A Section 508–conformant HTML version of this article is available at https://doi.org/10.1289/EHP15006.

Exploring Environmental and Cardiometabolic Impacts Associated with Adherence to the Sustainable EAT-Lancet Reference Diet: Findings from the China Health and Nutrition Survey

Man Wu,[1] Yiqian Lv,[1] Wenjing Liu,[1] Ke Liu,[1] Yin Wang,[1] Zhixin Cui,[1] and Huicui Meng[1,2,3]

[1]School of Public Health (Shenzhen), Shenzhen Campus of Sun Yat-Sen University, Sun Yat-Sen University, Shenzhen, Guangdong, China
[2]Guangdong Provincial Key Laboratory of Food, Nutrition and Health, Guangzhou, Guangdong, China
[3]Guangdong Province Engineering Laboratory for Nutrition Translation, Guangzhou, Guangdong, China

Background: To contribute to the growing evidence on the potential co-benefits of the EAT-Lancet reference diet for cardiometabolic health and sustainability, we investigated this topic in a nationwide prospective cohort of Chinese adults. Adherence to this diet has been measured using several indices, including the World Index for Sustainability and Health (WISH) and the Planetary Health Diet Index (PHDI).

Objectives: We aimed to investigate the associations between adherence to the EAT-Lancet reference diet, as evaluated by WISH and PHDI, with risk of new-onset cardiometabolic diseases (CMDs), risk of all-cause mortality, and greenhouse gas (GHG) emissions.

Methods: We included adults ($n = 14{,}652$ for CMDs and 15,318 for all-cause mortality) from the China Health and Nutrition Survey (1997–2015) in the analysis. Dietary intake data were collected, and WISH and PHDI scores were computed with established methods. CMDs included myocardial infarction (MI), type 2 diabetes mellitus (T2DM), and stroke. We used Cox proportional hazard regression models to analyze data with a mean of 10 years of follow-up from the date of baseline to the end of study or until the occurrence of the event of interest, whichever came first. We adjusted for sociodemographic, anthropometric, lifestyle, and dietary characteristics of participants as confounders.

Results: Greater adherence to the EAT-Lancet reference diet, as reflected by higher WISH or PHDI scores, was inversely associated with risk of MI {Q4 vs. Q1: hazard ratio (HR) = 0.68 [95% confidence interval (CI): 0.48, 0.96] for WISH and 0.14 (95% CI: 0.07, 0.29) for PHDI}, T2DM [Q4 vs. Q1: HR = 0.81 (95% CI: 0.67, 0.96) for WISH and 0.68 (95% CI: 0.57, 0.82) for PHDI], and all-cause mortality [Q4 vs. Q1: HR = 0.80 (95% CI: 0.68, 0.95) for WISH and 0.60 (95% CI: 0.46, 0.80) for PHDI] in fully adjusted models (all p-trend <0.05). Both WISH and PHDI were inversely associated with GHG emissions in fully adjusted models (all p-trend <0.05). WISH and PHDI were not significantly associated with risk of stroke.

Conclusions: Our findings supported the co-benefits of the EAT-Lancet reference diet for both cardiometabolic health and environmental sustainability. Long-term adherence to this reference diet as effectively indicated by either higher WISH or PHDI scores may reduce the risk and burden of CMDs and all-cause mortality in Chinese adults. https://doi.org/10.1289/EHP15006

Introduction

Diets and food systems play an integral role in both planetary and population health.[1] Activities within food systems, such as production and waste disposal, contribute to ~30% of global greenhouse gas (GHG) emissions.[2–4] According to the Global Burden of Disease database, adherence to unhealthy dietary patterns, particularly lower consumption of healthy plant-based food groups and higher consumption of unhealthy plant-based and animal-based food groups, is a significant risk factor for premature adult mortality and disability-adjusted life years attributable to cardiometabolic diseases (CMDs).[5,6] Additionally, adherence to unhealthy dietary patterns also leads to environmental burdens.[7] Transitioning to sustainable diets, which are defined as diets that are healthy, nutrient-dense, accessible, affordable, culturally acceptable, and environmental-friendly, can collectively provide long-term benefits for both planetary and population health.[8–10]

The EAT-Lancet reference diet has been proposed in 2019 as a benchmark for what a healthy, sustainable diet could look like with the intent to facilitate a global diet transition to promote human health while protecting the environment.[11,12] The EAT-Lancet reference diet emphasizes the consumption of nutrient-dense food groups, including whole grains, fruits, vegetables, nuts, legumes, and vegetable oils, with low to moderate amounts of dairy foods, seafood, and poultry, while minimizing or excluding energy-dense food groups, including refined grains, added sugars, red and processed meat, animal fats, as well as starchy vegetables.[11,12] Food groups of the EAT-Lancet reference diet, specifically healthy plant-based food groups such as whole grains, fruits, vegetables, and legumes, have fewer environmental burdens.[13] Projections by the EAT-Lancet Commission have suggested that adopting this reference diet could have the potential to prevent 19.0% to 23.6% of premature adult deaths, while following guidelines for planetary health.[11]

However, since these estimates are primarily based on theoretical models, empirical population-based studies are needed to confirm the health and environmental benefits of the EAT-Lancet reference diet. To date, limited prospective studies have investigated the associations between adherence to the EAT-Lancet reference diet, as measured by EAT-Lancet reference diet score (ERD), and the risk of CMDs and all-cause mortality, with equivocal results.[14–22] The heterogeneity in findings could be attributed to the different scoring systems used to assess adherence to the diet in these studies. The initial dichotomous scoring system for ERD proposed by the EAT-Lancet Commission allowed for only slight variations in scores among populations,[16,23] which may not capture subtle variations in adherence to EAT-Lancet reference diet among

Address correspondence to Huicui Meng, School of Public Health (Shenzhen), Shenzhen Campus of Sun Yat-Sen University, No. 66, Gongchang Road, Guangming District, Shenzhen, Guangdong 518107 China. Telephone: 86-15768992680. Email: menghc@mail.sysu.edu.cn

Supplemental Material is available online (https://doi.org/10.1289/EHP15006).

The authors declare that they have no actual or potential competing financial interests.

Received 18 March 2024; Revised 16 April 2025; Accepted 24 April 2025; Published 29 May 2025.

Note to readers with disabilities: *EHP* strives to ensure that all journal content is accessible to all readers. However, some figures and Supplemental Material published in *EHP* articles may not conform to 508 standards due to the complexity of the information being presented. If you need assistance accessing journal content, please contact ehpsubmissions@niehs.nih.gov. Our staff will work with you to assess and meet your accessibility needs within 3 working days.

individuals. Alternative indices, such as the World Index for Sustainability and Health (WISH) and Planetary Health Diet Index (PHDI),[24–26] have more nuanced scoring systems and are also based on the EAT-Lancet reference diet. WISH was calculated based on the amount of food group consumption, while PHDI was calculated based on the calorie density of food groups.[25,26] There is only one evidence from prospective cohort studies regarding the potential long-term cardiometabolic benefits of following the EAT-Lancet reference diet when adherence is measured by PHDI.[27] Furthermore, only two studies have used WISH[28] and PHDI[27] to measure adherence and investigated the environmental impacts of the EAT-Lancet reference diet, respectively. Although some studies have investigated the associations between adherence to the EAT-Lancet reference diet, as measured by PHDI, and the risk of all-cause mortality[29–31] and GHG emissions,[30–33] the computation of PHDI in these studies is quite different from the initial PHDI by Cacau et al.[26] Studies that investigate the potential cobenefits of adherence to EAT-Lancet reference diet, as measured by different indices and scoring systems, are crucial in suggesting which index should be used to best capture adherence to the EAT-Lancet reference diet and determining whether this reference diet should be integrated into food-based dietary guidelines to promote both environmental sustainability and human health through food choices.

The current study aimed to investigate the associations between adherence to the sustainable EAT-Lancet reference diet, assessed by WISH and PHDI, and the risk of new-onset CMDs and all-cause mortality in a nationwide prospective cohort of Chinese adults as well as potential effect modification by age, sex, body mass index (BMI), or baseline hypertension. It also sought to assess the environmental impacts of the EAT-Lancet reference diet on GHG emissions within the same cohort. Our hypothesis was that elevated WISH and PHDI scores, indicative of stronger adherence to EAT-Lancet reference diet, would be associated with reduced risk of new-onset CMDs and all-cause mortality as well as reduced GHG emissions in Chinese adults, and the associations may be modified by age, sex, BMI, or baseline hypertension.

Methods

Study Population

Data used in this study were obtained from the China Health and Nutrition Survey (CHNS),[34] an ongoing longitudinal open cohort initiated in 1989 to assess the changes in health and nutritional status among the Chinese population during a time of rapid social and economic transformation. Between 1989 and 2015, CHNS has conducted 10 waves of surveys using a multistage random cluster sampling design, covered 15 provinces with diverse geographic and economic characteristics, and involved a total of 7,200 households and more than 30,000 participants. Counties in provinces were stratified by income (low, middle, and high), and a weighted sampling scheme was used to randomly select four counties in each province. Villages, townships, and urban/suburban neighborhoods were then randomly chosen within these counties. Households were randomly selected from these areas. In-depth overview of the objective and design of CHNS has been previously provided.[34,35] The research protocols received approval from the Institutional Review Committees of the University of North Carolina at Chapel Hill and the National Institute for Nutrition and Health at the Chinese Center for Disease Control and Prevention.[36,37] Prior to participating in the survey, all participants provided written informed consent.[34]

This study analyzed data from the CHNS 1997–2015 wave to investigate the prospective associations between adherence to the EAT-Lancet reference diet, as evaluated by two indices (WISH and PHDI), and the risk of two outcomes: new-onset CMDs (cohort A)—including myocardial infarction (MI), type 2 diabetes mellitus (T2DM), and stroke—and all-cause mortality (cohort B). The same 33,314 participants were initially selected as the base populations for cohorts A and B. The baseline for each participant was defined as the date of their first dietary intake survey during the 1997–2015 wave. In both cohorts A and B, participants were excluded from the initial cohort if they were younger than 18 years old at baseline ($n = 8{,}992$), had no records from the 3-day consecutive 24-h dietary records ($n = 3{,}622$), or were missing all physical examination data ($n = 98$). In cohort A, participants were also excluded if they were diagnosed with CMDs or tumors or took medications to treat these diseases at baseline ($n = 849$), participated in only one wave of the survey ($n = 3{,}789$), or had no dietary data collected from the food weighing method ($n = 56$). In addition, we further excluded participants who had implausible cumulative average of total energy intake (<800 or >4,200 kcal/day for men; <500 or >3,500 kcal/day for women; $n = 290$)[38] or who were breastfeeding or pregnant ($n = 966$). Cohort A included a total of 14,652 participants, with 7,428 males and 7,224 females (Figure S1).

In cohort B, participants were also excluded if they participated in only one wave of the survey ($n = 3{,}981$) or had no dietary data collected from the food weighing method ($n = 59$). Participants were further excluded if they had implausible cumulative average of total energy intakes (<800 or >4,200 kcal/day for men; <500 or >3,500 kcal/day for women; $n = 274$)[38] or were breastfeeding or pregnant ($n = 970$). Cohort B included a total of 15,318 participants, with 7,760 males and 7,558 females (Figure S1).

Dietary Intake Assessment and Calculation of EAT-Lancet Reference Diet Indices

At each wave of survey, dietary intake data were collected at the individual level through 3-day consecutive 24-h dietary recalls, and consumption of cooking oils and condiments was determined at the household level using a food weighing method.[39] In the food weighing method, foods (purchased, homemade, and processed snack foods) were weighed at the beginning of each day prior to consumption, leftover foods were weighed at the end of each day after consumption, and the amount of food consumed and changes in food inventory from during the day were measured and recorded for the entire household. Food intakes of each household member were calculated by multiplying the intakes of the entire household with the proportion of energy requirements of each individual, estimated from the total estimated energy requirements of all members consumed together. Trained interviewers collected information on each food and beverage consumed by participants within the previous 24 h for three consecutive days, covering two weekdays and one weekend.[39] Detailed information included types, quantities, preparation methods, and dining locations of foods and beverages, and the quantities of consumption at an individual level were further cross-validated using a food weighing method at the household level during the same 3-day period.[39]

The daily intake of each nutrient, food, or food group was averaged over 3 days. The daily intake of each nutrient was calculated by multiplying the nutrient content of the edible portion of each food by the portion of the specific food eaten and then summing up the nutrient intakes from all foods containing this nutrient. The energy, nutrient contents, and edible portion of food items were matched to the China Food Composition Tables by food codes.[40–43] Previous studies have validated the feasibility of assessing energy and nutrient intakes via the dietary recall and food weighing method.[44] The daily intake of a specific food group was calculated by multiplying the amount by the edible portion of each food and then summing up the intakes of all foods within this particular food group. Dietary records were collected and updated at each wave of the survey with a total of six waves from 1997 to 2011. In order to capture long-term dietary habits and mitigate intraindividual variability, we used the cumulative averages of each individual's daily food group, food, or nutrient intakes from baseline to the date of diagnosis with CMD outcomes, death, or the end of follow-up.[45]

