Experimental Gerontology 106 (2018) 39–45

Contents lists available at ScienceDirect

Experimental Gerontology

journal homepage: www.elsevier.com/locate/expgero

Association between involuntary weight loss with low muscle mass and health-related quality of life in community-dwelling older adults: Nationwide surveys (KNHANES 2008–2011)

Miji Kim[a], Junghoon Kim[b], Chang Won Won[c,*]

[a] Department of Biomedical Science and Technology, College of Medicine, East-West Medical Research Institute, Kyung Hee University, Seoul, Republic of Korea
[b] Department of Preventive Medicine, Gachon University College of Medicine, Incheon, Republic of Korea
[c] Department of Family Medicine, College of Medicine, Kyung Hee University, Seoul, Republic of Korea

ARTICLE INFO

Section Editor: Holly M. Brown-Borg

Keywords:
Weight loss
Muscle mass
Body composition
Aging
Quality of life

ABSTRACTS

Objectives: To investigate the relationship between involuntary weight loss with low muscle mass and health-related quality of life in a large representative sample of older adults.

Methods: A nationwide cross-sectional study based on data from the Korea National Health and Nutritional Examination Survey, 2008 to 2011. Study participants included 2249 individuals aged ≥70 years. The participants reported an unintentional weight loss > 3 kg in the past year. Appendicular lean mass was measured using dual-energy X-ray absorptiometry and calculated with the appendicular lean mass index. Health-related quality of life was measured using the EuroQol-5 dimension (EQ-5D) instrument. Univariate and multivariate survey logistic regression models were used to calculate odds ratios (OR) with 95% confidence intervals (95% CI) for the lowest quintile of the EQ-5D index.

Results: In total, 39.1% of participants were male and 60.9% were female. The weighted mean age was 75.6 years (95% CI; 75.3–75.9). Clinically significant weight loss is typically 5% of one's body weight; average, 2.8 kg (3.1 kg for men; 2.7 kg, women) for our participants. Compared with the normal reference group and after adjusting for potential confounders, the ORs for the lowest quintile of the EQ-5D indices were 1.39 (95% CI, 0.92–2.10), 2.56 (95% CI, 1.56–4.18), and 3.40 (95% CI, 2.05 to 5.63) for the low muscle mass, involuntary weight loss, involuntary weight loss with low muscle mass groups, respectively.

Conclusion: Involuntary weight loss combined with low muscle mass was more closely associated with poor quality of life than involuntary weight loss alone in community-dwelling older adults.

1. Introduction

Achieving and maintaining a healthy body weight for improved quality of life (QoL) with advanced age is an important aspect of healthy aging. Aging is associated with various changes in the body composition, such as weight loss, loss of muscle mass, increased fat mass, and muscle fat infiltration. Weight loss is a common phenomenon in older adults leading to an age-related loss of muscle mass associated with aging (Newman et al., 2005a, 2001). Sarcopenia is identified as a major health problem among older adults and is a geriatric syndrome characterized by progressive loss of muscle mass, quality, and function associated with aging, which increases the risk of adverse events (Cruz-Jentoft et al., 2010a; Delmonico et al., 2007; Goodpaster et al., 2006).

Weight usually peaks at 60 years of age, with small decreases of approximately 0.1 kg to 0.2 kg per year after 70 years of age in healthy older adults (Chumlea et al., 1988). The following are changes in body composition that occur at various ages in men and women (Roubenoff and Hughes, 2000): men show a tendency to gain fat and lean mass in their 40s, followed by a trend toward weight loss, resulting in the loss of both fat and lean mass compartments after age 60 years and women consistently gain fat across the age spectrum. The effects of weight loss may depend on whether the loss is involuntary or unintentional. Involuntary weight loss, or the involuntary decline in weight over time, occurs in 15–20% of older adults and is linked to various health outcomes, including increased risk of morbidity and mortality (Alibhai et al., 2005).

Functional ability could be considered as the basis of an efficient geriatric assessment, giving emphasis on improving the life expectancy by optimizing health. It has also been shown to affect the subjective well-being of an individual and has been associated with morbidity and

* Corresponding author at: Department of Family Medicine, College of Medicine, Kyung Hee University, 23, Kyung Hee Dae-ro, Dongdaemun-gu, Seoul 02447, Republic of Korea.
E-mail address: chunwon62@naver.com (C.W. Won).

https://doi.org/10.1016/j.exger.2018.02.027
Received 15 February 2017; Received in revised form 17 November 2017; Accepted 25 February 2018
Available online 27 February 2018
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mortality (Jagger et al., 1993). Functional disability can hamper the QoL of an individual and cause severe social impact with long-term institutionalization and medical care in older adults (Guralnik et al., 1996). Health-related QoL (HRQoL) refers to the physical, mental, and social domains of health, observed as distinct domains that can be influenced, in a complex way, by individual's experiences, beliefs, expectations, and perceptions (Testa and Simonson, 1996). HRQoL is important in the older adult population, because it is a more powerful predictor of health services use and mortality than many objective measures of health (Dominick et al., 2002; Otero-Rodriguez et al., 2010). Therefore, HRQoL should be considered in evaluating an individual's perspective on the health outcomes in older adults.

