among Filipinos.

5. Conclusions

The prevalence of sarcopenia among adult Filipinos seen at our institution is lower than the prevalence of sarcopenia in different countries. Obesity is not significantly associated with increased risk of sarcopenia. However, lower WC, older age, smoking, and alcoholic beverage drinking were found to be significant predictors of sarcopenia. These findings still need to be validated in larger studies.

Conflicts of interest

No potential conflict of interest relevant to this article was reported.

Table 4
Multivariate analysis of association of sarcopenia and obesity, final reduced model.

| Variable                  | Incidence rate ratio | Confidence interval | Poisson regression (P-value) |
|---------------------------|----------------------|---------------------|-----------------------------|
| Obesity                   | 4.95                 | 0.73–33.66          | 0.10                        |
| Age                       | 1.15                 | 1.09–1.21           | <0.01                       |
| Sex                       | 0.25                 | 0.05–1.23           | 0.09                        |
| Waist Circumference       | 0.92                 | 0.85–0.99           | 0.021                       |
| Smoking history           | 3.17                 | 1.11–9.03           | 0.03                        |
| Alcoholic drinking        | 3.71                 | 1.26–10.89          | 0.02                        |
| Comorbidities             | 0.42                 | 0.10–1.83           | 0.25                        |
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