Adherence to the EAT-Lancet reference diet was assessed using two indices, including WISH and PHDI. WISH was developed to assess the impact of EAT-Lancet reference diet on both health and environmental sustainability using a unified scoring system.[25] The computation of WISH index involved 13 food groups in the EAT-Lancet reference diet, including grains (including both whole and refined grains), vegetables, fruits, legumes, dairy foods, fish, nuts, red meat (including processed meat), eggs, poultry, unsaturated oils, saturated oils, and added sugars. As previously described,[25] the 13 food groups were categorized based on their health impact into eight protective, two neutral, and three foods-to-limit categories. Simultaneously, the food groups were also classified according to their environmental impact into six low-impact categories (indicating positive impact on environment), three high-impact categories (indicating negative impact on environment), and four intermediate impact categories. Combined, grains, vegetables, fruits, legumes, and unsaturated oils were classified as protective with low environmental impact. Dairy foods and nuts were classified as protective with medium environmental impact. Fish was classified as protective with high environmental impact. Eggs and poultry were classified as neutral with medium environmental impact. Red meat and saturated oils were classified as foods-to-limit with high environmental impact, and added sugars were classified as foods-to-limit with low environmental impact. Each food group was assigned a score ranging from 0 to 10 points based on the linear relationships between food groups with health and environmental outcomes. The detailed calculation equations were presented in Table S1. For each food group, a score of 0 points indicated a participant's noncompliance with recommended intake levels, and a score of 10 points indicated full compliance. For food groups of grains, vegetables, fruits, and legumes, we assigned a score of 0 points to participants consuming less than the lower limit of recommended intake ranges; we assigned a score of 10 points to participants consuming equal to or greater than recommended intake levels; and we assigned a score calculated as $10 \times$ (reported intake − lower intake)/(recommended intake − lower intake) to participants consuming between the lower limit of recommended intake ranges and recommended intake levels. For the dairy foods, fish, and nuts food groups, we assigned a score of 0 points to participants consuming more than the upper limit of recommended intake ranges; we assigned a score of 10 points to participants consuming between recommended intake levels and upper limit of recommended intake ranges; and we assigned a score calculated as $10 \times$ (reported intake − lower intake)/(recommended intake − lower intake) to participants consuming between the lower limit of recommended intake ranges and recommended intake levels. The scoring criteria for unsaturated oils were similar to dairy foods, fish, and nuts, with the exception that we also assigned a score of 0 points to participants consuming less than the lower limit of recommended intake ranges. For red meat, eggs, and poultry, we assigned a score of 0 points to participants consuming more than the upper limit of recommended intake ranges; we assigned a score of 10 points to participants consuming between 0 g/d and recommended intake levels; and we assigned a score calculated as $10 \times$ (upper intake − reported intake)/(upper intake − recommended intake) to participants consuming between recommended intake levels and upper limit of recommended intake ranges. For saturated oils and added sugars, we assigned a score of 0 points to participants consuming more than the recommended intake levels, and we assigned a score of 10 points to participants within recommended intake ranges. We calculated the overall WISH score for each participant by summing up the scores of all of the individual food groups. A higher WISH score indicated greater adherence to a healthier and more environmentally sustainable EAT-Lancet reference diet (Table S1).

PHDI was also created to assess the impact of EAT-Lancet reference diet on both health and environmental sustainability using a unified scoring system.[26] The computation of PHDI involved four evaluation categories encompassing 16 food groups, including nuts and peanuts, legumes, fruits, vegetables, whole grains, eggs, fish and seafood, tubers and potatoes, dairy, vegetable oils, dark green vegetables, red and orange vegetables, red meat, chicken and substitutes, animal fats, and added sugars. For each participant, the caloric density of a specific food group was calculated as the ratio of energy from this food group divided by the total energy intake from all PHDI food groups of the participant.[26] We evaluated food groups of nuts and peanuts, legumes, fruits, vegetables, and whole grains based on whether their consumption was in adequate or inadequate amounts. For any particular food group in this category, we assigned a score of 0 points to participants without any consumption, we assigned a score of 10 points to participants with caloric densities equal to or greater than recommended caloric densities, and we calculated and assigned a score between 0 and 10 points (not inclusive of 0 or 10 points) in positive proportion to the recommended caloric densities for participants with caloric densities lower than recommended caloric densities. We evaluated food groups of eggs, fish and seafood, tubers and potatoes, dairy, and vegetable oils based on whether their consumption was in optimal amounts or not. For any particular food group in this category, we assigned a score of 0 points to participants without any consumption or with caloric densities equal to or greater than the upper boundary of caloric densities, we assigned a score of 10 points to participants with caloric densities equal to the recommended caloric densities, we calculated and assigned a score between 0 and 10 points (not inclusive of 0 or 10 points) in positive proportion to the recommended caloric densities for participants with caloric densities lower than recommended caloric densities, and we calculated a score between 0 and 10 points (not inclusive of 0 or 10 points) in inverse proportion to the recommended caloric densities for participants with caloric densities between recommended caloric densities and upper boundary of caloric densities. We evaluated the food groups of dark green vegetables and red and orange vegetables based on whether their ratios of energy consumption to the energy consumption of total vegetables met recommendations. For any particular food group in this category, we assigned a score of 0 points to participants without any consumption or with ratio of energy intakes equal to 100%, we assigned a score of 5 points to participants with ratio of energy consumption equal to the recommended ratios, we calculated and assigned a score between 0 to 5 points (not inclusive of 0 or 5 points) in positive proportion to the recommended ratio for participants with ratios of energy consumption lower than the recommended ratio, and we calculated a score between 0 and 5 points (not inclusive of 0 or 5 points) in inverse proportion for participants with ratio of energy consumption between recommended ratio and 100%. The food groups of red meat, chicken and substitutes, animal fats, and added sugars were evaluated based on whether their consumption was in moderate amounts or not, defined as caloric densities of these food groups lower than recommended upper boundaries. For any particular food group in this category, we assigned a score of 0 points to participants with caloric densities equal to or greater than recommended upper boundaries of caloric densities, we assigned a score of 10 points to participants without any consumption, and we calculated and assigned a score between 0 and 10 points (not inclusive of 0 or 10 points) in inverse proportion to the recommended upper boundaries of caloric densities for participants with caloric densities lower than the recommended upper boundaries of caloric densities (Figure S2). We calculated the recommended and upper boundaries of caloric densities for each food group, except for dark green vegetables and red and orange vegetables based on their contribution to a 2,500 kcal/day EAT-Lancet reference diet. We calculated the overall PHDI score for each participant by summing up the individual scores for each food group, resulting in a theoretical range of 0–150 for the total PHDI score. A higher PHDI score indicated greater adherence to a healthier and more environmentally sustainable EAT-Lancet reference diet.

Assessment of GHG Emissions

GHG emissions from the entire cycle of food production were calculated based on a previously established method[46] to assess the environmental impact of adherence to the EAT-Lancet reference diet. Briefly, a previous study by He et al.[46] gathered data on GHG emissions per gram of various types of foods from over 100 lifecycle assessment studies, which consider the GHG emissions from the period between the initial production stage of the product (such as extraction of raw materials) to the time when final product leaves the farm gate in the whole lifecycle process of each type of food. GHG emissions of each food group were calculated by multiplying the average GHG emissions per gram in the unit of gram CO_2 equivalents (gCO_{2e}), estimated from CHNS dataset,[46] by the amount of food group intakes of each participant. Subsequently, the total GHG emissions (gCO_{2e}) associated with specific dietary indices were calculated by summing up the emissions from all food groups included in the index.

Assessment of Covariates

Trained interviewers collected information on sociodemographic and lifestyle characteristics using validated questionnaires.[34] Education levels were categorized as primary (primary school or lower), middle (middle school), or high (high school or above). Region was geographically categorized as northern or southern China, with the Qinling–Huaihe line serving as the demarcation line.[47] Northern regions included Heilongjiang, Liaoning, Beijing, Shandong, Henan, and Shaanxi, and southern regions included Jiangsu, Shanghai, Hubei, Hunan, Guizhou, Guangxi, Chongqing, Yunnan, and Zhejiang. Urbanization of the community was measured with 12 components, including population density, economic activity, traditional and modern markets, transportation infrastructure, sanitation, communications, housing, education, diversity, health infrastructure, and social services, as described previously,[34] and urbanization index was categorized in tertiles as low, moderate, or high.

Smoking status and alcohol consumption information of participants was collected by professional interviewers through validated questionnaires, as detailed below. Smoking status and alcohol consumption were defined as smoking or alcohol use reported at any time from baseline to the end of follow-up. The criteria for smoking and drinking status confirmation were in agreement with previous CHNS cohort studies investigating the relationships between dietary factors and risk of new-onset CMDs[48,49] or all-cause mortality.[50,51]

During each wave of follow-up, participants were asked the following questions to confirm whether they have ever smoked from baseline to the end of follow-up: *a*) Have you ever smoked cigarettes (including hand-rolled or device-rolled)? If yes for *a*), the participants were further asked the following questions: *b*) How old were you when you started to smoke? *c*) Do you still smoke cigarettes now? *d*) If yes for *c*), how many cigarettes do you smoke per day? *e*) If no for *c*), how long ago did you stop smoking? *f*) Have you ever smoked a pipe? If yes for *f*), the participants were further asked the following questions: *g*) How old were you when you started smoking a pipe? *h*) Do you still smoke now? If yes for *h*), the participants were further asked the following question: *i*) What is the amount of tobacco you use in 1 month? Participants were confirmed as smoking from baseline to the end of follow-up if they answered yes to any of the above questions.

During each wave of follow-up, participants were asked the following questions to confirm whether they have ever consumed alcohol from baseline to the end of follow-up: *a*) During the past year, have you drunk beer or any other alcoholic beverage? If yes for *a*), the participants were further asked the following questions: *b*) How often do you drink? *c*) Do you drink beer, wine (including various colored wines, rice wine), or liquor? If yes for *c*), the participants were further asked the following question: *d*) What is the average weekly amount of consumption? Participants were confirmed as alcohol consumption if they answered yes to any of the above questions.

Physical activity status was calculated by assessing the time and intensity of occupational, household, leisure-time, and transportation activities using a validated self-reported questionnaire and presented as metabolic equivalent-hours/week (MET-h/wk).[52] Anthropometric measurements, including body weight (kg), height (m), and blood pressure (mmHg), were conducted with calibrated equipment following standard procedures at each wave.[53] BMI was calculated by dividing weight by the square of height and was categorized as underweight ($<18.5\,kg/m^2$), normal weight ($18.5–23.9\,kg/m^2$), overweight ($24–27.9\,kg/m^2$), or obesity ($\geq 28\,kg/m^2$) on the basis of guidelines for preventing and managing overweight and obesity in Chinese adults.[54] Systolic blood pressure (SBP) and diastolic blood pressure (DBP) were measured three times at each wave.

Ascertainment of CMDs and Death

The main outcomes were new-onset CMDs, including MI, T2DM, and stroke, and all-cause mortality between 2000 and 2015 in the CHNS cohort. Professional interviewers asked participants about their health and disease status using validated questionnaires. As previously described,[55] participants were asked a series of questions to confirm whether they had ever been diagnosed with CMDs (MI, T2DM, and stroke) during each follow-up wave. Questions included whether they had ever been diagnosed with CMDs by a physician, their age of diagnosis, their age of experiencing their first CMDs, whether they had any CMDs in the last year, and whether they had ever taken medications to treat CMDs. Confirmation as a CMD patient was established if the participant answered affirmatively to any of the above questions. By excluding participants under 18 years old in our analysis, we largely eliminated cases of type 1 diabetes mellitus, which has early onset and low incidence in China.[56,57] Moreover, cases of gestational diabetes mellitus were also ruled out by excluding pregnant individuals at baseline or follow-up. Collectively, the diagnosed diabetic patients in the current study were predominantly T2DM. The criteria for confirming T2DM aligned with previous studies that investigated the associations between dietary factors and risk of new-onset T2DM in the CHNS cohort.[58,59] Death of participants was reported by household members in each survey year. Data on cause-specific mortality was only available in 1991; hence, analysis was solely conducted with all-cause mortality in this study. Given conflicting records of health or death status in different waves, priority was given to the record from the first wave.

Baseline was defined as the time of the initial enrollment for participants between 1997 and 2015 in the study. The follow-up time of each participant was calculated from baseline to the initial diagnosis of MI, T2DM, or stroke; until death; until the last wave before exiting the survey; or until the end of wave 2015, whichever occurred first. If dietary survey data were unavailable, priority was given to the date of questionnaires from the same wave. In the analysis with new-onset CMDs as primary outcomes, participants with a diagnosis of MI, T2DM, or stroke at baseline were excluded from the study. In both analyses with new-onset CMDs and all-cause mortality, the year of occurrence of the new-onset MI, T2DM, stroke cases, or death cases during the follow-up period was used as the corresponding outcome date.

Statistical Analysis

Statistical analysis was performed using SAS 9.4 for Windows (SAS Institute Inc.). Baseline sociodemographic, anthropometric, and lifestyle characteristics of participants were presented based on quartiles (Q) of WISH and PHDI scores. Continuous variables were presented as median (P25, P75) or mean $\pm$ standard deviation (SD), and categorical variables were presented as *n* (%). Differences in baseline characteristics and daily intakes of food groups and nutrients across different quartiles of WISH and PHDI scores were compared with Kruskal–Wallis rank-sum analysis for continuous variables.

Participants were divided into four groups based on quartiles of WISH and PHDI scores. In order to capture long-term dietary habits and reduce intraindividual variations in the analysis, we used cumulative average values of dietary intake, BMI, urbanization index, and physical activity data from baseline to the date of diagnosis with CMD outcomes, death, or the end of follow-up.[45] In the analysis with new-onset CMDs as primary outcomes, we did not include data from the year in which participants were diagnosed with CMDs and thereafter in the calculation of cumulative average values to minimize confounding related to changes in dietary intakes or lifestyle behaviors following diagnosis. We used Cox proportional hazard regression models with year of follow-up as the time scale to assess the associations between adherence to the EAT-Lancet reference diet, as evaluated by WISH and PHDI scores, and risk of MI, T2DM, stroke, and all-cause mortality. We conducted the analyses over a mean 10-year follow-up period from the date of baseline to the end of the study or until the occurrence of the event of interest, whichever came first. We categorized the independent variables into quartiles of WISH and PHDI scores, using the lowest quartile of each index as the reference group to estimate hazard ratio (HR) and 95% confidence intervals (95% CIs) for the risk of MI, T2DM, stroke, and all-cause mortality. We assessed the proportional hazard assumption prior to performing Cox regression analysis. If certain independent variables and covariates did not meet the proportional hazard assumption, we incorporated time-dependent variables (constructed as time $\times$ variable interaction) into the Cox regression model. We fitted all outcomes in separate Cox models. Model 1 adjusted for age (<50, 50–54, 55–59, 60–64, or $\geq$65 years) and sex (male or female). Model 2 additionally adjusted for sociodemographic, lifestyle, and diet-related confounding factors, including BMI (underweight, normal weight, overweight, or obesity), educational level (primary, middle, or high), region (northern or southern), urbanization index (tertiles), physical activity (tertiles), baseline hypertension [no (SBP <140 mmHg and DBP <90 mmHg) or yes (SBP $\geq$140 mmHg or DBP $\geq$90 mmHg)], smoking status (yes or no), alcohol intake (yes or no), and total energy intake (quintiles). We chose to adjust for these variables as potential confounders because they were either statistically correlated with adherence to EAT-Lancet reference diet and risk of CMDs and all-cause mortality in the current study or in previous studies.[60–62] The selection of these confounding factors aligned with previous studies that investigated the associations between dietary factors and risk of new-onset CMDs[61] and all-cause mortality[60,62,63] in the CHNS cohort. Model 2 for stroke also adjusted for dietary sodium: potassium ratio as an additional confounding factor due to its close association with risk of stroke.[64] We performed a test for linear trend with the use of WISH and PHDI scores as continuous variables and assigned the median values of Q1–Q4 of these indices to the variables in the Cox regression model.

