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A priori-defined Diet Quality Indexes and Risk of Type 2 diabetes: The Multiethnic Cohort

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Abstract

Aim—Dietary patterns have been associated with type 2 diabetes incidence, but little is known about the impact of ethnicity on this relation. This study evaluated the association of four *a priori* dietary quality indexes and type 2 diabetes risk among whites, Japanese Americans, and Native Hawaiians in the Hawaii component of the Multiethnic Cohort (MEC).

Methods—After excluding participants with prevalent diabetes and missing values, the analysis included 89,185 participants (11,217 cases). Dietary intake was assessed at baseline with a quantitative food frequency questionnaire designed for use in the relevant ethnic populations. Sex- and ethnicity-specific hazard ratios were calculated for the Healthy Eating Index-2010 (HEI-2010), the alternative HEI-2010 (AHEI-2010), the alternate Mediterranean diet score (aMED), and the Dietary Approaches to Stop Hypertension (DASH).

Results—We observed significant inverse associations between higher scores of the DASH index and type 2 diabetes risk in white men and women, as well as in Japanese American women and Native Hawaiian men with respective risk reductions of 37, 31, 19 and 21% (highest compared to lowest index category). A higher adherence to the AHEI-2010 and aMED diet was related to a 13–28% lower type 2 diabetes risk in white participants but not in other ethnic groups. No significant associations with type 2 diabetes risk were observed for the HEI-2010 index.

Conclusions—The small ethnic differences in type 2 diabetes risk associated with scores of *a priori*-defined dietary patterns may be due to different consumption patterns of food components and the fact that the original indexes were not based on Asians and Pacific Islanders.

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Keywords

Alternative Healthy Eating Index; Healthy Eating Index; Alternate Mediterranean diet score; Dietary Approaches to Stop Hypertension; Dietary patterns; Multiethnic Cohort; Type 2 diabetes

Introduction

Prevalence and incidence rates of type 2 diabetes vary widely by ethnicity, with substantially higher rates in Asian Americans and Pacific Islanders than in whites residing in the United States (US) [1, 2]. In addition to genetic predisposition and prevalence of excess body weight, diet and lifestyle habits may contribute to this disparity. With regard to diet, instead of examining individual nutrients or foods in relation to the disease, dietary-pattern analyses have attracted interest as they take interaction and intercorrelations among foods and nutrients into account, potentially providing more promising strategies for preventing and controlling disease [3]. Two approaches of characterizing overall diet are commonly distinguished. *A priori* indexes evaluate dietary quality and are constructed on the basis of dietary recommendations and existing scientific evidence for chronic diseases, whereas *a posteriori*-derived dietary patterns are identified through an exploratory data-driven approach [3]. Given cultural differences in dietary habits and possible biologic differences in metabolism, associations may differ across geographic populations and ethnic groups [4–7]. For example, in the Coronary Artery Risk Development in Young Adults (CARDIA) Study, higher Diet Quality Index (DQI) scores were positively associated with insulin resistance among African American but not white participants [6]. Also, in the Insulin Resistance Atherosclerosis Study (IRAS), only white and not African American or Hispanic adults showed an inverse relation between adherence to the DASH diet and incidence of type 2 diabetes [5]. The Multi-Ethnic Study of Atherosclerosis (MESA) Study reported significant ethnic differences in all nutrients except saturated fat when intakes of specific nutrients based on the DASH guidelines were compared among white, Chinese American, African American, and Hispanic adults [4]. In previous analyses in the Multiethnic Cohort (MEC), the associations of *a posteriori*-defined dietary patterns with type 2 diabetes risk were weaker in Native Hawaiian than Japanese American and white participants [7]. To our knowledge, no study has yet investigated the associations between *a priori*-defined dietary quality indexes and type 2 diabetes risk in Pacific Islanders and Japanese Americans. Based on the hypothesis that a better diet quality protects from type 2 diabetes risk, we examined the association between four *a priori*-defined dietary indexes, namely HEI-2010, AHEI-2010, aMED, and DASH, and type 2 diabetes risk among white, Native Hawaiian, and Japanese American men and women in the Hawaii component of the MEC.

