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Diet Quality and Mortality Risk in Metabolically Obese Normal-Weight Adults

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Abstract

Objective: To examine the associations among the Dietary Approaches to Stop Hypertension (DASH)–style diet, the Healthy Eating Index (HEI), and mortality risk in metabolically obese normal-weight (MONW) adults.

Patients and Methods: Data were from normal-weight (body mass index of 18.5 to <25) adults aged 30 to 90 years at baseline in the Third National Health and Nutrition Examination Survey, October 18, 1988, through October 15, 1994, followed up for deaths (all-cause, cardiovascular, and cancer related) until December 31, 2011. A total of 2103 participants without known cardiovascular disease and cancer at baseline were included in this prospective cohort study. Metabolic obesity was defined as having 2 or more of the following: high glucose, blood pressure, triglyceride, C-reactive protein, and insulin resistance values and low high-density lipoprotein cholesterol levels; metabolic healthy status was defined as having 0 or 1 of these metabolic derangements.

Results: During median follow-up of 18.6 years, there were 344 and 296 deaths in the MONW and metabolically healthy normal-weight (MHNW) phenotypes, respectively. In MONW individuals, a 1-SD increment in adherence to a DASH diet (2 points) or HEI (14 points) was significantly associated with reductions (17% [hazard ratio (HR), 0.83; 95% CI, 0.72-0.97] and 22% [HR, 0.78; 95% CI, 0.68-0.90], respectively) in the risk of all-cause mortality, after adjustment for potential confounders. The corresponding HRs for cardiovascular disease mortality were 0.72 (95% CI, 0.55-0.94) and 0.79 (95% CI, 0.65-0.97), respectively. In addition, reduction of cancer mortality was observed with 1-SD increment of HEI (HR, 0.63; 95% CI, 0.46-0.88). However, no association was observed in the MHNW phenotype. Sensitivity analyses suggested relationships robust to different definitions of MONW and also dose responses with the number of metabolic derangements.

Conclusion: Higher diet quality scores were associated with lower risk of mortality in normal-weight individuals with metabolic abnormalities.

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Despite being apparently nonobese, a subset of normal-weight individuals seems to be more susceptible to insulin resistance, type 2 diabetes mellitus, and cardiovascular disease (CVD), which are all metabolic conditions associated with obesity.[1-3] These individuals display a metabolically obese normal weight (MONW) phenotype characterized by higher visceral adiposity, impaired insulin sensitivity, and a more atherogenic lipid profile compared with their metabolically healthy normal-weight (MHNW) counterparts.[3] It has been reported that the prevalence of the MONW phenotype ranges from 7.1% to 30.1% in the US population depending on the criteria used.[4,5] Identification of modifiable risk factors in MONW individuals who are apparently healthy but at high risk for cardiometabolic disease could be beneficial to preventing cardiometabolic morbidity and mortality.[6] In addition, the MONW phenotype may relate to cancer morbidity and mortality, although there has been less research in this area.[7]

Healthy dietary patterns are associated with a reduced risk of CVD and cancer.[8] In the United States, the Dietary Approaches to Stop Hypertension (DASH) score and the Healthy Eating Index (HEI) are used to assess diet quality.[9] The DASH diet was developed to

prevent hypertension,[10] and it has been reported that adherence to the DASH diet is related to a reduced risk of CVD[11] and type 2 diabetes mellitus.[12] The HEI was developed by US Department of Agriculture researchers to measure adherence to the Dietary Guidelines for Americans and the Food Guide Pyramid[13] and has been associated with lower inflammation and risk of chronic disease.[14,15]

To date, intervention studies assessing the effect of healthy dietary patterns on reducing the risk of chronic disease have been largely focused on an obese population.[16,17] Because the MONW phenotype presents risks for the development of diseases leading to avoidable morbidity and premature mortality, it is important to understand the role that modifiable factors, such as dietary pattern, may play in modifying that risk.[9,11] Furthermore, the role of a dietary pattern on mortality in MONW individuals is unknown.