We utilized linear regression models to estimate the least-squares means [95% confidence level (95% CL)] of amounts of GHG emissions to investigate the associations between WISH and PHDI scores and the amount of GHG emissions. We adjusted for the same confounding factors in models 1 and 2 of the linear regression analysis as in the Cox regression models.

We performed stratified analysis and tested for potential effect modification in the associations between WISH and PHDI scores and risk of MI, T2DM, stroke, and all-cause mortality on the basis of age (<60 or $\geq$60 years), sex (male or female), BMI (<24 or $\geq$24 kg/m^2), and baseline hypertension (yes or no). We chose these potential effect modifiers because they have been reported to modify the associations between plant-based diets and other dietary factors with risk of CMDs[55] or all-cause mortality[65] in previous studies. We chose factors as potential confounders to align with model 2 of the Cox regression model, but intentionally excluded the stratification variables as an adjustment for confounding factors in the corresponding models. We conducted a series of sensitivity analyses to estimate the potential impact of reverse causation. We reanalyzed the associations between WISH and PHDI scores and risk of CMDs and all-cause mortality by excluding cases of MI, T2DM, stroke, or death that occurred during the initial 2 years of follow-up. We conducted an analysis with all-cause mortality as the main outcome by excluding participants who were diagnosed with CMDs or tumors or took medications to treat these diseases at baseline. We considered a two-tailed $p < 0.05$ statistically significant in all statistical analyses.

Results

Baseline Sociodemographic, Anthropometric, and Lifestyle Characteristics and Dietary Intakes of Study Participants

A total of 14,652 participants were included in cohort A with new-onset CMDs as primary outcomes and a total of 15,318 participants were included in cohort B with all-cause mortality as primary outcomes. During a mean follow-up period of 10 years, a total of 280 new-onset cases of MI (147,183 person-years), 1,051 new-onset cases of T2DM (143,849 person-years), 404 new-onset cases of stroke (146,982 person-years), and 1,343 cases of all-cause mortality (154,485 person-years) were identified. Participants with higher WISH and PHDI scores were more likely to have higher intakes of carbohydrate, dietary fiber, vegetables, fruits, dairy foods, legumes, nuts, and unsaturated oil and lower intakes of fat, red meat, poultry, and saturated oils in comparison to those with lower scores (Tables 1–3; Table S2).

Distribution of WISH and PHDI Scores and Cumulative Average Intakes of Food Groups Included in the EAT-Lancet Reference Diet in Study Participants

The distribution of WISH and PHDI scores and cumulative average intakes of food groups included in these indices across wave 1997–2011 among all participants were presented in Tables S3–S5. The mean WISH score of all participants was about 66 ± 11

Table 1. Baseline sociodemographic, anthropometric, and lifestyle characteristics of 14,652 Chinese adults in cohort A who participated in the China Health and Nutrition Survey 1997–2015 wave and were included in the analysis with risk of CMDs as outcomes, based on quartiles of EAT-Lancet reference diet indices.

		Quartiles of WISH		Quartiles of PHDI	
Variables[a]	All	Q1	Q4	Q1	Q4
Number	14,652	3,663	3,663	3,663	3,701
Age (years)	45 ± 15	45 ± 15	45 ± 15	44 ± 15	46 ± 15
Female [n (%)]	7,224 (49.3)	1,796 (49.0)	1,733 (47.3)	1,698 (46.4)	1,936 (52.3)
Male [n (%)]	7,428 (50.7)	1,867 (51.0)	1,930 (52.7)	1,965 (53.6)	1,765 (47.7)
BMI (kg/m^2)	22.1 (20.7, 24.7)	21.9 (20.5, 24.5)	22.3 (20.9, 24.9)	21.6 (20.3, 24.1)	22.6 (21.0, 25.2)
SBP (mmHg)	118.7 (110.0, 129.3)	118.0 (110.0, 128.7)	119.3 (110.0, 129.3)	118.0 (110.0, 127.7)	120.0 (110.0, 130.0)
DBP (mmHg)	78.0 (70.0, 82.3)	76.7 (70.0, 82.0)	78.0 (70.0, 82.7)	76.3 (70.0, 81.3)	79.3 (70.7, 83.8)
Education level [n (%)]					
Primary	6,883 (47.0)	1,782 (48.6)	1,628 (44.4)	1,820 (49.7)	1,586 (42.9)
Middle	4,166 (28.4)	1,026 (28.1)	1,057 (28.9)	1,054 (28.8)	989 (26.7)
High	3,603 (24.6)	855 (23.3)	978 (26.7)	789 (21.5)	1,126 (30.4)
Urbanization index [n (%)]					
Low	4,859 (33.2)	1,081 (29.5)	1,253 (34.2)	1,214 (33.1)	1,194 (32.3)
Medium	4,899 (33.4)	1,504 (41.1)	997 (27.2)	1,501 (41.0)	992 (26.8)
High	4,894 (33.4)	1,078 (29.4)	1,413 (38.6)	948 (25.9)	1,515 (40.9)
Region [n (%)]					
Southern	8,551 (58.4)	2,304 (62.9)	2,161 (59.0)	2,688 (73.4)	1,577 (42.6)
Northern	6,101 (41.6)	1,359 (37.1)	1,502 (41.0)	975 (26.6)	2,124 (57.4)
Smoking [n (%)]					
Yes	4,648 (31.7)	1,155 (31.5)	1,212 (33.1)	1,211 (33.1)	1,092 (29.5)
No	10,004 (68.3)	2,508 (68.5)	2,451 (66.9)	2,452 (66.9)	2,609 (70.5)
Drinking alcohol [n (%)]					
Yes	5,401 (36.9)	1,332 (36.4)	1,383 (37.8)	1,342 (36.6)	1,333 (36.0)
No	9,251 (63.1)	2,331 (63.6)	2,280 (62.2)	2,321 (63.4)	2,368 (64.0)
Physical activity status [n (%)][b]					
Low	4,676 (31.9)	1,251 (34.2)	1,127 (30.8)	1,129 (30.8)	1,242 (33.6)
Medium	5,232 (35.7)	1,356 (37.0)	1,280 (34.9)	1,313 (35.9)	1,332 (35.9)
High	4,744 (32.4)	1,056 (28.8)	1,256 (34.3)	1,221 (33.3)	1,127 (30.5)
WISH	64.0 (56.6, 71.5)	50.0 (46.4, 53.3)	78.2 (74.8, 81.3)	57.1 (50.0, 63.8)	70.0 (62.3, 78.1)
PHDI	51.8 (44.3, 60.0)	44.7 (39.1, 51.9)	57.8 (51.1, 64.6)	40.0 (35.6, 42.3)	65.0 (62.0, 69.8)

Note: BMI, body mass index; CMD, cardiometabolic disease; DBP, diastolic blood pressure; MET-h/wk, metabolic equivalent-hours/week; PHDI, Planetary Health Diet Index; Q, quartiles; SBP, systolic blood pressure; SD, standard deviation; WISH, World Index for Sustainability and Health.
[a]Continuous variables were presented as mean ± SD or median (P25, P75), and the categorical variables were presented as n (%).
[b]The categories for physical activity status are determined by the tertiles of the accumulated average MET-h/wk. The "Low" category includes participants with MET-h/wk values in the lowest tertile, the "Medium" category includes those in the middle tertile, and the "High" category includes those in the highest tertile.

(ranging from 20.0 to 108.5), which reached half of the theoretical maximum score of 130. Approximately 54% of all participants got WISH scores that exceeded half the theoretical maximum score (Table S3). The mean PHDI score of all participants was about 55 ± 11 (ranging from 13.3 to 100.5), which was 20 points less than half of the theoretical maximum score of 150. Only about 4.4–4.6% of all participants got PHDI scores that exceeded half the theoretical maximum score (Table S3). From the perspective of food group consumption, participants were recommended to increase their consumption of whole grains, vegetables (including dark green vegetables and red and orange vegetables), fruits, legumes, dairy products, and nuts and reduce consumption of eggs, tubers and potatoes, poultry, red meat (including processed meat), saturated oils (animal fat), and added sugars to improve adherence to the EAT-Lancet reference diet (Tables S4 and S5).

Associations between Adherence to EAT-Lancet Reference Diet and Risk of New-Onset CMDs and All-Cause Mortality

In fully adjusted models, participants with higher WISH scores had a 32%, 19%, and 20% lower risk of MI (model 2; Q4 vs. Q1: HR = 0.68; 95% CI: 0.48, 0.96; p-trend = 0.0365), T2DM (model 2; Q4 vs. Q1: HR = 0.81; 95% CI: 0.67, 0.96; p-trend = 0.0103), and all-cause mortality (model 2; Q4 vs. Q1: HR = 0.80; 95% CI: 0.68, 0.95; p-trend = 0.0377) in comparison to those with lower WISH scores, respectively (Table 4). There was no significant association between WISH and risk of stroke (Table 4).

Participants with higher PHDI scores, which also represented higher adherence to EAT-Lancet reference diet, had an 86%, 32%, and 40% lower risk of MI (model 2; Q4 vs. Q1: HR = 0.14; 95% CI: 0.07, 0.29; p-trend <0.0001), T2DM (model 2; Q4 vs. Q1: HR = 0.68; 95% CI: 0.57, 0.82; p-trend <0.0001), and all-cause mortality (model 2; Q4 vs. Q1: HR = 0.60; 95% CI: 0.46, 0.80; p-trend = 0.0004) in comparison to those with lower PHDI scores, respectively, in fully adjusted models (Table 4). There was no significant association between PHDI and risk of stroke (Table 4).

Associations between Adherence to EAT-Lancet Reference Diet and GHG Emissions

The least-squares means of GHG emissions by quartiles of adherence to EAT-Lancet reference diet in the study population were shown in Table 5. Regardless of outcomes, the amounts of GHG emissions decreased significantly across quartiles of WISH and PHDI scores in both models adjusted for age and sex and fully adjusted models (all p-trend <0.0001). Compared with participants in the lowest quartiles of WISH and PHDI scores, participants in the highest quartiles had 15% to 17% lower amounts of GHG emissions. (Table 5; Figure 1).

Associations between Adherence to EAT-Lancet Reference Diet and Risk of New-Onset CMDs and All-Cause Mortality on the Basis of Potential Effect Modifiers

There were significant effect modifications of the associations between WISH with risk of MI by sex (p-interaction = 0.0010)

Table 2. Baseline sociodemographic, anthropometric, and lifestyle characteristics of 15,318 Chinese adults in cohort B who participated in the China Health and Nutrition Survey 1997–2015 wave and were included in the analysis with risk of all-cause mortality as outcome, based on quartiles of EAT-Lancet reference diet indices.

		Quartiles of WISH		Quartiles of PHDI	
Variables[a]	All	Q1	Q4	Q1	Q4
Number	15,318	3,747	3,830	3,829	3,948
Number (diagnosed with CMDs or tumors or took medications to treat CMDs)	652	161	161	94	246
Age (years)	46 ± 15	46 ± 16	46 ± 15	45 ± 15	47 ± 15
Female [*n* (%)]	7,558 (49.3)	1,983 (52.9)	1,722 (45.0)	1,798 (47.0)	2,062 (52.2)
Male [*n* (%)]	7,760 (50.7)	1,764 (47.1)	2,108 (55.0)	2,031 (53.0)	1,886 (47.8)
BMI (kg/m^2)	22.2 (20.8, 24.8)	22.3 (20.8, 24.8)	22.1 (20.8, 24.8)	21.6 (20.4, 24.2)	22.7 (21.1, 25.3)
SBP (mmHg)	119.3 (110.0, 130.0)	118.7 (110.0, 129.3)	119.3 (110.0, 130.0)	118.0 (110.0, 128.3)	120.0 (110.4, 130.0)
DBP (mmHg)	78.0 (70.0, 82.7)	78.0 (70.0, 82.0)	78.0 (70.0, 83.3)	76.7 (70.0, 81.7)	79.3 (71.3, 84.0)
Education level [*n* (%)]					
Primary	7,186 (46.9)	1,643 (43.8)	1,937 (50.6)	1,896 (49.5)	1,685 (42.7)
Middle	4,353 (28.4)	1,025 (27.4)	1,103 (28.8)	1,103 (28.8)	1,062 (26.9)
High	3,779 (24.7)	1,079 (28.8)	790 (20.6)	830 (21.7)	1,201 (30.4)
Urbanization index [*n* (%)]					
Low	5,085 (33.2)	835 (22.3)	1,671 (43.6)	1,273 (33.2)	1,242 (31.5)
Medium	5,089 (33.2)	1,516 (40.5)	1,047 (27.4)	1,576 (41.2)	1,060 (26.8)
High	5,144 (33.6)	1,396 (37.2)	1,112 (29.0)	980 (25.6)	1,646 (41.7)
Region [*n* (%)]					
Southern	8,918 (58.2)	2,331 (62.2)	2,174 (56.8)	2,812 (73.4)	1,674 (42.4)
Northern	6,400 (41.8)	1,416 (37.8)	1,656 (43.2)	1,017 (26.6)	2,274 (57.6)
Smoking [*n* (%)]					
Yes	4,813 (31.4)	1,083 (28.9)	1,555 (40.6)	1,257 (32.8)	1,146 (29.0)
No	10,505 (68.6)	2,664 (71.1)	2,275 (59.4)	2,572 (67.2)	2,802 (71.0)
Drinking alcohol [*n* (%)]					
Yes	5,600 (36.6)	1,303 (34.8)	1,488 (38.9)	1,386 (36.2)	1,408 (35.7)
No	9,718 (63.4)	2,444 (65.2)	2,342 (61.1)	2,443 (63.8)	2,540 (64.3)
Physical activity status [*n* (%)][b]					
Low	5,053 (33.0)	1,382 (36.9)	1,128 (29.4)	1,210 (31.6)	1,370 (34.7)
Medium	5,158 (33.7)	1,435 (38.3)	1,141 (29.8)	1,300 (34.0)	1,350 (34.2)
High	5,107 (33.3)	930 (24.8)	1,561 (40.8)	1,319 (34.4)	1,228 (31.1)
WISH	58.6 (50.0, 66.8)	43.2 (39.4, 46.7)	72.4 (70.0, 77.5)	50.8 (43.2, 60.0)	63.2 (55.1, 71.4)
PHDI	51.9 (44.4, 60.0)	46.3 (40.0, 54.1)	56.8 (50.0, 63.9)	40.0 (35.7, 42.4)	65.1 (62.0, 70.0)

Note: BMI, body mass index; CMD, cardiometabolic disease; DBP, diastolic blood pressure; MET-h/wk, metabolic equivalent-hours/week; PHDI, Planetary Health Diet Index; Q, quartiles; SBP, systolic blood pressure; SD, standard deviation; WISH, World Index for Sustainability and Health.
[a]Continuous variables were presented as mean ± SD or median (P25, P75), and the categorical variables were presented as *n* (%).
[b]The categories for physical activity status are determined by the tertiles of the accumulated average MET-h/wk. The "Low" category includes participants with MET-h/wk values in the lowest tertile, the "Medium" category includes those in the middle tertile, and the "High" category includes those in the highest tertile.

