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Original Study

Association of Sarcopenia and Obesity With Multimorbidity in Korean Adults: A Nationwide Cross-Sectional Study

Keun Ok An PhD [a], Junghoon Kim PhD [b,*]

[a] Sports and Health Care Major, College of Humanities and Arts, Korea National University of Transportation, Chungju, Chungbuk, Republic of Korea
[b] Department of Preventive Medicine, Gachon University College of Medicine, Incheon, Republic of Korea

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A B S T R A C T

Objectives: Age-related muscle loss (sarcopenia) and increased fat mass (obesity) may contribute to chronic disease. Multimorbidity needs more complex health care and is associated with an elevated risk of mortality, disability, and poor quality of life. Sarcopenia and obesity together may be more closely associated with multimorbidity than either sarcopenia or obesity alone. However, a possible multimorbidity link with sarcopenic obesity is unknown. Thus, we aimed to investigate the association of sarcopenic obesity and multimorbidity in Korean adults.

Design/Setting: A nationwide cross-sectional study based on data from Korea National Health and Nutritional Examination Survey, 2008 to 2011.

Participants: Study participants included 10,118 adults aged ≥40 years.

Measurements: Skeletal muscle mass was measured using dual energy x-ray absorptiometry. Sarcopenia was defined as 1 standard deviation below the mean using the skeletal muscle mass index based on a young population reference group. Obesity was defined using the waist circumference sex-specific cutoff point for Asians.

Results: When examined individually, there was a significant association of sarcopenia [odds ratio (OR): 1.49, 95% confidence interval (CI): 1.31–1.70] and obesity (OR: 1.63, 95% CI: 1.45–1.84) with the risk of multimorbidity after being adjusted for potential covariates. When examined as sarcopenia and obesity combined, a greater increase in the risk of multimorbidity was found (OR: 3.0, 95% CI: 2.60–3.40) compared with either sarcopenia (OR: 1.50, 95% CI: 1.18–1.77) or obesity (OR: 1.80, 95% CI: 1.39–2.30) alone.

Conclusions: In conclusion, we found that sarcopenia and obesity are independently associated with the risk of multimorbidity, but with these conditions combined, sarcopenic obesity has a greater risk of multimorbidity.

With increasing life expectancy, the aged population has increasingly complex medical conditions in terms of the number of chronic diseases and medications taken, geriatric syndromes, and physical or mental disabilities.[1–3] The co-occurrence of 2 or more chronic diseases are commonly defined as multimorbidity and constitute major health care challenges because of the need for more complex health care and being more likely to have poor health outcomes.[2] For example, compared with a single disease, multimorbidity is associated with an elevated risk of mortality, disability, poor health-related quality of life, more hospitalization, institutionalization, and increased medical costs.[4]

Age-related skeletal muscle loss (sarcopenia) and increased fat mass (obesity) may contribute to muscular and cardiovascular disease (CVD). Previous studies have shown that sarcopenia and obesity are linked to both muscular disease and CVD such as decreased physical function, disability, mobility problems, CVD, and mortality.[5–10] Furthermore, sarcopenic obesity, a co-occurrence of low muscle and excess body fat, is an emerging clinical entity in which these 2 conditions may contribute to negative synergism in the pathophysiology of both physical and metabolic dysfunction.[11,12] In fact, several previous studies reported that sarcopenic obesity has a synergistic effect with the risk of chronic disease compared with sarcopenia or obesity alone.[13–15] However, these previous inquiries have demonstrated the effects of sarcopenia and sarcopenic obesity on single chronic diseases, although only a few studies have investigated the association of

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* Address correspondence to Junghoon Kim, PhD, Department of Preventive Medicine, Gachon University College of Medicine, Incheon 21999, Republic of Korea.
E-mail address: junghoonkim@gachon.ac.kr (J. Kim).

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obesity with multimorbidity.[4] Furthermore, to our knowledge, the association of sarcopenic obesity and multimorbidity has not been explored. Because multimorbidity is linked to increased likelihood of disability and mortality beyond the risk attributable to single diseases,[2,3] identifying its contributing factor is important for improving public health. Thus, we aimed to investigate whether sarcopenic obesity is more closely associated with multimorbidity than sarcopenia and obesity alone in a nationally representative population aged ≥40 years in South Korea.

Materials and Methods

Participants

In this nationwide cross-sectional study, we used the database from the Korea National Health and Nutritional Examination Survey (KNHANES) 2008 to 2011. The KNHANES is a series of cross-sectional surveys with nationally representative samples from the civilian, non-institutionalized, South Korean population, using a stratified and multistage probability cluster design.[16,17] The present study was restricted to participants aged ≥20 years who completed the health examination, including whole body dual-energy x-ray absorptiometry (DXA) scans (n = 19,130). To define sarcopenia, we divided participants into a young reference group (aged 20–39 years, n = 5944) and a study group (aged ≥40 years, n = 13,186). In the study group, 499 participants who had missing skeletal muscle mass and waist circumference were excluded. We also excluded 423 participants with fasting blood samples of <8 hours, 1834 participants with incomplete data on multimorbidity, and 312 participants with missing data on other covariates. In total, 10,118 participants were included (Figure 1). All participants provided written informed consent, and the KNHANES study was approved by the Institutional Review Board of the Korea Centers for Disease Control and Prevention.

