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Vegetarianism and cardiometabolic disease risk factors: Differences between South Asian and US adults

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ABSTRACT

Objectives: Cardiometabolic diseases are increasing disproportionately in South Asia compared with other regions of the world despite high levels of vegetarianism. This unexpected discordance may be explained by differences in the healthfulness of vegetarian and non-vegetarian diets in South Asia compared with the United States. The aim of this study was to compare the food group intake of vegetarians with non-vegetarians in South Asia and the United States and to evaluate associations between vegetarianism and cardiometabolic disease risk factors (overweight/obesity, central obesity, diabetes, hypertension, high triacylglycerols, high low-density lipoprotein, low high-density lipoprotein, and high Framingham Heart Score).

Methods: Using cross-sectional data from adults (age 20–69 y) in South Asia (Centre for Cardiometabolic Risk Reduction in South-Asia [CARRS] 2010–2011; N = 15 665) and the United States (National Health and Nutrition Examination Survey 2003–2006; N = 2159), adherence to a vegetarian diet was assessed using food propensity questionnaires. Multivariable logistic regression was used to estimate odds ratios and predicted margins (e.g., adjusted prevalence of the outcomes).

Results: One-third (33%; n = 4968) of adults in the South Asian sample were vegetarian compared with only 2.4% (n = 59) in the US sample. Among South Asians, vegetarians more frequently ate dairy, legumes, vegetables, fruit, desserts, and fried foods than non-vegitarians (all $P < 0.05$). Among Americans, vegetarians more frequently ate legumes, fruit, and whole grains, and less frequently ate refined cereals, desserts, fried foods, fruit juice, and soft drinks than non-vegetarians (all $P < 0.05$). After adjustment for confounders (age, sex, education, tobacco, alcohol, and also city in CARRS), South Asian vegetarians were slightly less frequently overweight/obese compared with non-vegetarians: 49% (95% confidence interval [CI], 45%–53%) versus 53% (95% CI, 51%–56%), respectively; whereas US vegetarians were considerably less frequently overweight/obese compared with non-vegetarians: 48% (95% CI, 32%–63%) versus 68% (95% CI, 65%–70%), respectively. Furthermore, US vegetarians were less likely to exhibit central obesity than non-vegetarians: 62% (95% CI, 43%–78%) versus 78% (95% CI, 76%–80%), respectively.

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Conclusions: There is greater divergence between vegetarian and non-vegetarian diets in the United States than in South Asia, and US vegetarians have more consistently healthier food group intakes than South Asian vegetarians. Vegetarians in both populations have a lower probability of overweight/obesity compared with non-vegetarians. The strength of this association may be stronger for US vegetarian diets, which were also protective against central obesity.

Introduction

The prevalence of cardiometabolic diseases such as diabetes [1,2] and coronary heart disease [3,4] is increasing disproportionately in South Asia compared with other regions of the world [5,6] despite high levels of vegetarianism [7]—a phenomenon referred to as the "South Asian paradox." For example, the age-adjusted prevalence of diabetes among adults in India increased from 6.7% in 2006 to 9.3% in 2014 [8,9]. In the United States, these numbers were 7.8% and 10.8%, respectively [8,9]. Between 1990 and 2020, coronary heart disease is estimated to increase by 120% to 137% in developing countries compared with 30% to 60% in developed countries [6]. In India, between 2000 and 2030, an estimated 35% of all cardiovascular disease (CVD) deaths will occur among individuals ages 35 to 64 y, compared with only 12% in the United States [6].

The South Asian paradox may be explained by differences in the relative healthfulness of vegetarian versus non-vegetarian diets in South Asia compared with the United States and Europe [7]. Although several studies, including randomized controlled trials, have documented protective effects of vegetarian diets on cardiometabolic disease risk factors in US and European populations [10–12], few have evaluated these relationships in South Asian populations.

Two studies have explored these associations among South Asian immigrants to New Zealand and the United States: The first found vegetarians had, on average, a lower body mass index (BMI) and waist circumference compared with non-vegetarians but no difference in insulin resistance after adjustment for BMI [13]. The second study found lower insulin resistance among vegetarians than non-vegetarians but did not adjust for BMI [14]. The few studies conducted among South Asians living in South Asia reported mixed results: Some observed that vegetarians were less likely to be overweight [15,16] and have diabetes [16,17] compared with non-vegetarians; whereas others observed no difference in BMI [18,19] but found that vegetarians exhibit lower levels of circulating lipids and blood pressure compared with non-vegetarians [18].