Table 3. Baseline daily intakes of nutrients and food groups of 14,652 Chinese adults in cohort A who participated in the China Health and Nutrition Survey 1997–2015 wave and were included in the analysis with risk of CMDs as outcomes, based on quartiles of EAT-Lancet reference diet indices.

		Quartiles of WISH			Quartiles of PHDI		
Variables	All	Q1	Q4	*p*-Value[a]	Q1	Q4	*p*-Value[a]
Total energy (kcal)	2,219.8 ± 735.8	2,109.1 ± 761.4	2,326.6 ± 676.6	<0.0001	2,220.5 ± 761.3	2,213.9 ± 722.0	<0.0001
Carbohydrate (%E)	56.2 ± 13.4	54.9 ± 12.9	55.7 ± 12.7	<0.0001	54.6 ± 12.8	57.6 ± 13.8	<0.0001
Protein (%E)	12.3 ± 3.0	12.1 ± 3.1	12.4 ± 2.9	0.0002	11.7 ± 3.0	13.1 ± 2.9	<0.0001
Fat (%E)	29.7 ± 12.8	31.3 ± 12.9	30.0 ± 11.6	<0.0001	32.1 ± 12.7	27.3 ± 12.7	<0.0001
Dietary fiber (g)	11.7 ± 8.8	9.9 ± 9.4	13.3 ± 8.7	<0.0001	9.3 ± 7.9	14.7 ± 9.0	<0.0001
Na (mg)	5,645.1 ± 16,455.1	5,614.9 ± 15,543.5	5,489.5 ± 5,193.1	<0.0001	5,869.1 ± 14,985.3	5,268.3 ± 5,510.0	0.0004
K (mg)	1,658.7 ± 850.4	1,446.2 ± 688.8	1,858.0 ± 789.7	<0.0001	1,481.0 ± 665.1	1,847.3 ± 863.3	0.11
Na:K ratio	3.7 ± 8.6	4.3 ± 12.3	3.2 ± 2.5	<0.0001	4.3 ± 11.8	3.1 ± 3.1	<0.0001
Grains (g)	425.3 ± 165.7	392.7 ± 152.9	443.9 ± 167.4	<0.0001	407.5 ± 150.9	443.0 ± 181.3	<0.0001
Whole grains (g)	19.6 ± 57.7	13.3 ± 44.3	22.4 ± 70.6	<0.0001	6.8 ± 29.0	32.8 ± 80.3	<0.0001
Vegetables (g)	265.3 ± 145.8	211.5 ± 123.2	317.5 ± 145.9	<0.0001	256.2 ± 146.9	266.7 ± 141.9	0.0010
Fruits (g)	26.6 ± 71.0	14.7 ± 47.0	46.3 ± 97.4	<0.0001	6.1 ± 32.0	54.4 ± 97.3	<0.0001
Dairy foods (g)	14.8 ± 53.7	6.7 ± 36.4	27.0 ± 71.8	<0.0001	5.0 ± 31.1	27.9 ± 68.7	<0.0001
Red meat (g)	66.3 ± 68.9	78.5 ± 64.4	54.6 ± 67.8	<0.0001	81.5 ± 65.1	50.2 ± 65.6	<0.0001
Poultry (g)	10.3 ± 25.4	15.1 ± 33.3	7.1 ± 18.8	<0.0001	19.1 ± 33.4	5.0 ± 16.7	<0.0001
Eggs (g)	23.2 ± 31.4	31.9 ± 32.9	16.1 ± 26.9	<0.0001	20.1 ± 29.9	26.5 ± 31.2	<0.0001
Fish (g)	19.1 ± 34.2	11.5 ± 31.0	28.7 ± 35.4	<0.0001	20.3 ± 36.9	18.6 ± 34.9	<0.0001
Legumes (g)	49.0 ± 67.5	28.3 ± 47.6	72.8 ± 81.6	<0.0001	25.9 ± 45.0	72.1 ± 79.6	<0.0001
Nuts (g)	3.2 ± 12.3	1.7 ± 9.4	5.4 ± 14.8	<0.0001	0.5 ± 4.2	7.8 ± 19.1	<0.0001
Unsaturated oils (g)	31.8 ± 29.1	22.2 ± 30.0	41.8 ± 22.9	<0.0001	23.2 ± 33.4	36.9 ± 20.9	<0.0001
Saturated oils (g)	6.8 ± 18.8	15.2 ± 26.2	1.0 ± 6.2	<0.0001	18.0 ± 27.6	0.7 ± 4.6	<0.0001
Added sugars (g)	1.0 ± 5.1	0.9 ± 5.7	1.2 ± 4.9	<0.0001	1.1 ± 4.9	1.1 ± 5.9	<0.0001

Note: Continuous variables were presented as mean ± SD. CMD, cardiometabolic disease; E, energy; K, potassium; Na, sodium; PHDI, Planetary Health Diet Index; Q, quartiles; SD, standard deviation; WISH, World Index for Sustainability and Health.
[a]Kruskal–Wallis rank-sum analysis was used to test significant differences across different quartiles of EAT-Lancet reference diet indices.

Table 4. Associations between EAT-Lancet reference diet indices and risk of MI, T2DM, stroke ($n = 14,652$), and all-cause mortality ($n = 15,318$) in Chinese adults who participated in the China Health and Nutrition Survey 1997–2015 wave.

Variables	Quartiles Q1	Q2	Q3	Q4	*p*-Trend
World Index for Sustainability and Health					
MI					
Number	3,663	3,663	3,663	3,663	—
Median (range)	53.0 (20.0, 58.7)	62.3 (58.8, 66.3)	70.0 (66.3, 74.0)	79.1 (74.0, 108.5)	—
Cases [rate (%)][a]	79 (2.16)	67 (1.83)	68 (1.86)	66 (1.80)	—
Person-years	33,155	36,045	38,056	39,927	—
Model 1[b]	1.00 (Ref)	0.78 (0.56–1.08)	0.84 (0.60–1.16)	0.78 (0.56–1.08)	0.17
Model 2[c]	1.00 (Ref)	0.69 (0.50–0.96)	0.70 (0.50–0.98)	0.68 (0.48–0.96)	0.0365
T2DM					
Number	3,663	3,663	3,663	3,663	—
Median (range)	53.0 (20.0, 58.7)	62.2 (58.7, 66.2)	70.0 (66.2, 73.9)	79.1 (73.9, 108.5)	—
Cases [rate (%)][a]	263 (7.18)	267 (7.29)	254 (6.93)	267 (7.29)	—
Person-years	32,478	35,187	37,084	39,099	—
Model 1[b]	1.00 (Ref)	0.93 (0.78–1.10)	0.87 (0.74–1.04)	0.86 (0.72–1.02)	0.07
Model 2[c]	1.00 (Ref)	0.88 (0.74–1.04)	0.78 (0.66–0.94)	0.81 (0.67–0.96)	0.0103
Stroke[d]					
Number	3,663	3,663	3,663	3,663	—
Median (range)	53.0 (20.0, 58.7)	62.3 (58.7, 66.3)	70.0 (66.3, 74.0)	79.1 (74.0, 108.5)	—
Cases [rate (%)][a]	105 (2.87)	98 (2.68)	95 (2.59)	106 (2.89)	—
Person-years	33,122	35,932	38,052	39,876	—
Model 1[b]	1.00 (Ref)	0.85 (0.65–1.12)	0.86 (0.65–1.13)	0.91 (0.69–1.19)	0.52
Model 2[c]	1.00 (Ref)	0.81 (0.61–1.07)	0.75 (0.57–1.01)	0.87 (0.65–1.16)	0.33
All-cause mortality					
Number	3,830	3,798	3,860	3,830	—
Median (range)	51.0 (20.0, 56.8)	60.6 (56.8, 64.4)	68.4 (64.4, 72.2)	77.6 (72.2, 108.5)	—
Cases [rate (%)][a]	382 (9.97)	361 (9.51)	344 (8.91)	256 (6.68)	—
Person-years	35,141	38,277	39,698	41,369	—
Model 1[b]	1.00 (Ref)	0.88 (0.77–1.02)	0.91 (0.79–1.06)	0.71 (0.60–0.83)	<0.0001
Model 2[c]	1.00 (Ref)	0.94 (0.81–1.08)	1.02 (0.88–1.19)	0.80 (0.68–0.95)	0.0377
Planetary Health Diet Index					
MI					
Number	3,663	3,663	3,663	3,663	—
Median (range)	42.7 (13.3, 47.7)	51.6 (47.7, 54.9)	58.6 (54.9, 62.8)	68.3 (62.8, 100.5)	—
Cases [rate (%)][a]	72 (1.97)	74 (2.02)	68 (1.86)	66 (1.80)	—
Person-years	33,628	37,828	38,582	37,145	—
Model 1[b]	1.00 (Ref)	0.61 (0.42–0.88)	0.35 (0.21–0.59)	0.23 (0.11–0.49)	<0.0001
Model 2[c]	1.00 (Ref)	0.53 (0.36–0.76)	0.26 (0.16–0.45)	0.14 (0.07–0.29)	<0.0001
T2DM					
Number	3,663	3,663	3,663	3,663	—
Median (range)	42.6 (13.3, 47.6)	51.5 (47.6, 54.7)	58.4 (54.7, 62.7)	68.2 (62.7, 100.5)	—
Cases [rate (%)][a]	244 (6.66)	290 (7.92)	260 (7.10)	257 (7.02)	—
Person-years	33,067	37,015	37,612	36,155	—
Model 1[b]	1.00 (Ref)	1.00 (0.85–1.19)	0.86 (0.73–1.03)	0.89 (0.75–1.06)	0.09
Model 2[c]	1.00 (Ref)	0.94 (0.79–1.12)	0.72 (0.60–0.86)	0.68 (0.57–0.82)	<0.0001
Stroke [d]					
Number	3,663	3,663	3,663	3,663	—
Median (range)	42.7 (13.3, 47.7)	51.6 (47.7, 54.9)	58.6 (54.9, 62.7)	68.3 (62.7, 100.5)	—
Cases [rate (%)][a]	86 (2.35)	97 (2.65)	117 (3.19)	104 (2.84)	—
Person-years	33,641	37,826	38,488	37,027	—
Model 1[b]	1.00 (Ref)	0.95 (0.71–1.28)	1.13 (0.86–1.49)	1.05 (0.79–1.40)	0.51
Model 2[c]	1.00 (Ref)	0.88 (0.66–1.18)	0.98 (0.73–1.30)	0.82 (0.60–1.10)	0.28
All-cause mortality					
Number	3,830	3,829	3,830	3,829	—
Median (range)	42.9 (13.3, 47.9)	51.8 (47.9, 55.1)	58.8 (55.1, 63.0)	68.7 (63.0, 100.5)	—
Cases [rate (%)][a]	380 (9.92)	363 (9.48)	319 (8.33)	281 (7.34)	—
Person-years	35,443	40,052	40,405	38,585	—
Model 1[b]	1.00 (Ref)	0.73 (0.62–0.86)	0.59 (0.47–0.72)	0.48 (0.37–0.64)	<0.0001
Model 2[c]	1.00 (Ref)	0.77 (0.66–0.91)	0.69 (0.56–0.85)	0.60 (0.46–0.80)	0.0004

Note: Data were presented as HR (95% CI) estimated by Cox proportional hazard regression models. The data of model 2 for each outcome were presented in Figure 1. —, no data; BMI, body mass index; CI, confidence interval; HR, hazard ratio; MI, myocardial infarction; Q, quartiles; Ref, reference; T2DM, type 2 diabetes mellitus.
[a]Rate was calculated using the number of cases of new-onset CMDs or deaths divided by the number of participants in each quartile.
[b]Model 1 adjusted for sex and age.
[c]Model 2 further adjusted for BMI, region, urbanization index, educational level, physical activity, baseline hypertension, smoking status, alcohol intake, and total energy intake.
[d]Model 2 for stroke also adjusted for the sodium:potassium ratio.

(Figure 2A; Table S6). There was an inverse association between WISH and risk of MI in male participants (Q4 vs. Q1: HR = 0.34; 95% CI: 0.20, 0.59; *p*-trend = 0.0002) rather than in female participants (Q4 vs. Q1: HR = 1.19; 95% CI: 0.75, 1.90; *p*-trend = 0.49) (Figure 2A; Table S6). There was no evidence of effect modifications of the associations between WISH with risk of T2DM, stroke, and all-cause mortality by age, sex, BMI, or baseline hypertension (all *p*-interaction >0.05) (Figure 2A; Table S6).