Methods

Study population

The MEC collected baseline data from 1993 through 1996 to study diet and cancer incidence among five ethnic groups (whites, Native Hawaiians, Japanese Americans, Latinos, African Americans) living in Hawaii and California [8]. The study design has been described in detail previously [8]. Briefly, more than 215,000 men and women aged 45 to 75 years at recruitment and living in Hawaii or California (primarily in Los Angeles) were enrolled by returning a mailed self-administered survey consisting of a quantitative food frequency questionnaire (QFFQ) containing questions on demographics, medical conditions, anthropometric measures, and lifestyle factors. The institutional review boards at the University of Southern California and the University of Hawaii approved the study protocol. Response rates to the baseline questionnaire mailings ranged from 28% to 51% in the different ethnic-sex groups. A comparison of MEC participants with US census data indicated that cohort members represent all levels of education although they are somewhat better educated than the Hawaii population and do not present the general US population [8]. Because a linkage with health plans was only possible in Hawaii, we restricted the present study to the Hawaii component of the MEC consisting of 103,898 participants of primarily white, Japanese American, and Native Hawaiian ancestry. Individuals who reported more than one ancestry were assigned to one of the categories according to the following priority ranking: Native Hawaiian, Japanese American, and white. After excluding participants with prevalent diabetes at study entry (n=10,028), questionable diabetes status (n=1,036), or invalid or missing covariate data (n=3,649), the study population consisted of 89,185 participants. Since the MEC was established, annual linkages with state death certificate files have been performed to update vital status.

Case Ascertainment

Incident diabetes cases were identified through a short follow-up questionnaire (1999–2003) that inquired about medical conditions (response rate 84%), a medication inventory (2003–2006) including diabetes drugs (response rate 38%), and linkage with health insurance plans in 2007 [1]. All cohort members known to be alive and not refusing to participate were linked with the diabetes care registries of the two major health insurers that capture 90% of the population of Hawaii. Entrance into the registries is based on multiple pieces of evidence, such as repeated outpatient visits for diabetes, clinical information, pharmacy records, or hospital discharge diagnoses [1]. The assessment of diabetes status by questionnaire provided information for participants who were censored due to death before 2007 (N=11,948). For cohort members alive at the time of the linkage, self-reported diabetes status not confirmed by one of the health plans was considered questionable and excluded. The midpoint between two time points of diabetes assessment was used as the estimated diagnosis date when the health plans did not provide an exact date.

Dietary Assessment

The MEC uses a QFFQ with several unique attributes, including ethnic-specific foods, reliance on a food composition table specific to the MEC, and use of a large recipe database [9], which was described in detail previously [10]. Briefly, usual food intake over the past 12 months was assessed using eight or nine (for beverages) categories. Quantities of foods were assessed using three portion sizes specific to each food item, which were also shown in representative images. The QFFQ was validated and calibrated in each ethnic-sex group using data from 1,606 participants and three randomly scheduled 24-hour dietary recalls [10]. The contribution of each food item on the QFFQ to the major food groups and subgroups according to The Pyramid Servings Database [11] were included in the MEC food composition table. The MyPyramid Equivalents Database (MPED) is a standardized food-grouping system developed by the United States Department of Agriculture that disaggregates most foods into their ingredients and allocates each ingredient to one of 32 food groupings (version 2.0, www.ars.usda.gov/ba/bhnrc/fsrg, accessed 8 April 2014).

Dietary Indexes

Dietary indexes used in this study were *a priori* defined and selected from the literature (Table 1). The indexes were chosen based on available scientific evidence supporting a role in chronic diseases or explicitly hypertension (DASH) but not specifically diabetes risk. This analysis builds on work begun by the Dietary Patterns Methods Project [12–14] (unpublished results: Harmon BE, Boushey CJ, Shvetsov YB, Ettienne R, Reedy J, Wilkens LR, Le Marchand L, Henderson BE, Kolonel LN, Epidemiology Program, University of Hawaii Cancer Center, Honolulu, HI (BEHarmon, CJB, YBS, RE, LRW, LL, LNK), National Cancer Institute, Rockville, MD (JR), University of Southern California, Los Angeles, CA (BEHenderson)). Several items in the QFFQ combined foods or omitted foods such that the components in some index components were modified as indicated in the footnotes of Table 1. After computing MPEDs for each MEC participant, MPED groups and subgroups were used in the scoring of each dietary index. Portion sizes were adjusted to reflect the use of cup and ounce equivalents with MPEDs for those dietary indexes that were defined as serving sizes.

