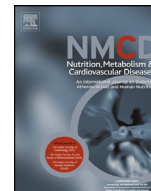


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Obesity, weight change, and mortality in older adults with metabolic abnormalities

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Abstract *Background and aims:* It is expected that older adults with metabolic abnormalities may benefit from weight loss; however, data on this population are limited. Our study was to assess the effect of obesity and weight change on mortality risk in older adults with metabolic abnormalities.

Methods and results: A total of 3649 Chinese older adults aged 60–90 years with metabolic abnormalities were included between 2000 and 2014. Weight change between two health checkup periods was calculated. During a median follow-up period of 37 months, 503 all-cause mortality and 235 cardiovascular disease mortality occurred. Death rate was the lowest in overweight participants and in the participants with weight stability. After adjustment for covariates, hazard ratios (95% confidence intervals) of overweight participants for all-cause mortality and cardiovascular mortality were 0.71 (0.59, 0.86) and 0.72 (0.55, 0.95), respectively, whereas obesity was not significantly associated with mortality risk. Furthermore, relative to weight stability, risks of mortality significantly increased with the increase in weight loss or weight gain, except small weight gain. These associations were unchanged when the participants were stratified by baseline covariates and even when several definitions of weight change were considered. *Conclusions:* Overweight was associated with less mortality risk, and obesity was not associated with mortality risk in older adults with metabolic abnormalities. Mortality risk increased with the increase in weight loss or weight gain, regardless of body weight levels at the baseline. These findings suggest that maintaining a stable weight may be the best choice in older adults with metabolic abnormalities.

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Introduction

Obesity and metabolic abnormality are important global health challenges because of their high prevalence, thus resulting in cardiovascular disease and mortality [1,2]. Obesity is closely associated with metabolic abnormality. Although an increased risk of adverse health outcomes was observed in obese patients with metabolic dysfunction [3,4], a number of studies reported that weight reduction improved obesity-related cardiovascular disease risk factors and reduced risk of metabolic disorders [5,6]. Therefore, it is reasonable to expect a reduction in mortality risk after weight loss in patients with metabolic abnormalities, especially in those with obesity coexisted.

However, unexpectedly, the effects of obesity and weight loss on health outcomes in patients with established diseases and in older adults (≥ 60 years) remain controversial [7–9]. Recently, several observational studies reported that obesity was associated with reduced mortality in patients with coronary heart disease, diabetes, or heart failure [10–12]. No effect or adverse effect of weight loss on health outcomes in obese patients or in older adults has been reported [13,14]. Nevertheless, it is not clear that these results can be extrapolated for older adults with metabolic abnormalities, and data on this population are limited. Therefore, we performed a retrospective cohort study to investigate whether obesity and weight loss were associated with mortality risk in older adults with metabolic abnormalities.

Methods

Study design and participants

The present study recruited older adults aged 60–90 years with metabolic abnormalities who visited the clinics of Agency for Offices Administration of Chinese People's Liberation Army (PLA) or the Chinese PLA General Hospital from Jan 2000 to Dec 2014. The patients who underwent health checkups at least twice, with time intervals of nearly one year between the first and second health checkup periods, were eligible for participation ($n = 4539$). A follow-up was performed after the second health checkup period. We excluded 817 patients who had diagnosed coronary heart disease, heart failure, stroke, lung disease, kidney disease, or cancer before the follow-up. We successively excluded those with missing data on weight or height ($n = 46$) and those who had a body mass index (BMI) < 18.5 kg/m² ($n = 27$) at the first or second health checkup period. Finally, a total of 3649 older adults with metabolic abnormalities were included and followed up. Written informed consent was obtained from all participants. The study was approved by the Medical Ethics Committee of Chinese PLA General Hospital.

Measurements of body weight and weight change

Weights and heights at the first and second health checkup periods were collected from hospital medical

records. BMI at the second health checkup period was calculated in kg/m² and stratified into three levels, normal weight (BMI 18.5–23.9 kg/m²), overweight (24–27.9 kg/m²), and obese (≥ 28 kg/m²), based on the recommendation by the Working Group on Obesity in China [15]. Weight change was calculated by subtracting weight (kg) at the first health checkup period from weight at the second health checkup period, and this was stratified into seven levels: large weight loss (>4 kg loss), moderate weight loss (1.5–4 kg loss), small weight loss (0.5–1.5 kg loss), weight stability (≤ 0.5 kg loss or gain), small weight gain (0.5–1.5 kg gain), moderate weight gain (1.5–4 kg gain), and large weight gain (>4 kg gain). Participants with normal weight and participants with weight stability were set as reference groups in all analyses.

Covariates

Data on smoking status, individual medical history, and medication use were obtained from hospital medical records. Smoking was defined as at least 100 cigarettes in a lifetime, and patients were characterized as nonsmoker, ex-smoker, or current smoker. Blood pressure, fasting glucose, serum lipid, and serum creatinine levels were measured by routine methods. Covariates at the second health checkup period were used for this analysis.

Definition of metabolic abnormality

According to metabolic syndrome based on Chinese guidelines on prevention and treatment of dyslipidemia in adults [16], metabolic abnormality was defined as having one or more abnormalities as follows: (1) high blood pressure level, defined as blood pressure $\geq 130/85$ mmHg and/or having been previously diagnosed as having hypertension and taking blood pressure-lowering medications; (2) high plasma glucose level, defined as fasting plasma glucose level ≥ 6.10 mmol/L and/or having been previously diagnosed as having diabetes and taking glucose-lowering medications; and (3) dyslipidemia, defined as triglyceride level ≥ 1.70 mmol/L or taking lipid-lowering medications and/or high-density lipoprotein-cholesterol level < 1.04 mmol/L.

Follow-up and outcomes

In this study, the follow-up period began on the date after the second health checkup period and lasted until Dec 31, 2016. The follow-up protocol included a combination of hospital medical records and telephone contacts with the participants or family members. The primary outcome was all-cause mortality. The cause of death was determined by physician review of death certificates using personal identify card numbers. Diagnostic codes from the tenth revision of the International Classification of Diseases (ICD-10) were used to classify deaths as due to cardiovascular disease (including fatal myocardial infarction, fatal stroke, fatal peripheral vascular disease, and sudden death).

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