There were significant effect modifications of the associations between PHDI and risk of T2DM by sex (*p*-interaction = 0.0273)

Table 5. Associations between EAT-Lancet reference diet indices and GHG emissions in Chinese adults who participated in the China Health and Nutrition Survey 1997–2015 wave.

Variables	Quartiles				*p*-Trend
	Q1	Q2	Q3	Q4	
World Index for Sustainability and Health					
GHG emissions in MI outcome (gCO_{2e})					
Model 1[a]	4,745.86 (4,669.80–4,823.17)	4,536.38 (4,464.01–4,609.93)	4,430.68 (4,358.80–4,503.74)	4,479.64 (4,407.61–4,552.86)	<0.0001
Model 2[b]	5,049.34 (4,973.17–5,126.68)	4,775.50 (4,705.68–4,846.35)	4,537.40 (4,470.52–4,605.27)	4,253.91 (4,191.21–4,317.56)	<0.0001
GHG emissions in T2DM outcome (gCO_{2e})					
Model 1[a]	4,754.75 (4,678.23–4,832.52)	4,535.24 (4,462.42–4,609.24)	4,435.18 (4,362.99–4,508.56)	4,470.98 (4,398.58–4,544.57)	<0.0001
Model 2[b]	5,056.76 (4,980.25–5,134.45)	4,774.18 (4,704.08–4,845.31)	4,532.86 (4,465.89–4,600.83)	4,251.57 (4,188.68–4,315.40)	<0.0001
GHG emissions in stroke outcome (gCO_{2e})					
Model 1[a]	4,740.51 (4,664.57–4,817.69)	4,532.84 (4,460.40–4,606.45)	4,432.71 (4,360.83–4,505.77)	4,477.02 (4,404.99–4,550.23)	<0.0001
Model 2[b]	5,043.13 (4,967.24–5,120.18)	4,774.62 (4,704.91–4,845.37)	4,536.74 (4,470.00–4,604.48)	4,253.00 (4,190.49–4,316.46)	<0.0001
GHG emissions in all-cause mortality outcome (gCO_{2e})					
Model 1[a]	9,921.54 (9,742.13–10,104.26)	9,389.74 (9,223.91–9,558.56)	9,323.56 (9,158.84–9,491.24)	8,789.36 (8,634.99–8,946.48)	<0.0001
Model 2[b]	9,864.10 (9,696.25–10,034.87)	9,364.35 (9,208.23–9,523.12)	8,962.05 (8,813.89–9,112.71)	8,381.39 (8,242.96–8,522.14)	<0.0001
Planetary Health Diet Index					
GHG emissions in MI outcome (gCO_{2e})					
Model 1[a]	3,782.81 (3,695.69–3,870.94)	3,265.69 (3,184.62–3,347.78)	3,184.06 (3,104.78–3,264.34)	3,064.02 (2,986.98–3,142.04)	<0.0001
Model 2[b]	3,749.66 (3,665.52–3,834.75)	3,360.40 (3,282.29–3,439.42)	3,243.71 (3,168.93–3,319.36)	3,116.87 (3,043.85–3,190.74)	<0.0001
GHG emissions in T2DM outcome (gCO_{2e})					
Model 1[a]	3,789.71 (3,702.07–3,878.38)	3,277.56 (3,196.01–3,360.14)	3,192.67 (3,112.88–3,273.47)	3,047.50 (2,970.27–3,125.72)	<0.0001
Model 2[b]	3,764.41 (3,679.77–3,850.02)	3,366.05 (3,287.56–3,445.48)	3,242.42 (3,167.46–3,318.27)	3,101.14 (3,028.02–3,175.12)	<0.0001
GHG emissions in stroke outcome (gCO_{2e})					
Model 1[a]	3,771.30 (3,684.37–3,859.23)	3,284.02 (3,202.73–3,366.33)	3,183.33 (3,104.11–3,263.55)	3,050.49 (2,973.56–3,128.40)	<0.0001
Model 2[b]	3,746.12 (3,662.22–3,830.97)	3,371.66 (3,293.65–3,450.58)	3,239.49 (3,164.99–3,314.86)	3,105.26 (3,032.55–3,178.84)	<0.0001
GHG emissions in all-cause mortality outcome (gCO_{2e})					
Model 1[a]	3,801.93 (3,717.50–3,887.32)	3,320.85 (3,241.95–3,400.70)	3,208.63 (3,131.85–3,286.35)	3,138.79 (3,063.91–3,214.57)	<0.0001
Model 2[b]	3,766.63 (3,681.22–3,853.02)	3,397.01 (3,317.59–3,477.36)	3,255.84 (3,180.33–3,332.24)	3,168.58 (3,094.25–3,243.79)	<0.0001

Note: Data were presented as least-squares means (95% CL) estimated by multiple linear regression models. $n = 14,652$ for cohort A with cardiometabolic diseases as primary outcomes, and $n = 15,318$ for cohort B with all-cause mortality as the primary outcome. The data of model 2 for GHG emissions in each outcome were presented in Figure 1. BMI, body mass index; CL, confidence level; gCO_{2e}, grams CO_2 equivalents; GHG, greenhouse gas; MI, myocardial infarction; Q, quartiles; T2DM, type 2 diabetes mellitus.
[a]Model 1 adjusted for sex and age.
[b]Model 2 further adjusted for BMI, region, urbanization index, educational level, physical activity, baseline hypertension, smoking status, alcohol intake, and total energy intake.

and baseline hypertension (*p*-interaction = 0.0198), respectively (Figure 2B; Table S6). There was an inverse association between PHDI and risk of T2DM in female participants (Q4 vs. Q1: HR = 0.68; 95% CI: 0.52, 0.88; *p*-trend = 0.0019), while there was a potential U-shaped association in male participants with Q3 demonstrating a significant reduced risk of T2DM (Q3 vs. Q1: HR = 0.59; 95% CI: 0.46, 0.77; *p*-trend = 0.0009) (Figure 2B; Table S6). The inverse association between PHDI and risk of T2DM was relatively stronger in participants with hypertension at baseline (Q4 vs. Q1: HR = 0.50; 95% CI: 0.37, 0.69; *p*-trend <0.0001) than those without hypertension at baseline (Q4 vs. Q1: HR = 0.80; 95% CI: 0.64, 1.00; *p*-trend = 0.0130) (Figure 2B; Table S6). Similarly, there were significant effect modifications of the associations between PHDI and risk of all-cause mortality by sex (*p*-interaction = 0.0132) (Figure 2B; Table S6). There was an inverse association between PHDI and risk of all-cause mortality in female participants (Q4 vs. Q1: HR = 0.50; 95% CI: 0.33, 0.75; *p*-trend = 0.0005) rather than in male participants (Q4 vs. Q1: HR = 0.76; 95% CI: 0.51, 1.13; *p*-trend = 0.16) (Figure 2B; Table S6). There was no evidence of effect modifications of the associations between PHDI with risk of MI and stroke by age, sex, BMI, or baseline hypertension (all *p*-interaction >0.05) (Figure 2B; Table S6).

The sensitivity analyses excluding cases of CMDs and deaths within the first 2 years of follow-up demonstrated similar results to the main analyses (Table 6). The sensitivity analyses for the associations between adherence to EAT-Lancet reference diet with risk of all-cause mortality excluding participants with CMDs and cancer at baseline also demonstrated similar results to the main analyses, except for WISH (Table S7).

Discussion

The current study demonstrated associations between greater adherence to the EAT-Lancet reference diet, as represented by higher WISH or PHDI scores, and reduced risk of MI, T2DM, and all-cause mortality, which partially supported our hypothesis. None of the two indices was significantly associated with risk of stroke. In terms of environmental sustainability, higher WISH and PHDI scores were associated with lower GHG emissions. To the best of our knowledge, the current study provided the first and most comprehensive documentation of long-term prospective inverse associations between adherence to the sustainable EAT-Lancet reference diet, as assessed by WISH or PHDI, and risk of MI, T2DM, and all-cause mortality and GHG emissions in Chinese adults, highlighting the co-benefits of this reference diet for cardiometabolic health and environmental sustainability.

In the current study, higher WISH and PHDI scores were associated with a reduced risk of MI and T2DM. These findings corroborated our hypothesis and were consistent with several studies reported previously.[15,19,20] Participants with higher WISH and PHDI scores consumed more vegetables, fruits, and unsaturated oils compared to those with lower scores, and these food groups have been reported to be inversely associated with risk of MI[66] and T2DM.[67] This may be attributed to their enrichment in polyphenolic compounds[68] and favorable effects on improving cardiometabolic risk factors.[66] A recent study by our group has demonstrated that higher WISH and PHDI scores are associated with lower inflammatory potential of diet,[55] potentially elucidating the inverse associations between adherence to the EAT-Lancet reference diet and risk of MI and T2DM. In accordance with our results, participants with greater adherence to the EAT-Lancet reference diet typically consumed more recommended food groups from high-quality dietary patterns such as the Mediterranean and Dietary Approaches to Stop Hypertension (DASH) diets, which relate to lower risk of MI and T2DM.[69,70]

To our knowledge, we provided the first documentation that greater adherence to the EAT-Lancet reference diet, as reflected

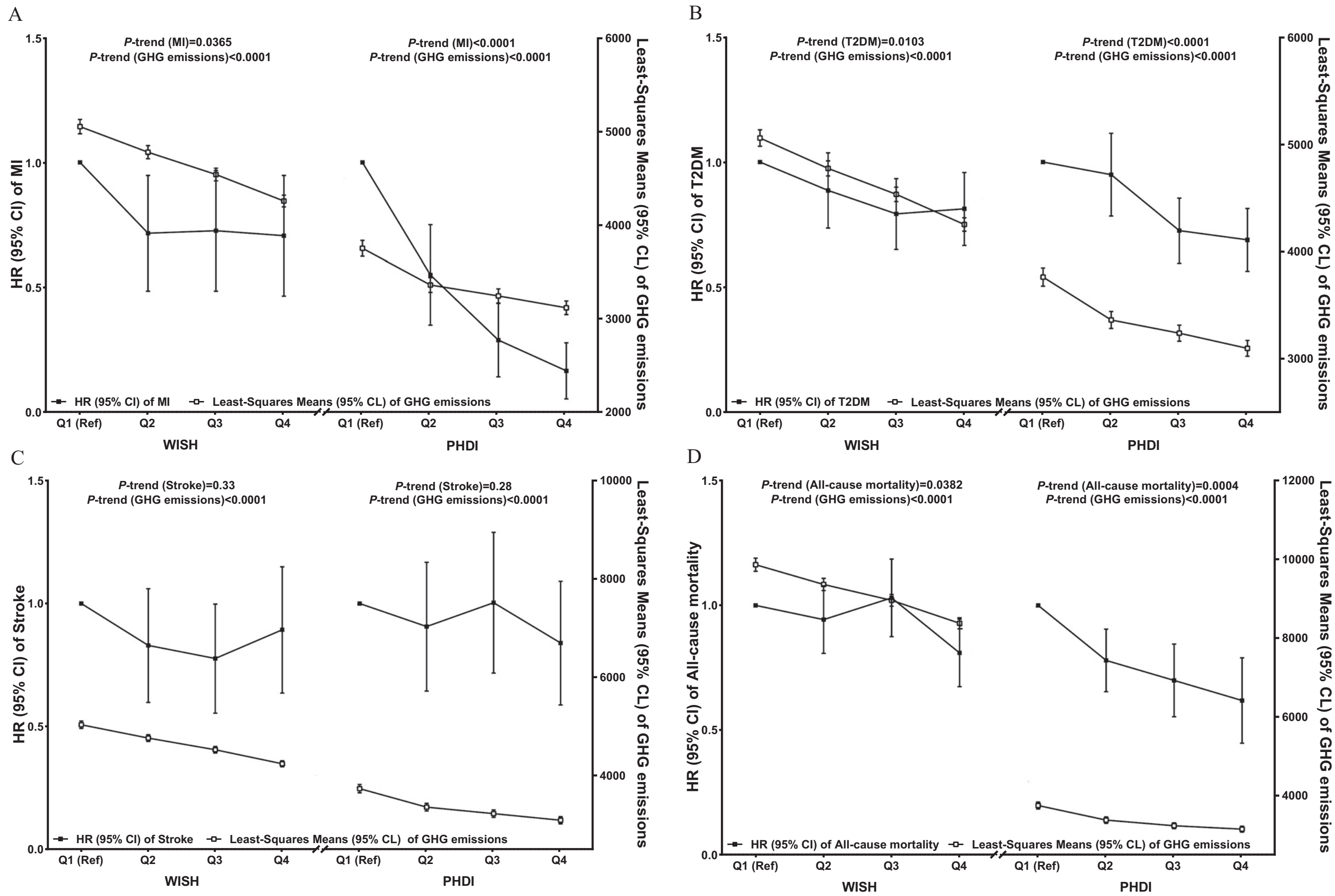

Figure 1. Associations between EAT-Lancet reference diet indices with GHG emissions and risk of MI, T2DM, stroke ($n = 14{,}652$), and all-cause mortality ($n = 15{,}318$) in Chinese adults who participated in the China Health and Nutrition Survey 1997–2015 wave. The corresponding numerical data are listed in Tables 4 and 5. Data for MI (A), T2DM (B), stroke (C), and all-cause mortality (D) were presented as HR (95% CI) estimated by Cox proportional hazard regression models. Model adjusted for sex, age, BMI, region, urbanization index, educational level, physical activity, baseline hypertension, smoking status, alcohol intake, and total energy intake. Model for stroke also adjusted for the sodium:potassium ratio. Data for GHG emissions were presented as least-squares means (95% CL) estimated by multiple linear regression models and models adjusted for same confounding factors as in Cox proportional hazard regression models. $n = 14{,}652$ for cohort A with cardiometabolic diseases as primary outcomes, and $n = 15{,}318$ for cohort B with all-cause mortality as the primary outcome. Note: BMI, body mass index; CI, confidence interval; CL, confidence level; GHG, greenhouse gas; HR, hazard ratio; MI, myocardial infarction; PHDI, Planetary Health Diet Index; Q, quartiles; Ref, reference; T2DM, type 2 diabetes mellitus; WISH, World Index for Sustainability and Health.

by higher WISH or PHDI scores, was not significantly associated with risk of stroke. Higher WISH and PHDI scores were inversely associated with risk of all-cause mortality, and these findings were in line with prior studies.[15,21] The current study utilized the initial computation methods for PHDI, which incorporate caloric densities from food groups in its computation, whereas WISH only accounts for specific quantities consumed. The initial method for PHDI minimized the impact of interindividual variations in total energy intakes. Recently other studies have proposed several different computation methods for PHDI,[29–32] which utilized a combination of recommended intake levels and energy intake ratios as scoring criteria. In accordance with the current study, these studies have also reported inverse associations between PHDI scores and risk of all-cause mortality.[29,30]

Sex significantly modified the associations between WISH with risk of MI and PHDI with risk of T2DM and all-cause mortality. An inverse association between WISH and risk of MI was only observed in male participants, while the inverse association between PHDI and risk of all-cause mortality was only observed in female participants. The reason for these sex-specific differences and whether sex hormones play important roles warrants further investigation. We have noticed the situations of significant effect modifications with similar HR (95% CI) values with CI overlaps and nonsignificant effect modifications with different HR (95% CI) values in stratified groups, which were also not uncommon in previous studies.[71,72] In the interaction analysis, the overall sample size was adequate and the statistical power was high, which allowed detection of significant interaction even if the difference between point estimates of the two subgroups was small. However, in the stratified analysis, the sample size of each subgroup decreased after stratification, resulting in lower statistical power of stratified analysis and wider CIs for HR estimation, which may lead to CI overlaps and mask the differences between subgroups.