The HEI-2010 reflects the 2010 Dietary Guidelines for Americans [15] with higher scores reflecting better adherence to federal dietary guidelines [16]. HEI-2010 updates the components used in the development of HEI-2005 [17] with modifications to components measuring vegetable and bean intake, seafood and plant protein intake, refined grain intake, and the ratio of polyunsaturated and monounsaturated to saturated fatty acids in the diet [16]. All components except the fatty acid ratio were calculated as per 4,187 kJ and points of 5, 10 or 20 were assigned to optimal intakes (Table 1).

The AHEI-2010 includes foods and nutrients indicated by scientific literature to be predictive of chronic diseases such as type 2 diabetes, cardiovascular disease or coronary heart disease [18]. This index builds on aspects of the original HEI [19], the original AHEI [20], and a comprehensive review of relevant literature since the establishment of the first AHEI. Red and processed meat, sugar-sweetened beverages (SSB), and sodium were reverse coded such that lower intakes provided the maximum points. The aMED as developed by Fung *et al*. [21] was an adaptation of the Mediterranean Diet Score developed by Trichopoulou *et al*. [22] that takes into account scientific literature on diet and chronic disease risk. The DASH index as outlined by Fung *et al*. [23] includes eight components that are emphasized in the DASH diet used for hypertension management [23, 24]. For this particular index, scoring is based on intake quintiles created within the entire MEC dataset; participants in the lowest quintile received one point and individuals in quintile five received five points. Red and processed meat, SSB, and sodium were reverse coded.

Statistical Analysis

Cox proportional hazards regression using follow-up time as underlying time metric was applied to assess the association between the four dietary indexes and type 2 diabetes risk.

Follow-up time was calculated as the time between the date of baseline questionnaire and date of diabetes diagnosis, date of death, or last date when diabetes status was available (date of questionnaire or health plan linkage, i.e., the end of 2007 for all cohort members who were part of the linkage) [1]. Hazard ratios (HR) and 95% confidence intervals (CI) were calculated for the dietary indexes divided into five sex-specific categories (C1-C5) based on the analysis data set distribution using the lowest index score category as a reference category (C1); this parameterization accounts for nonlinear trends. As a secondary analysis, to be interpreted as a trend test, the scores were evaluated as standardized continuous variables by dividing each index value by its respective standard deviation.

The Cox models were stratified by age to ensure that the estimation procedure was based on comparisons of participants at the same age and adjusted for several variables known to be associated with diabetes risk, including ethnicity (whites as the reference), physical activity (hours/week), smoking (current smoker, past smoker, and never smoker), years of education (<12, 12, 13–15, and ≥16 years), total energy intake (kJ/day), and body mass index (BMI; <22, 22-<25, 25-<30, and ≥30 kg/m^2) calculated from self-reported height and weight. Waist circumference as a measure of central adiposity was assessed for less than half of the study population approximately 10 years after baseline and an analysis in this subset suggested that waist and hip measurements were not better predictors of diabetes than BMI [25]. To test for interactions, we evaluated the statistical significance of cross-product terms of ethnicity with index scores divided by their respective standard deviation.