There is an even greater paucity of data comparing vegetarian diets in South Asia to other populations. Exploring intercountry differences is an important first step in identifying points of intervention to improve diet quality and prevent disease. Therefore, we assessed differences in food group intake of vegetarians versus non-vegetarians and quantified the association of vegetarian dietary patterns with overweight/obesity, central obesity, diabetes, hypertension, dyslipidemia, and a composite CVD risk score within urban South Asian (India and Pakistan) and national US samples.

Methods

Samples

We examined cross-sectional data on men and non-pregnant women (ages 20–69 y) in urban South Asia were from the baseline survey of the CARRS (Centre for Cardiometabolic Risk Reduction in South-Asia) cohort, conducted in three cities in 2010–2011: Chennai and New Delhi in India, and Karachi in Pakistan [20]. Cross-sectional data on men and non-pregnant women (ages 20–69 y) in the United States were from NHANES (National Health and Nutrition Examination Survey) 2003–2004 and 2005–2006, which assessed more comparable dietary data to CARRS than more recent NHANES. Both CARRS [20] and NHANES used complex, multistage probability sampling to select representative samples of the target populations (for CARRS, each of the three cities, n = 16 288, and for NHANES, the general US population, n = 12 761 for 2003–2004 and n = 12 862 for 2005–2006). The response rates for CARRS were 94.7% for questionnaire completion and 84.3% for biospecimen collection. The response rates for interview and examination completion in NHANES 2003–2004 were 79% and 76%, respectively, and 80% and 77%, respectively, for NHANES 2005–2006.

This study was conducted according to the guidelines laid down in the Declaration of Helsinki and all procedures involving human participants were approved by the Emory University Institutional Review Board, the Public Health Foundation of India Ethics Review Committee, the Aga Khan University Ethics Review Committee, and the Madras Diabetes Research Foundation Ethics Review Committee. Written informed consent was obtained from all participants.

Dietary assessment

CARRS administered a 26-item food propensity questionnaire adapted from the INTERHEART study [21]. To improve comparability between CARRS and NHANES, NHANES 139-item food propensity questionnaire data, collected only during the 2003–2004 and 2005–2006 survey cycles, were used. For both questionnaires, portion-size information was not collected, only the frequency of consumption (never or less than once a month, per month, per week, or per day) over the past year, which was standardized to consumption per day and categorized into four categories: never consumed, consumed ≥1 time/mo but <1 time/wk, consumed ≥1 time/wk but <1 time/d, and consumed daily.

More specifically for NHANES, the National Cancer Institute's DietCalc software was used to convert raw frequencies from the food propensity questionnaire into average consumption per day. This software also imputed data in the case of inconsistent responses to stem and follow-up questions. Given that the NHANES food propensity questionnaire queried many more items (N = 139), multiple items were collapsed and summed within individuals to derive average daily frequencies for food groups that were consistent with those in CARRS. Similarly, for CARRS, because some items—such as *mithai* (Indian sweets)—were added to make the instrument culturally appropriate, select items were also collapsed and summed within individuals. In the end, this resulted in 18 food groups used for the analysis (Supplementary Table 1). As a sensitivity analysis, vegetables were further divided into leafy green vegetables, other raw vegetables, and cooked vegetables including potatoes but not fried potatoes. Cooked vegetables were even further divided into non-potato cooked vegetables and potatoes for NHANES; this distinction could not be made for CARRS given the items included on the CARRS food propensity questionnaire.

Six dietary patterns were defined as follows: non-vegetarian (no restrictions on animal-based products); vegan (eat meat, poultry, fish, eggs, and dairy never or <1 time/mo); lacto-vegetarian (eat meat, poultry, fish, and eggs never or <1 time/mo); lacto-ovo vegetarian (eat meat, poultry, and fish never or <1 time/mo); pesco-vegetarian (eat meat and poultry never or <1 time/mo); and semi-vegetarian (eat meat, poultry, and fish ≥1 time/mo but <1 time/wk) [16,22]. Given the small sample size of vegetarian dietary patterns in NHANES, participants following any of the five vegetarian dietary patterns were combined into a single "vegetarian" group. The same was done for CARRS participants for the purposes of comparison, in addition to a subgroup analysis looking across different vegetarian dietary patterns within the CARRS sample. Thus, herein, unless otherwise indicated, the term *vegetarian* refers to all participants adhering to any of the five vegetarian dietary patterns.

Outcome assessment

In both studies, trained study staff used standardized procedures to measure weight, height, waist circumference, and blood pressure. BMI was calculated as weight (kg) divided by height-squared (m^2). Obesity including overweight was defined as BMI ≥25 kg/m^2. This definition is consistent with the definition used