In the current study, adherence to the EAT-Lancet reference diet, as assessed by WISH or PHDI, was associated with lower GHG emissions, underscoring the beneficial impacts of this diet on environmental sustainability in China. These findings align with previous studies conducted in developed countries or at global levels.[13,16,28–30,32,73] Combined with the results of health outcomes, we for the first time demonstrated that greater adherence to the EAT-Lancet reference diet, as assessed by higher WISH or PHDI scores, potentially offer co-benefits on cardiometabolic and environmental health among Chinese adults.

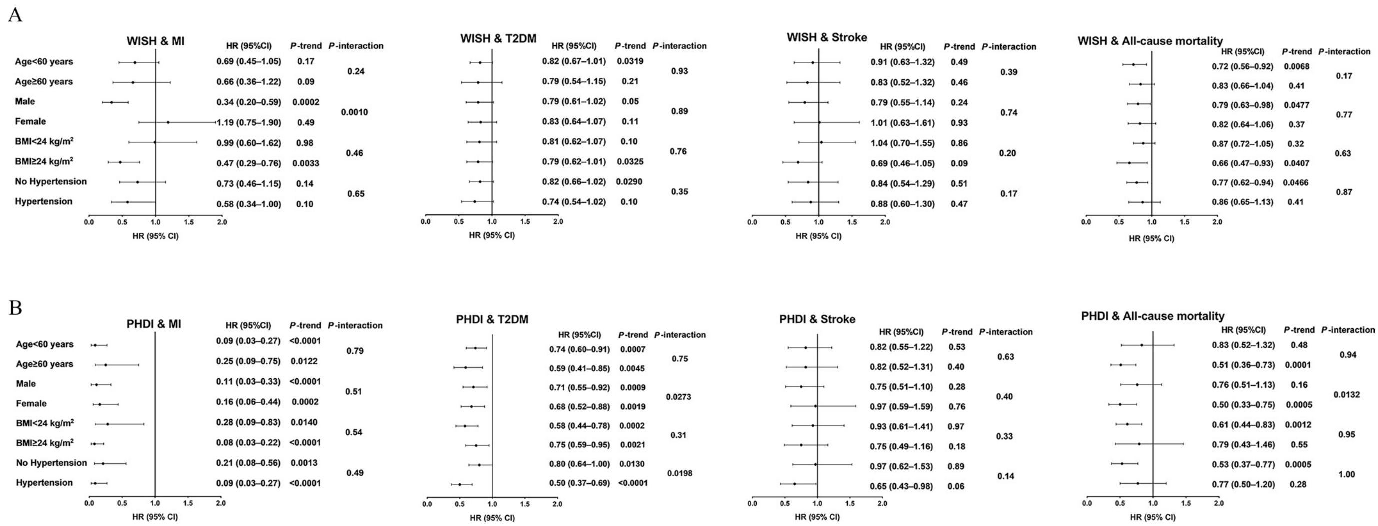

Figure 2. Associations between EAT-Lancet reference diet indices and risk of MI, T2DM, stroke ($n = 14{,}652$), and all-cause mortality ($n = 15{,}318$) in Chinese adults who participated in the China Health and Nutrition Survey 1997–2015 wave, stratified by age, sex, BMI, and baseline hypertension history. Data were presented as HR (95% CI) estimated by Cox proportional hazard regression models. The corresponding numerical data were listed in Table S6. Models adjusted for sex, age, BMI, region, urbanization index, education level, physical activity, baseline hypertension, smoking status, alcohol intake, and total energy intake. Model for stroke also adjusted for the sodium:potassium ratio. Stratification variables were not adjusted as confounding factors in the corresponding models. Note: BMI, body mass index; CI, confidence interval; HR, hazard ratio; MI, myocardial infarction; PHDI, Planetary Health Diet Index; T2DM, type 2 diabetes mellitus; WISH, World Index for Sustainability and Health.

However, the environmental outcome of this study was confined to GHG emissions, and the exploration of other environmental aspects such as land and water resources requires further explorations.

Based on the WISH and PHDI scores in the current study, the adherence to the EAT-Lancet reference diet of most participants was low, indicating possible challenges in acceptability, applicability, and affordability in recommending this sustainable diet among the Chinese population. To improve adherence to the EAT-Lancet reference diet, individuals were recommended to increase intakes of fruits, legumes, dairy products, and nuts and reduce intakes of eggs and red meat (including processed meat) based on the current study. The government is responsible for increasing public awareness and understanding of sustainable diet, such as the EAT-Lancet reference diet, through a variety of strategies such as social media and public service announcements, to highlight the advantages of a sustainable diet in promoting population health and environmental sustainability. The heterogeneity in dietary patterns, eating habits, health status, and environmental issues is large across different regions in China.[74] To improve the acceptability of the EAT-Lancet reference diet, it is necessary to develop a regionally tailored EAT-Lancet reference diet that aligns with local dietary preferences. A recent study has developed region-specific diets[74] with both environmental sustainability and health benefits on the basis of the EAT-Lancet reference diet. This study indicates a promise of applying region-specific EAT-Lancet reference diets among Chinese adults. Interventional studies are required to assess the applicability of the regional tailored diet among Chinese adults and explore the contributing factors and barrier factors that may influence the applicability. To improve the health and sustainability of Chinese diets, it is also recommended that the government formulate specific and strong policies, such as incorporation of regionally tailored EAT-Lancet reference diet into dietary guidelines. In terms of affordability, a recent analysis with the CHNS study from wave 1997 to 2015 has reported that higher adherence to the EAT-Lancet reference diet is associated with an increase in diet costs of 3.3% (95% CI: 2.8, 3.8) in Chinese adults.[33] The level of economic development varies greatly among different regions in China. To improve affordability of this diet, the government should make food pricing policies in accordance with economic levels at different regions and optimize the layout of food markets to encourage people in different regions to consume the healthy and sustainable EAT-Lancet reference diet at a reasonable price.

The current study has several strengths. Adherence to the EAT-Lancet reference diet was assessed using two indices with different computation methods, which enables thorough comparisons and validations of these indices in Chinese adults. This study represents a pioneering investigation of the prospective associations between adherence to the EAT-Lancet reference diet, as assessed by WISH and PHDI, with the risk of CMDs and all-cause mortality in healthy adults free from CMDs at baseline which, to our knowledge, is a topic not previously examined in any population. The study explored the dual benefits of adherence to the EAT-Lancet reference diet by investigating its relationships with GHG emissions and health outcomes. The CHNS cohort employed stringent quality controls for laboratory examinations and questionnaire data collection. To ensure the accuracy and reliability of dietary intake data, 3-day consecutive 24-h dietary recall records at the individual level were implemented together with a household level food weighing method. In addition, the study also conducted multiple sensitivity analyses, enhancing the reliability of results.

Several limitations of this study should be acknowledged. The scoring criteria for WISH did not account for the interindividual variations in total energy intakes and contribution of each food group to total energy intakes. Collections of food intake data with the use of 3-day consecutive 24-h dietary recall records may not represent long-term dietary habits accurately. However, this limitation was partially overcome by computing WISH and PHDI based on cumulative average intakes of food groups in order to provide a better representation of long-term dietary habits. The information on dietary intakes of participants before entry into the cohort was not adjusted for in the analysis. The data on amount of GHG emissions per gram of different types of foods were collected from previous life cycle assessment (LCA) studies.[46] Due to uncertainties in data quality, system boundary selection and assumptions in LCA studies, and nonuniform

Table 6. Associations between EAT-Lancet reference diet indices and risk of MI, T2DM, stroke, and all-cause mortality in sensitivity analysis excluding participants who were diagnosed with MI, T2DM, stroke, or died during the first 2 years of follow-up.

Variables	Quartiles				p-Trend
	Q1	Q2	Q3	Q4	
World Index for Sustainability and Health					
MI ($n = 14{,}644$)					
Number	3,661	3,661	3,661	3,661	—
Number (excluded MI cases)	2	2	2	2	—
Median (range)	53.1 (20.0, 58.7)	62.3 (58.8, 66.3)	70.0 (66.3, 74.0)	79.1 (74.0, 108.5)	—
Cases [rate (%)][a]	77 (2.10)	66 (1.80)	65 (1.78)	64 (1.75)	—
Person-years	33,151	36,039	38,054	39,923	—
Model 1[b]	1.00 (Ref)	0.79 (0.57–1.10)	0.82 (0.59–1.14)	0.77 (0.55–1.08)	0.16
Model 2[c]	1.00 (Ref)	0.70 (0.50–0.98)	0.69 (0.49–0.97)	0.67 (0.47–0.96)	0.0338
T2DM ($n = 14{,}639$)					
Number	3,660	3,660	3,660	3,659	—
Number (excluded T2DM cases)	3	3	3	4	—
Median (range)	53.0 (20.0, 58.7)	62.2 (58.7, 66.2)	70.0 (66.2, 73.9)	79.1 (73.9, 108.5)	—
Cases [rate (%)][a]	260 (7.10)	264 (7.21)	250 (6.83)	264 (7.22)	—
Person-years	32,473	35,181	37,095	39,076	—
Model 1[b]	1.00 (Ref)	0.93 (0.78–1.10)	0.87 (0.73–1.03)	0.86 (0.72–1.02)	0.06
Model 2[c]	1.00 (Ref)	0.88 (0.74–1.04)	0.78 (0.65–0.93)	0.80 (0.67–0.96)	0.0095
Stroke ($n = 14{,}642$)[d]					
Number	3,660	3,661	3,661	3,660	—
Number (excluded stroke cases)	3	2	2	3	—
Median (range)	53.0 (20.0, 58.7)	62.3 (58.7, 66.3)	70.0 (66.3, 74.0)	79.1 (74.0, 108.5)	—
Cases [rate (%)][a]	103 (2.81)	96 (2.62)	92 (2.51)	103 (2.81)	—
Person-years	33,112	35,919	38,062	39,870	—
Model 1[b]	1.00 (Ref)	0.85 (0.64–1.12)	0.84 (0.63–1.11)	0.89 (0.68–1.18)	0.44
Model 2[c]	1.00 (Ref)	0.80 (0.60–1.06)	0.74 (0.55–0.99)	0.86 (0.64–1.15)	0.29
All-cause mortality ($n = 15{,}293$)					
Number	3,823	3,794	3,853	3,823	—
Number (excluded death cases)	7	3	7	7	—
Median (range)	51.0 (20.0, 56.8)	60.6 (56.8, 64.4)	68.4 (64.4, 72.2)	77.6 (72.2, 108.5)	—
Cases [rate (%)][a]	378 (9.89)	354 (9.33)	337 (8.75)	249 (6.51)	—
Person-years	35,097	38,311	39,690	41,361	—
Model 1[b]	1.00 (Ref)	0.87 (0.75–1.01)	0.90 (0.78–1.04)	0.69 (0.59–0.81)	<0.0001
Model 2[c]	1.00 (Ref)	0.92 (0.80–1.07)	1.01 (0.87–1.18)	0.79 (0.67–0.94)	0.0306
Planetary Health Diet Index					
MI ($n = 14{,}644$)					
Number	3,661	3,661	3,661	3,661	—
Number (excluded MI cases)	2	2	2	2	—
Median (range)	42.7 (13.3, 47.7)	51.6 (47.7, 54.9)	58.6 (54.9, 62.8)	68.3 (62.8, 100.5)	—
Cases [rate (%)][a]	69 (1.88)	73 (1.99)	66 (1.80)	64 (1.75)	—
Person-years	33,631	37,817	38,578	37,141	—
Model 1[b]	1.00 (Ref)	0.61 (0.42–0.89)	0.33 (0.19–0.57)	0.21 (0.10–0.46)	<0.0001
Model 2[c]	1.00 (Ref)	0.53 (0.36–0.77)	0.25 (0.14–0.43)	0.13 (0.06–0.28)	<0.0001
T2DM ($n = 14{,}639$)					
Number	3,659	3,661	3,659	3,660	—
Number (excluded T2DM cases)	4	2	4	3	—
Median (range)	42.6 (13.3, 47.7)	51.5 (47.7, 54.7)	58.4 (54.7, 62.7)	68.2 (62.7, 100.5)	—
Cases [rate (%)][a]	242 (6.61)	284 (7.76)	256 (7.00)	256 (6.99)	—
Person-years	33,044	37,050	37,596	36,135	—
Model 1[b]	1.00 (Ref)	0.99 (0.83–1.17)	0.86 (0.72–1.02)	0.90 (0.75–1.07)	0.11
Model 2[c]	1.00 (Ref)	0.92 (0.78–1.10)	0.71 (0.60–0.85)	0.69 (0.58–0.83)	<0.0001
Stroke ($n = 14{,}642$)[d]					
Number	3,662	3,657	3,663	3,660	—
Number (excluded stroke cases)	1	6	0	3	—
Median (range)	42.7 (13.3, 47.7)	51.6 (47.7, 54.9)	58.6 (54.9, 62.7)	68.3 (62.7, 100.5)	—
Cases [rate (%)][a]	85 (2.32)	91 (2.49)	117 (3.19)	101 (2.76)	—
Person-years	33,639	37,815	38,488	37,021	—
Model 1[b]	1.00 (Ref)	0.90 (0.67–1.21)	1.14 (0.86–1.51)	1.03 (0.77–1.37)	0.52
Model 2[c]	1.00 (Ref)	0.83 (0.61–1.11)	0.98 (0.74–1.31)	0.80 (0.59–1.08)	0.28
All-cause mortality ($n = 15{,}293$)					
Number	3,823	3,824	3,822	3,824	—
Number (excluded death cases)	7	5	8	5	—
Median (range)	42.9 (13.3, 47.9)	51.8 (47.9, 55.1)	58.8 (55.1, 63.0)	68.7 (63.0, 100.5)	—
Cases [rate (%)][a]	372 (9.73)	357 (9.34)	310 (8.11)	279 (7.30)	—
Person-years	35,437	40,068	40,389	38,565	—
Model 1[b]	1.00 (Ref)	0.73 (0.62–0.86)	0.58 (0.47–0.72)	0.49 (0.37–0.65)	<0.0001
Model 2[c]	1.00 (Ref)	0.78 (0.66–0.92)	0.70 (0.56–0.87)	0.63 (0.47–0.84)	0.0015