Sarcopenia and Obesity

Appendicular skeletal muscle mass (ASM) was measured for each participant using a DXA densitometer (DISCOVER-W fan-beam densitometer; Hologic, Marlborough, MA). The ASM index was calculated and then divided by the individual's body weight and expressed as a percentage (ASM/weight × 100).[6] Sarcopenia was diagnosed when the ASM index value was at least 1 standard deviation (SD) below the sex-specific means in the young reference group using the modified method of Janssen et al.[6] The mean and SD for ASM/weight (%) was 33.1 ± 3.0 for the males (n = 2502) and 26.2 ± 2.5 for the females (n = 3334) among the young reference group after excluding participants with missing DXA data. The cutoff value for sarcopenia was 30.1% for males and <21.2% for females.

Obesity was determined according to the waist circumference thresholds for abdominal obesity using the International Diabetes Federation cutoff point for non-Europeans (≥90 cm in males and ≥80 cm in females).[18] Based on these categorized sarcopenia and obesity criteria, participants were classified into one of 4 groups: nonsarcopenic and nonobesity group (normal), sarcopenic nonobese group (sarcopenia), nonsarcopenic obese group (obesity), or sarcopenic obesity group (sarcopenic obesity).

Multimorbidity

To define multimorbidity, we measured the morbidities of CVD, hypertension, type 2 diabetes, stroke, arthritis, lung disease, cancer, and depression, all of which have a major impact on health status, quality of life, and mortality.[2,19–22] Hypertension was defined by a self-reported physician diagnosis as a systolic blood pressure ≥140 mmHg, diastolic blood pressure ≥90 mmHg, or currently taking antihypertensive medication. Type 2 diabetes mellitus was also based on a self-reported physician diagnosis as a fasting blood glucose ≥126 mg/dL or currently taking antihyperglycemic medication. Lung disease was defined by doctor diagnosis using radiography.[16,23] Other morbidities including arthritis, stroke, CVD, and cancer were defined using self-reported doctor diagnoses. Depression was assessed using a self-reported questionnaire in which participants answered the question "Have you felt depressive for more than 2 weeks during the past 1 year, so much that it disturbed your daily life?"[17] We defined a "yes" answer as having depression.[24] Multimorbidity was defined as the presence of 2 or more of these 8 clinical health conditions based on recent previous studies.[3,4]

Other Covariates

We also used information from the following variables that have been shown to be associated with the risk of chronic health conditions

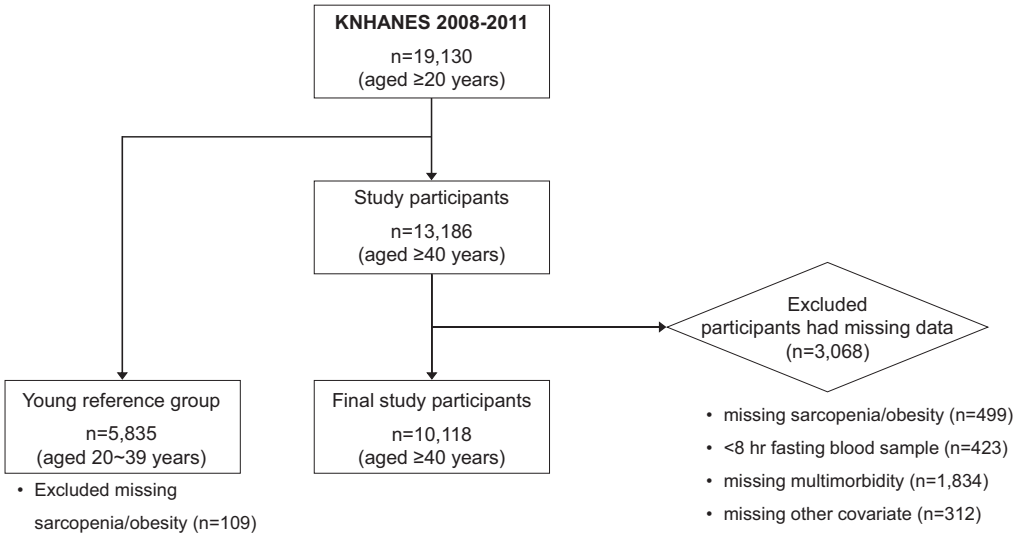

Fig. 1. Flow chart of study participants.