Therefore, we addressed whether a high-quality diet, measured by DASH or HEI criteria, relates to cardiovascular, cancer, and all-cause mortality risk in MONW individuals in a nationally representative normal-weight US population.

PATIENTS AND METHODS

Study Population

We used data from the Third National Health and Nutrition Examination Survey (NHANES III), October 18, 1988, through October 15, 1994, followed up for deaths until December 31, 2011, in this prospective cohort analysis. NHANES III was conducted using a complex multistage stratified clustered probability sample design to achieve a nationally representative sample of the civilian, noninstitutionalized US population. The survey included personal interviews, physical examinations, and laboratory measurements.

The primary analysis included 2,509 normal-weight (body mass index [BMI] of 18.5 to <25 [calculated as the weight in kilograms divided by the height in meters squared]) adults aged 30 to 90 years at baseline who were eligible for mortality follow-up and had complete dietary data and cardiometabolic parameters, including fasting glucose, insulin, triglycerides, high-density lipoprotein cholesterol (HDL-C), blood pressure (BP), and high-sensitivity C-reactive protein (hs-CRP). We excluded individuals who reported a history of myocardial infarction (n=112), stroke (n=94), congestive heart failure (n=83), or cancer (other than skin cancer) (n=136). To reduce the possibility of reverse causation with diets being modified due to diseases elevating mortality risk, we excluded individuals who died during the first year of follow-up (n=33). We also excluded those who reported implausible extreme energy intakes (n=48), pregnant (n=14) or lactating (n=14) women, and those with an hs-CRP level greater than 10 mg/L (to convert to nmol/L, multiply by 9.542) (n=2). Finally, a total of 2103 individuals were included in these analyses because some of the participants had multiple exclusion criteria (for instance some people might have both myocardial infarction and cancer), the sum of those with each exclusion criterion should be greater than those excluded) (Figure). We did not include individuals younger than 30 years at baseline because the prevalence of the MONW

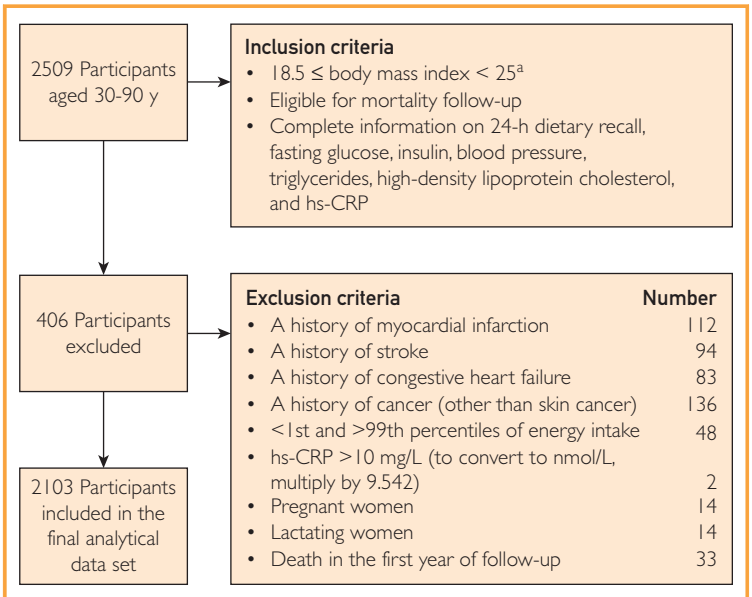

FIGURE. Participant flow diagram. Because some of the participants had multiple exclusion criteria (for instance some people might have both myocardial infarction and cancer), the number of sum of those with each exclusion criterion should be greater than the number of those excluded. [a]For sensitivity analyses, alternative definitions of normal weight were applied using (1) waist circumference less than 102 cm in men and less than 88 cm in women or (2) body mass index of 18.5 to less than 25 and waist circumference less than 102 cm in men and less than 88 cm in women. hs-CRP = high-sensitivity C-reactive protein.