Note: Data were presented as HR (95% CI) estimated by Cox proportional hazard regression models. —, no data; BMI, body mass index; CI, confidence interval; HR, hazard ratio; MI, myocardial infarction; Q, quartiles; Ref, reference; T2DM, type 2 diabetes mellitus.
[a]Rate was calculated using the number of cases of new-onset CMDs or deaths divided by the number of participants in each quartile.
[b]Model 1 adjusted for sex and age.
[c]Model 2 further adjusted for BMI, region, urbanization index, educational level, physical activity, baseline hypertension, smoking status, alcohol intake, and total energy intake.
[d]Model 2 for stroke also adjusted for the sodium:potassium ratio.

methods for modeling biocarbon, the accuracy of GHG emissions could not be guaranteed.[75] However, the methods for calculating GHG emissions were similar to several of the previous studies assessing the environmental impacts of the EAT-Lancet reference diet.[29,31,33] The confirmation of new-onset CMD cases relied on self-reported questionnaires rather than clinical diagnosis, which may lead to imprecision of case numbers. Despite a wide array of potential confounders adjusted for in our models, we could not completely rule out the possibility of other potential residual confounders, which is a limitation inherent to observational studies. In addition, the potential underlying mechanisms of the associations between adherence to the EAT-Lancet reference diet and risk of CMDs and all-cause mortality were not explored.

Conclusion

In conclusion, this study is the first, to our knowledge, to report long-term inverse associations between adherence to the sustainable EAT-Lancet reference diet, as assessed by WISH or PHDI, and risk of new-onset MI and T2DM and all-cause mortality as well as GHG emissions in Chinese adults. Our results suggested potential dual benefits of the EAT-Lancet reference diet for both cardiometabolic health and environmental sustainability, and long-term adherence to this reference diet guided by higher WISH or PHDI scores may be an effective strategy for reducing the risk and burden of CMDs and premature death in Chinese adults. Future studies should focus on exploring the causal relationships through randomized controlled trials. These findings collectively contribute new insights to the current literature highlighting the need to consider incorporating a WISH-assessed or PHDI-assessed EAT-Lancet reference diet into dietary guidelines for use as an effective tool intended to help reduce the risk of CMDs and premature death in the Chinese population.

Acknowledgments

Conceptualization and methodology, H.M. and M.W.; formal analysis, M.W., Y.L., W.L., and H.M.; validation and visualization, M.W., Y.L., and W.L.; data curation and resources, Y.L., W.L., K.L., Y.W., and Z.C.; writing–original draft, M.W., Y.L., and H.M.; writing–review and editing, H.M., M.W., and Y.L.; supervision, H.M.; project administration, H.M. and M. W.; funding acquisition, H.M.

We thank the National Institute of Nutrition and Food Safety, China Center for Disease Control and Prevention, Carolina Population Center (P2CHD050924 and T32HD007168), the University of North Carolina at Chapel Hill, the NIH (R01-HD30880, DK056350, R24HD050924, and R01-HD38700), and the Fogarty International Center of NIH (D43TW009077 and D43TW007709) for financial support for the CHNS data collection and analysis files from 1989 to 2006 and both parties plus the China–Japan Friendship Hospital, Ministry of Health for support for CHNS 2009 and future surveys. This research was funded by the National Natural Science Foundation of China (grant number 82273615).

This research uses data from China Health and Nutrition Survey (CHNS).

References

1. Shah UA, Merlo G. 2023. Personal and planetary health—the connection with dietary choices. JAMA 329(21):1823–1824, PMID: 37155189, https://doi.org/10.1001/jama.2023.6118.
2. Crippa M, Solazzo E, Guizzardi D, Monforti-Ferrario F, Tubiello FN, Leip A. 2021. Food systems are responsible for a third of global anthropogenic GHG emissions. Nat Food 2(3):198–209, PMID: 37117443, https://doi.org/10.1038/s43016-021-00225-9.
3. Nelson ME, Hamm MW, Hu FB, Abrams SA, Griffin TS. 2016. Alignment of healthy dietary patterns and environmental sustainability: a systematic review. Adv Nutr 7(6):1005–1025, PMID: 28140320, https://doi.org/10.3945/an.116.012567.
4. Hemler EC, Hu FB. 2019. Plant-based diets for personal, population, and planetary health. Adv Nutr 10(suppl 4):S275–S283, PMID: 31728495, https://doi.org/10.1093/advances/nmy117.
5. Forray AI, Coman MA, Simonescu-Colan R, Mazga AI, Cherecheș RM, Borzan CM. 2023. The global burden of type 2 diabetes attributable to dietary risks: insights from the Global Burden of Disease Study 2019. Nutrients 15(21):4613, PMID: 37960266, https://doi.org/10.3390/nu15214613.
6. Zhang B, Pu L, Zhao T, Wang L, Shu C, Xu S, et al. 2023. Global burden of cardiovascular disease from 1990 to 2019 attributable to dietary factors. J Nutr 153(6):1730–1741, PMID: 37003507, https://doi.org/10.1016/j.tjnut.2023.03.031.
7. EAT-Lancet Commission. 2019. *EAT-Lancet Commission Summary Report*. https://eatforum.org/content/uploads/2019/07/EAT-Lancet_Commission_Summary_Report.pdf [accessed 16 January 2024].
8. Meybeck A, Gitz V. 2017. Sustainable diets within sustainable food systems. Proc Nutr Soc 76(1):1–11, PMID: 28195528, https://doi.org/10.1017/S0029665116000653.
9. Magkos F, Tetens I, Bügel SG, Felby C, Schacht SR, Hill JO, et al. 2020. A perspective on the transition to plant-based diets: a diet change may attenuate climate change, but can it also attenuate obesity and chronic disease risk? Adv Nutr 11(1):1–9, PMID: 31504086, https://doi.org/10.1093/advances/nmz090.
10. Watanabe D, Maruyama K, Tamakoshi A, Muraki I, JACC Study Group. 2024. Association between diet-related greenhouse gas emissions and mortality among Japanese adults: the Japan collaborative cohort study. Environ Health Perspect 132(11):117002, PMID: 39509283, https://doi.org/10.1289/EHP14935.
11. Willett W, Rockström J, Loken B, Springmann M, Lang T, Vermeulen S, et al. 2019. Food in the anthropocene: the EAT-Lancet Commission on healthy diets from sustainable food systems. Lancet 393(10170):447–492, PMID: 30660336, https://doi.org/10.1016/S0140-6736(18)31788-4.
12. Wang DD, Li Y, Afshin A, Springmann M, Mozaffarian D, Stampfer MJ, et al. 2019. Global improvement in dietary quality could lead to substantial reduction in premature death. J Nutr 149(6):1065–1074, PMID: 31049577, https://doi.org/10.1093/jn/nxz010.
13. Lengle JM, Michaelsen Bjøntegaard M, Hauger Carlsen M, Jafarzadeh S, Frost Andersen L. 2024. Environmental impact of Norwegian self-selected diets: comparing current intake with national dietary guidelines and EAT-Lancet targets. Public Health Nutr 27(1):e100, PMID: 38523532, https://doi.org/10.1017/S1368980024000715.
14. Stubbendorff A, Sonestedt E, Ramne S, Drake I, Hallström E, Ericson U. 2022. Development of an EAT-Lancet index and its relation to mortality in a Swedish population. Am J Clin Nutr 115(3):705–716, PMID: 34791011, https://doi.org/10.1093/ajcn/nqab369.
15. Knuppel A, Papier K, Key TJ, Travis RC. 2019. EAT-Lancet score and major health outcomes: the EPIC-Oxford study. Lancet 394(10194):213–214, PMID: 31235280, https://doi.org/10.1016/S0140-6736(19)31236-X.
16. Colizzi C, Harbers MC, Vellinga RE, Verschuren WMM, Boer JMA, Biesbroek S, et al. 2023. Adherence to the EAT-Lancet healthy reference diet in relation to risk of cardiovascular events and environmental impact: results from the EPIC-NL cohort. J Am Heart Assoc 12(8):e026318, PMID: 37066787, https://doi.org/10.1161/JAHA.122.026318.
17. Berthy F, Brunin J, Allès B, Fezeu LK, Touvier M, Hercberg S, et al. 2022. Association between adherence to the EAT-Lancet diet and risk of cancer and cardiovascular outcomes in the prospective NutriNet-Santé cohort. Am J Clin Nutr 116(4):980–991, PMID: 35918246, https://doi.org/10.1093/ajcn/nqac208.
18. Lazarova SV, Sutherland JM, Jessri M. 2022. Adherence to emerging plant-based dietary patterns and its association with cardiovascular disease risk in a nationally representative sample of Canadian adults. Am J Clin Nutr 116(1):57–73, PMID: 35265975, https://doi.org/10.1093/ajcn/nqac062.
19. Xu C, Cao Z, Yang H, Hou Y, Wang X, Wang Y. 2021. Association between the EAT-Lancet diet pattern and risk of type 2 diabetes: a prospective cohort study. Front Nutr 8:784018, PMID: 35096931, https://doi.org/10.3389/fnut.2021.784018.
20. López GE, Batis C, González C, Chávez M, Cortés-Valencia A, López-Ridaura R, et al. 2023. EAT-Lancet healthy reference diet score and diabetes incidence in a cohort of Mexican women. Eur J Clin Nutr 77(3):348–355, PMID: 36471166, https://doi.org/10.1038/s41430-022-01246-8.
21. Ibsen DB, Christiansen AH, Olsen A, Tjønneland A, Overvad K, Wolk A, et al. 2022. Adherence to the EAT-Lancet diet and risk of stroke and stroke subtypes: a cohort study. Stroke 53(1):154–163, PMID: 34872335, https://doi.org/10.1161/STROKEAHA.121.036738.
22. Pitt S, Kałuża J, Widenfalk A, Åkesson A, Wolk A. 2024. Adherence to the EAT-Lancet diet in relation to mortality and exposure to food contaminants in population-based cohorts of Swedish men and women. Environ Int 184:108495, PMID: 38354461, https://doi.org/10.1016/j.envint.2024.108495.

