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Associations of obesity and weight change with physical and mental impairments in elderly Chinese people

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ABSTRACT

Objective: To examine the associations between anthropometric measurements and functional impairments in a sample of urban elderly Chinese people.

Methods: In two population-based cohort studies, the Shanghai Women's Health Study (SWHS) and Shanghai Men's Health Study (SMHS), 11,505 men and 17,166 women aged 70–88 years at the time of the functional assessment were studied. Weight history was collected and anthropometric data were taken at study enrollment (from 1996 to 2000 for the SWHS, 2002–2006 for the SMHS). Information on functional status and current weight was collected at the most recent follow-up survey (from 2011 to 2015). Logistic regression analyses were applied to estimate the associations of body mass index (BMI), waist-hip-ratio (WHR), and weight changes with functional decline.

Results: After a median follow-up of 14.4 years (range 5.4–18.2 years), we found that BMI/WHR at or after middle age, and weight gain during adulthood were significantly associated with impaired walking ability and mental functioning. Being underweight after age 70 was associated with poorer hearing and/or vision as well as poorer memory. The associations between obesity and functional impairment were generally not modified by sex, comorbidity or exercise.

Conclusion: Weight gain, obesity at or after middle age, and underweight after age 70 were associated with physical and mental functional impairments among elderly Chinese people. These findings highlight the importance of maintaining healthy weight to reduce age-related functional decline.

1. Introduction

Physiological changes that take place during the aging process can result in functional impairments, which include limitations in mobility, communication, interpersonal interactions, and independence in carrying out daily activities [1]. Increased lifespan has resulted in a steady rise of the aged population as well as corresponding health problems. According to a recent study conducted in the US, for example, about 15% of the older non-nursing home population has physical impairments [2]. Another national study conducted in 2010 found that about 41% of the US population between 62 and 90 years old has at least mild mental impairment [3]. Decline in functional ability can substantially influence the independence and quality of life for the elderly population [4–7]. However, to date, limited medical interventions have been available to address these impairments [8,9]. A better understanding of factors associated with functional impairments is of utmost public health importance for developing strategies to prevent or delay the onset of functional impairments in old age and to reduce the associated economic and societal burden.

Overweight and obesity are growing health concerns in many countries around the world. The prevalence of obesity in the US has increased from 12% in 1991 to 35% in 2012, based on data from the Centers for Disease Control and Prevention [10,11]. The trend of obesity is also increasing in developing countries, including China, the most populous country in the world [12]. Multiple studies have linked overweight and obesity to functional impairments. A systematic review assessing risk factors for functional status decline in community-dwelling elderly populations has suggested that body mass index (BMI) is one of the most relevant factors in the acceleration of physical function decline [13]. Another study published in 2005 also identified central obesity as a possible risk factor for impairments in physical function, especially for those over 70 years old [14]. However, the

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majority of existing studies focus on physical functioning; the associations between body size and body composition with mental functioning are insufficiently investigated. Furthermore, most of the published studies were conducted in western populations. Whether the reported associations extend to Asian populations remains unclear.

The purpose of this study is to comprehensively investigate the associations between body size and body composition variables with physical, hearing/vision, and mental functional decline in the elderly urban Chinese population by analyzing two large-scale prospective cohort studies, the Shanghai Men's Health Study (SMHS) and Shanghai Women's Health Study (SWHS).

2. Materials and methods

2.1. Study subjects

The SWHS and SMHS are two population-based prospective cohorts that recruited a total of 74,941 Chinese women (aged 40–70 years) and 61,480 Chinese men (aged 40–74) from 8 urban communities of Shanghai, China. The baseline surveys, conducted from 1996 to 2000 for SWHS and from 2002 to 2006 for SMHS, collected information on participants' socio-demographic and lifestyle factors, medical history, and usual dietary habits. Anthropometric measurements were taken. Since the initial surveys, participants have been followed up every 2–4 years through in-person interviews to update their health and lifestyle information (follow-up rates ≥92% for both cohorts). Up to July 2016, there have been in total 5 follow-up surveys for SWHS and 3 for SMHS. Detailed information on study design and recruitment methods have been published previously [15,16]. Our study has been approved by the institutional review boards of participating institutions and written informed consent was acquired from all participants (Fig. 1).

In the latest follow-up surveys, self-reported information on participants' functional status was collected for those aged 70 or older (n = 12,150 for men, n = 18,602 for women). For this study, we excluded participants with missing information on the functional status evaluation (n = 124 for men, n = 144 for women), missing information on anthropometric measurements either at baseline (n = 11 for men, n = 5 for women), or the last follow-up surveys (n = 510 for men, n = 1287 for women). Ultimately, a total of 11,505 men and 17,166 women were included in this study.