Among studies investigating the relationship between weight loss, muscle mass, and QoL, a longitudinal study reported that involuntary weight loss ≥5 kg over 1 year was related with functional decline in activities of daily living (ADLs), regardless of baseline body mass index. Whereas, intentional weight loss did not affect the rate of functional change (Ritchie et al., 2008). Therefore, monitoring weight among older adults is important, as changes in weight may reflect the risk of functional decline. Furthermore, previous studies have highlighted low muscle mass as an independent risk factor for physical disability and mortality in older adults (Chuang et al., 2016; Janssen, 2006; Janssen et al., 2002; Srikanthan and Karlamangla, 2014). Previous studies involving older subjects, involuntary weight loss and skeletal muscle loss are associated with poorer QoL indices (Beaudart et al., 2015; Compston et al., 2016; Verlaan et al., 2017). The involuntary weight loss often coexists with muscle mass loss, and both low muscle mass and involuntary weight loss combined may contribute to higher risk factors for physical disability in daily activity and QoL among older adults. To our knowledge, whether or not there are differences when considering the independent or the synergic role of involuntary weight loss and skeletal muscle loss on HRQoL is little known in a large, community-dwelling, older population. Therefore, the aim of this study was to investigate the relationship between involuntary weight loss with low muscle mass and HRQoL in a large representative cohort of older adults.

2. Methods

2.1. Design and study population

The Korea National Health and Nutrition Examination Survey 4 (KNHANES 2008–2011), is a nationwide, population based, cross-sectional health examination and survey, regularly conducted by the Division of Chronic Disease Surveillance, of the Korea Centers for Disease Control and Prevention (KCDC), in the Ministry of Health and Welfare, to monitor the general health and nutrition status of South Koreans. Subjects are randomly assigned from 600 randomly selected districts of cities and provinces in South Korea. As shown in Fig. 1, of the 37,753 subjects from the KNHANES 2008–2011, we initially selected 4139 subjects aged ≥70 years. Of the selected subjects, 2781 subjects underwent dual-energy X-ray absorptiometry (DEXA) examination. Subjects were excluded if any of the following data were not available: DEXA data of body composition, the EuroQol-5 dimension (EQ-5D), or the question about involuntary weight change. Ultimately, 2349 subjects (999 men and 1350 women) were included in the analysis. All KNHANES surveys were approved by the Institutional Review Board of the KCDC, and all the participants provided written informed consent (IRB number: 2008-04EXP-01-C, 2009-01CON-03-2C, 2010-02CON-21-C and 2011-02CON-06-C).

2.2. Low muscle mass and involuntary weight loss

Whole-body composition was estimated using DEXA (DISCOVERY-W fan-beam densitometer, Hologic, Inc., USA). The appendicular lean mass (ALM) was calculated as the sum of the lean mass of both the right and left arms and legs, with the assumption that all non-fat and non-bone tissue was skeletal muscle (Kim and Kim, 2013). The appendicular muscle index was defined as the appendicular lean mass divided by the square of height. We used the Asian Working Group for Sarcopenia's criteria for diagnosing sarcopenia (Chen et al., 2014). Low muscle mass was defined using the cutoff point of ≤7.0 kg/m^2 in men, and ≤5.4 kg/m^2 in women.

Involuntary weight loss is referred to as involuntary or unintended weight loss (Wong, 2014). Clinically important weight loss is often defined as weight loss ≥5% of usual body weight over a period of 6 to 12 months (Gaddey and Holder, 2014). We used two questions in KNHANES to evaluate weight change and voluntariness: “Were there any changes in weight compared to the previous year?” and “Have you ever tried to control weight voluntarily in the previous year?” For the question regarding weight change, the answers were categorized as “No changes,” “Lost weight,” and “Gained weight.” For the question regarding voluntariness, the answers were classified as “Tried to lose weight,” “Tried to maintain current weight,” “Tried to gain weight,” and “Never tried to control weight.” In this study, we defined involuntary weight loss as those who lost weight > 3 kg and answered with “Tried to maintain current weight,” “Tried to gain weight,” or “Never tried to control weight.” In this study population, 5% of one's body weight mass in Korean older adults was 2.8 kg (3.1 kg for men and 2.7 kg for women) on average and we defined 3.0 kg as clinically important weight loss regardless of gender. Based on these criteria for low muscle mass and involuntary weight loss, subjects were classified into one of four groups: no involuntary weight loss without low muscle mass (normal), no involuntary weight loss with low muscle mass (low muscle mass alone), involuntary weight loss without low muscle mass (involuntary weight loss alone), and involuntary weight loss with low muscle mass.

2.3. Health-related quality of life

HRQoL was evaluated using the EuroQol five-dimensional (EQ-5D) questionnaire, which assesses five dimensions of health: mobility, self-care, usual activities, pain/discomfort, and anxiety/depression (Brooks, 1996). Responses in each dimension were divided into three categories: no problem, moderate problem, or extreme problem. The problem group included subjects who responded moderate or extreme problem among 3 levels of the EQ-5D descriptive system. Using a combination of these items, a single health index score was calculated using the Korea valuation set developed by the KCDCP (Lee et al., 2009). Average scores of the EQ-5D index ranged from −0.17 to 1, where 1 indicates no problem in any of the five dimensions, zero indicates death, and negative values indicate health statuses worse than death.

2.4. Covariates

We considered the following as potential confounders: demographics (age, sex, education level, and household income), lifestyle-related factors (physical activity, muscular training, smoking status, energy intake, and alcohol consumption), and body composition (body mass index; BMI), in addition to history of clinical health conditions (hypertension, diabetes, stroke, heart disease, renal failure, chronic obstructive pulmonary disease (COPD), and cancer). Education level was classified as < middle school, middle school, high school, and ≥college. We classified household income as quartiles in each survey year. Alcohol consumption was categorized into four groups as never, ≤once a week, 2–3 times per week, and ≥4 times per week, while self-reported smoking status was categorized as never, former, and current smoker. Physical activity level was evaluated using the questionnaire of the International Physical Activity Questionnaire (The IPAQ group, 2005), and participants were categorized into two groups based on the current guideline of the WHO (< 150 min/week and ≥150 min/week) (Waxman, 2004). In addition, the participants responded their days per week of muscular training, and classified as low (< 2 days/week) or

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