23. Burggraf C, Teuber R, Brosig S, Meier T. 2018. Review of a priori dietary quality indices in relation to their construction criteria. Nutr Rev 76(10):747–764, PMID: 30053192, https://doi.org/10.1093/nutrit/nuy027.
24. Parker MK, Misyak SA, Gohlke JM, Hedrick VE. 2023. Cross-sectional measurement of adherence to a proposed sustainable and healthy dietary pattern among United States adults using the newly developed Planetary Health Diet Index for the United States. Am J Clin Nutr 118(6):1113–1122, PMID: 37742929, https://doi.org/10.1016/j.ajcnut.2023.09.009.
25. Trijsburg L, Talsma EF, Crispim SP, Garrett J, Kennedy G, de Vries JHM, et al. 2021. Method for the development of WISH, a globally applicable index for healthy diets from sustainable food systems. Nutrients 13(1):93, PMID: 33396659, https://doi.org/10.3390/nu13010093.
26. Cacau LT, De Carli E, de Carvalho AM, Lotufo PA, Moreno LA, Bensenor IM, et al. 2021. Development and validation of an index based on EAT-Lancet recommendations: the Planetary Health Diet Index. Nutrients 13(5):1698, PMID: 34067774, https://doi.org/10.3390/nu13051698.
27. Zhan J, Bui L, Hodge RA, Zimmer M, Pham T, Rose D, et al. 2025. Planetary Health Diet Index trends and associations with dietary greenhouse gas emissions, disease biomarkers, obesity, and mortality in the United States (2005–2018). Am J Clin Nutr 121(3):580–588, PMID: 39793707, https://doi.org/10.1016/j.ajcnut.2025.01.007.
28. Teixeira B, Afonso C, Severo M, Carvalho C, Torres D, Lopes C, et al. 2024. Exploring dietary patterns and their association with environmental sustainability and body mass index in children and adolescents: insights from the National Food, Nutrition and Physical Activity Survey 2015–2016. Sci Total Environ 945:174051, PMID: 38885700, https://doi.org/10.1016/j.scitotenv.2024.174051.
29. Bui LP, Pham TT, Wang F, Chai B, Sun Q, Hu FB, et al. 2024. Planetary Health Diet Index and risk of total and cause-specific mortality in three prospective cohorts. Am J Clin Nutr 120(1):80–91, PMID: 38960579, https://doi.org/10.1016/j.ajcnut.2024.03.019.
30. Ye Y-X, Geng T-T, Zhou Y-F, He P, Zhang J-J, Liu G, et al. 2023. Adherence to a planetary health diet, environmental impacts, and mortality in Chinese adults. JAMA Netw Open 6(10):e2339468, PMID: 37874563, https://doi.org/10.1001/jamanetworkopen.2023.39468.
31. Chen H, Wang X, Ji JS, Huang L, Qi Y, Wu Y, et al. 2024. Plant-based and planetary-health diets, environmental burden, and risk of mortality: a prospective cohort study of Middle-aged and older adults in China. Lancet Planet Health 8(8):e545–e553, PMID: 39122323, https://doi.org/10.1016/S2542-5196(24)00143-8.
32. Frank SM, Jaacks LM, Meyer K, Rose D, Adair LS, Avery CL, et al. 2024. Dietary quality and dietary greenhouse gas emissions in the USA: a comparison of the Planetary Health Diet Index, healthy eating index-2015, and dietary approaches to stop hypertension. Int J Behav Nutr Phys Act 21(1):36, PMID: 38566176, https://doi.org/10.1186/s12966-024-01581-y.
33. Cai H, Talsma EF, Chang Z, Wen X, Fan S, Van't Veer P, et al. 2024. Health outcomes, environmental impacts, and diet costs of adherence to the EAT-Lancet diet in China in 1997–2015: a health and nutrition survey. Lancet Planet Health 8(12):e1030–e1042, PMID: 39674193, https://doi.org/10.1016/S2542-5196(24)00285-7.
34. Zhang B, Zhai FY, Du SF, Popkin BM. 2014. The China Health and Nutrition Survey, 1989–2011. Obes Rev 15(suppl 1):2–7, PMID: 24341753, https://doi.org/10.1111/obr.12119.
35. Popkin BM, Du S, Zhai F, Zhang B. 2010. Cohort profile: the China Health and Nutrition Survey–monitoring and understanding socio-economic and health change in China, 1989–2011. Int J Epidemiol 39(6):1435–1440, PMID: 19887509, https://doi.org/10.1093/ije/dyp322.
36. Wang L, Wang H, Zhang B, Popkin BM, Du S. 2020. Elevated fat intake increases body weight and the risk of overweight and obesity among Chinese adults: 1991–2015 trends. Nutrients 12(11):3272, PMID: 33114561, https://doi.org/10.3390/nu12113272.
37. Zhao J, Zuo L, Sun J, Su C, Wang H. 2021. Trends and urban-rural disparities of energy intake and macronutrient composition among Chinese children: findings from the China Health and Nutrition Survey (1991 to 2015). Nutrients 13(6):1933, PMID: 34199924, https://doi.org/10.3390/nu13061933.
38. Yu D, Zhang X, Xiang Y-B, Yang G, Li H, Gao Y-T, et al. 2014. Adherence to dietary guidelines and mortality: a report from prospective cohort studies of 134,000 Chinese adults in urban Shanghai. Am J Clin Nutr 100(2):693–700, PMID: 24944055, https://doi.org/10.3945/ajcn.113.079194.
39. Su C, Zhao J, Wu Y, Wang H, Wang Z, Wang Y, et al. 2017. Temporal trends in dietary macronutrient intakes among adults in rural China from 1991 to 2011: findings from the CHNS. Nutrients 9(3):227, PMID: 28273878, https://doi.org/10.3390/nu9030227.
40. Institute of Nutrition and Food Hygiene CAoPM. 1991. *Food Composition Table (National Representative Values)*. Beijing, China: People's Medical Publishing House.
41. Yang YX, Wang GY, Pan XC. 2002. *China Food Composition Table 2002*. Beijing, China: Peking University Medical Press.
42. Yang YX, He M, Pan XC. 2004. *China Food Composition Table 2004*. Beijing, China: Peking University Medical Press.
43. Yang YX, Wang GY, Pan XC. 2009. *China Food Composition Table*. 2nd ed. Beijing, China: Peking University Medical Press.
44. Zhai F, Guo X, Popkin BM, Ma L, Wang Q, Shuigao WY, et al. 1996. Evaluation of the 24-hour individual recall method in China. Food Nutr Bull 17(2):1–7, https://doi.org/10.1177/156482659601700209.
45. Hu FB, Stampfer MJ, Rimm E, Ascherio A, Rosner BA, Spiegelman D, et al. 1999. Dietary fat and coronary heart disease: a comparison of approaches for adjusting for total energy intake and modeling repeated dietary measurements. Am J Epidemiol 149(6):531–540, PMID: 10084242, https://doi.org/10.1093/oxfordjournals.aje.a009849.
46. He P, Baiocchi G, Hubacek K, Feng K, Yu Y. 2018. The environmental impacts of rapidly changing diets and their nutritional quality in China. Nat Sustain 1(3):122–127, https://doi.org/10.1038/s41893-018-0035-y.
47. Hu Y, Li M, Wu J, Wang R, Mao D, Chen J, et al. 2019. Prevalence and risk factors for anemia in non-pregnant childbearing women from the Chinese Fifth National Health and Nutrition Survey. Int J Environ Res Public Health 16(7):1290, PMID: 30974871, https://doi.org/10.3390/ijerph16071290.
48. Wang Z, Siega-Riz AM, Gordon-Larsen P, Cai J, Adair LS, Zhang B, et al. 2018. Diet quality and its association with type 2 diabetes and major cardiometabolic risk factors among adults in China. Nutr Metab Cardiovasc Dis 28(10):987–1001, PMID: 30143408, https://doi.org/10.1016/j.numecd.2018.06.012.
49. Cao Y, Yu Y. 2024. Associations between cholesterol intake, food sources and cardiovascular disease in Chinese residents. Nutrients 16(5):716, PMID: 38474843, https://doi.org/10.3390/nu16050716.
50. Chen X, Jiao J, Zhuang P, Wu F, Mao L, Zhang Y, et al. 2021. Current intake levels of potatoes and all-cause mortality in China: a population-based nationwide study. Nutrition 81:110902, PMID: 32739659, https://doi.org/10.1016/j.nut.2020.110902.
51. Zhang Z, Chen B, Zeng J, Fan M, Xu W, Li X, et al. 2022. Associations between consumption of dietary fibers and the risk of type 2 diabetes, hypertension, obesity, cardiovascular diseases, and mortality in Chinese adults: longitudinal analyses from the China Health and Nutrition Survey. Nutrients 14(13):2650, PMID: 35807831, https://doi.org/10.3390/nu14132650.
52. Ng SW, Norton EC, Popkin BM. 2009. Why have physical activity levels declined among Chinese adults? Findings from the 1991–2006 China Health and Nutrition Surveys. Soc Sci Med 68(7):1305–1314, PMID: 19232811, https://doi.org/10.1016/j.socscimed.2009.01.035.
53. Yan S, Li J, Li S, Zhang B, Du S, Gordon-Larsen P, et al. 2012. The expanding burden of cardiometabolic risk in China: the China Health and Nutrition Survey. Obes Rev 13(9):810–821, PMID: 22738663, https://doi.org/10.1111/j.1467-789X.2012.01016.x.
54. Chen C, Lu FC, Department of Disease Control Ministry of Health, PR China. 2004. The guidelines for prevention and control of overweight and obesity in Chinese adults. Biomed Environ Sci 17(suppl):1–36, PMID: 15807475.
55. Wu M, Li S, Lv Y, Liu K, Wang Y, Cui Z, et al. 2023. Associations between the inflammatory potential of diets with adherence to plant-based dietary patterns and the risk of new-onset cardiometabolic diseases in Chinese adults: findings from a nation-wide prospective cohort study. Food Funct 14(19):9018–9034, PMID: 37740363, https://doi.org/10.1039/d3fo02579a.
56. Atkinson MA, Eisenbarth GS, Michels AW. 2014. Type 1 diabetes. Lancet 383(9911):69–82, PMID: 23890997, https://doi.org/10.1016/S0140-6736(13)60591-7.
57. Patterson CC, Dahlquist GG, Gyürüs E, Green A, Soltész G, EURODIAB Study Group. 2009. Incidence trends for childhood type 1 diabetes in Europe during 1989–2003 and predicted new cases 2005–20: a multicentre prospective registration study. Lancet 373(9680):2027–2033, PMID: 19481249, https://doi.org/10.1016/S0140-6736(09)60568-7.
58. Zhang Y, Zhuang P, Mao L, Chen X, Wang J, Cheng L, et al. 2019. Current level of fish and omega-3 fatty acid intakes and risk of type 2 diabetes in China. J Nutr Biochem 74:108249, PMID: 31683102, https://doi.org/10.1016/j.jnutbio.2019.108249.
59. He J, Fang A, Yu S, Shen X, Li K. 2020. Dietary nonheme, heme, and total iron intake and the risk of diabetes in adults: results from the China Health and Nutrition Survey. Diabetes Care 43(4):776–784, PMID: 32033991, https://doi.org/10.2337/dc19-2202.
60. Na X, Lan H, Wang Y, Tan Y, Zhang J, Zhao A. 2022. Association between milk intake and all-cause mortality among Chinese adults: a prospective study. Nutrients 14(2):292, PMID: 35057475, https://doi.org/10.3390/nu14020292.
61. Hua Y, Zhang Z, Liu A. 2022. Long-term diet quality and risk of diabetes in a national survey of Chinese adults. Nutrients 14(22):4841, PMID: 36432527, https://doi.org/10.3390/nu14224841.
62. Wu F, Zhuang P, Zhang Y, Zhan C, Zhang Y, Jiao J. 2021. Egg and dietary cholesterol consumption and mortality among hypertensive patients: results from a population-based nationwide study. Front Nutr 8:739533, PMID: 34778336, https://doi.org/10.3389/fnut.2021.739533.

63. Yan M, Liu Y, Wu L, Liu H, Wang Y, Chen F, et al. 2022. The association between dietary purine intake and mortality: evidence from the CHNS cohort study. Nutrients 14(9):1718, PMID: 35565687, https://doi.org/10.3390/nu14091718.
64. Jayedi A, Ghomashi F, Zargar MS, Shab-Bidar S. 2019. Dietary sodium, sodium-to-potassium ratio, and risk of stroke: a systematic review and nonlinear dose-response meta-analysis. Clin Nutr 38(3):1092–1100, PMID: 29907351, https://doi.org/10.1016/j.clnu.2018.05.017.
65. Gao Y, Wang Y, Zhang D, Wu T, Li Q. 2023. The relationship between dietary inflammatory index and all-cause, cardiovascular disease-related, and cancer-related mortality. J Multidiscip Healthc 16:2543–2556, PMID: 37667797, https://doi.org/10.2147/JMDH.S423558.
66. Gomez-Delgado F, Katsiki N, Lopez-Miranda J, Perez-Martinez P. 2021. Dietary habits, lipoprotein metabolism and cardiovascular disease: from individual foods to dietary patterns. Crit Rev Food Sci Nutr 61(10):1651–1669, PMID: 32515660, https://doi.org/10.1080/10408398.2020.1764487.
67. Toi PL, Anothaisintawee T, Chaikledkaew U, Briones JR, Reutrakul S, Thakkinstian A. 2020. Preventive role of diet interventions and dietary factors in type 2 diabetes mellitus: an umbrella review. Nutrients 12(9):2722, PMID: 32899917, https://doi.org/10.3390/nu12092722.
68. Mozaffarian D. 2016. Dietary and policy priorities for cardiovascular disease, diabetes, and obesity: a comprehensive review. Circulation 133(2):187–225, PMID: 26746178, https://doi.org/10.1161/CIRCULATIONAHA.115.018585.
69. Satija A, Bhupathiraju SN, Spiegelman D, Chiuve SE, Manson JE, Willett W, et al. 2017. Healthful and unhealthful plant-based diets and the risk of coronary heart disease in U.S. Adults. J Am Coll Cardiol 70(4):411–422, PMID: 28728684, https://doi.org/10.1016/j.jacc.2017.05.047.
70. Sarsangi P, Salehi-Abargouei A, Ebrahimpour-Koujan S, Esmaillzadeh A. 2022. Association between adherence to the mediterranean diet and risk of type 2 diabetes: an updated systematic review and dose-response meta-analysis of prospective cohort studies. Adv Nutr 13(5):1787–1798, PMID: 35472102, https://doi.org/10.1093/advances/nmac046.
71. Baden MY, Liu G, Satija A, Li Y, Sun Q, Fung TT, et al. 2019. Changes in plant-based diet quality and total and cause-specific mortality. Circulation 140(12):979–991, PMID: 31401846, https://doi.org/10.1161/CIRCULATIONAHA.119.041014.
72. Garcia-Arellano A, Martínez-González MA, Ramallal R, Salas-Salvadó J, Hébert JR, Corella D, et al. 2019. Dietary inflammatory index and all-cause mortality in large cohorts: the SUN and PREDIMED studies. Clin Nutr 38(3):1221–1231, PMID: 30651193, https://doi.org/10.1016/j.clnu.2018.05.003.
73. Laine JE, Huybrechts I, Gunter MJ, Ferrari P, Weiderpass E, Tsilidis K, et al. 2021. Co-benefits from sustainable dietary shifts for population and environmental health: an assessment from a large European cohort study. Lancet Planet Health 5(11):e786–e796, PMID: 34688354, https://doi.org/10.1016/S2542-5196(21)00250-3.
74. Ye B, Xiong Q, Yang J, Huang Z, Huang J, He J, et al. 2024. Adoption of region-specific diets in China can help achieve gains in health and environmental sustainability. Nat Food 5(9):764–774, PMID: 39215095, https://doi.org/10.1038/s43016-024-01038-2.
75. Finkbeiner M, Ackermann R, Bach V, Berger M, Brankatschk G, Chang Y, et al. 2014. Challenges in life cycle assessment: an overview of current gaps and research needs. In: *Background and Future Prospects in Life Cycle Assessment*. Dordrecht, the Netherlands: Springer, 207–258.