2.2. Functional status assessment

Four sets of questions were used to measure different aspects of functional status, including two on physical functioning and the other two on mental functioning. Briefly, in terms of independent walking ability, subjects who needed any assistance to walk on a flat surface were categorized as having an inability to walk independently, while those who could walk without any assistance were classified as independent walkers. With regard to hearing and vision capabilities, participants were divided into three groups—those with a serious problem, those with a minor problem, and those with no impairment. As for memory status, subjects were grouped into three categories: serious, minor, or no problem in memory function. For independent decision-making, participants were classified into three groups: always having difficulty, sometimes having difficulty, or having no difficulty in making decisions by themselves.

2.3. Anthropometric assessment

Anthropometric measurements, including height, weight, and circumferences of waist and hips, were taken at cohort study enrollment. For each individual, those measurements were taken twice, and a third measurement taken if the difference between the first two measurements exceeded 1 cm for height or waist and hip circumferences, or exceeded 1 kg for weight. Self-reported information on height and weight at 20 years old, weight at 40 years old for men, and weight at 50 years old for women was also collected. Measured and self-reported heights and weights were used to calculate body mass index (BMI, kg/m^2) at each age level. BMI was used to classify participants into groups of underweight (< 18.5 kg/m^2), normal (18.5–24.9 kg/m^2), overweight (25–29.9) kg/m^2), and obese (≥30 kg/m^2) according to the BMI cut-off points recommended by the World Health Organization [17]. Waist-hip ratio (WHR) was calculated by using the measured waist and hip circumferences at baseline and categorized by quartile distribution. Participants' weight changes from 20 years old to age at study enrollment and from 20 years old to middle age (40 years old for men, 50 years old for women) were also calculated.

2.4. Statistical analysis

Weight changes and WHR were categorized into quartiles based on distributions among women and men separately. Those variables were also treated as continuous variables in the data analysis with one unit for weight change being 2.5 kg and for WHR, 0.1. Logistic regressions were used to derive odds ratios (ORs) and 95% confidence intervals (CIs) for the association of body size and body composition variables with functional status. For analyses on BMI, participants in the normal weight category (BMI between 18.5–25) were treated as the reference group. For the other exposure variables, the lowest quartile was used as the reference group. Stratified analyses were also conducted to evaluate potential effect modification by sex, comorbidity scores, and exercise

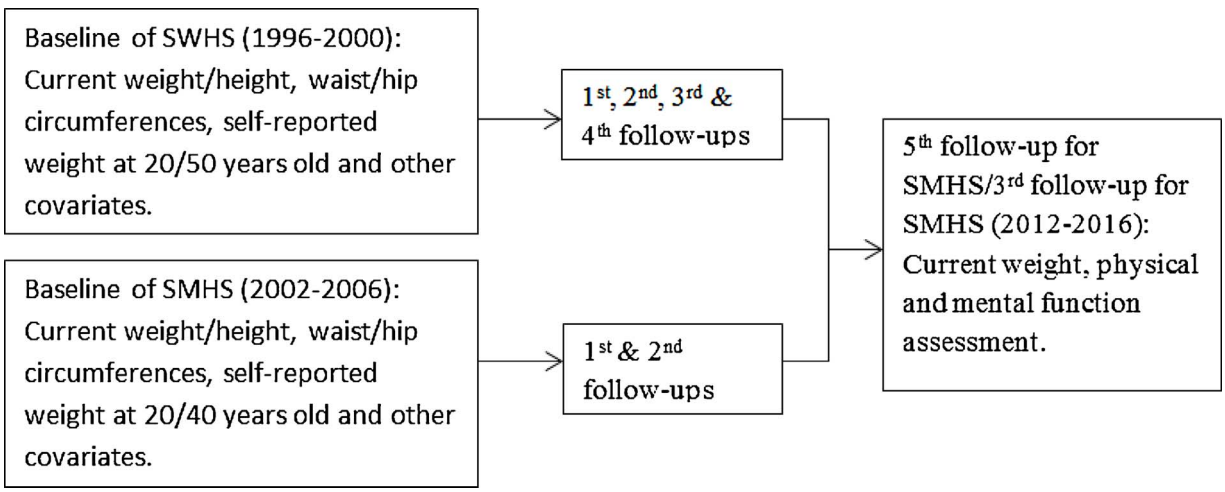

Fig. 1. Timeline for data collection of study variables in SWHS (1996–2016) and SMHS (2002–2016).