Since consumption of alcohol, coffee, soda, and red meat was found to be associated with diabetes risk in this population [26–28], models involving indexes that did not include these food items in their score calculation were additionally adjusted for these variables (HEI-2010 for alcohol, regular soda, coffee intake, and meat intake; AHEI-2010 for coffee consumption; aMED for regular soda and coffee intake; DASH for alcohol and coffee intake). Daily intakes of red meat were converted to energy density values (per 4,187 kJ) and logarithmically transformed to normalize the distribution. We further investigated the importance of individual components of the dietary patterns for type 2 diabetes risk by sequentially subtracting components from the score and calculating the proportion of exposure effect (PEE) explained as $(1-(\beta_{adjusted}/\beta_{crude}))$ multiplied with 100% (according to [29]) for sex-ethnic groups with significant associations between the continuous index score and type 2 diabetes risk. All analyses were conducted using SAS version 9.3 (SAS Institute, Inc., Cary NC). *P*-values were two-sided, and $p<0.05$ was considered as significant.

Results

Of the 89,185 Hawaii cohort members in this analysis, 42.3% were Japanese American, 35.7% were white, 12.9% were Native Hawaiian, and 9.1% of other ancestries. The respective percentages of mixed ethnic backgrounds were 3, 5, and 84% for Japanese Americans, whites, and Native Hawaiians; of the latter 29% were of Hawaiian/Asian admixture, 27% were Hawaiian/White, and 44% represented all other combinations.

In men (Table 2) and women (Table 3), high scores for all indexes were associated with being older, being a never smoker, consuming less soda or red meat, and reporting a higher energy intake (except HEI-2010). Whites had higher scores for the HEI-2010 and the DASH index, whereas Japanese Americans scored better for the AHEI-2010. A smaller proportion of Native Hawaiians was found in the higher categories for the HEI-2010, AHEI-2010, and DASH indexes. The distributions of single food components differed by ethnic group (data not shown). Whites reported a higher mean intake and range of dairy products, Native Hawaiians of red meat, SSB and fruit juice, whereas Japanese American men and women reported a higher mean intake and range of refined grains than other participants. The four indexes were strongly associated with each other; the correlation coefficients were 0.74 for HEI-2010 and DASH, 0.68 for aMED and AHEI-2010, 0.67 for HEI-2010 and AHEI-2010, 0.63 for DASH and aMED, and 0.57 for aMED and HEI-2010.

The categorized HEI-2010 score was not significantly associated with type 2 diabetes risk (Tables 4 and 5) and the continuous HEI-2010 score only showed a significant inverse trend in white men. In contrast, significant inverse associations of the AHEI-2010 score with type 2 diabetes risk were detected in men and women of all ethnicities combined (score points in men: C5 73–101 vs. C1 25–56, in women: C5 47–100 vs. C1 30–58; 12% risk reduction, respectively). However, inverse associations were seen in white men and women only (26% and 22% lower risk C5 vs C1, respectively). The significant risk estimate per one SD of the continuous AHEI-2010 score suggested a trend not only in white men and women but also in Native Hawaiian women. Comparing highest to lowest score category, the aMED score was associated with type 2 diabetes risk in all men (score points: C5 7–9 vs. C1 0–2; 11% lower risk) with a significant trend test; this association was again limited to white men (28% lower risk). The DASH index was inversely associated with type 2 diabetes risk across all ethnic groups in both sexes although not significant in Japanese American men and Native Hawaiian women. The respective HRs were 0.79 (95% CI: 0.73, 0.87) in all men and 0.77 (95% CI: 0.70, 0.84) in all women for the highest vs. the lowest category (score points in both sexes: C5 28–39 vs. C1 9–19). The associations were strongest in white men and women (HR=0.63 [95% CI: 0.52, 0. and 0.69 [95% CI: 0.55, 0.88]). Significant dose-response relations were confirmed by the 17, 14, and 7% lower type 2 diabetes risk per one SD increase in DASH score for white men and women, and Japanese American women, respectively. For all indexes, the interaction term between diet quality and ethnicity was only significant in men ($p=0.03$ for HEI-2010, $p=0.003$ for AHEI-2010, $p=0.008$ for aMED, and $p<0.001$ for DASH).

Adjustments for food items known to be associated with type 2 diabetes in this population modified the association only for the HEI-2010 score, which became non-significant in white men after adjustment for red meat (HR for a one SD: 1.00 [95% CI: 0.94, 1.07]). When alternately excluding components from the dietary pattern scores to analyze their importance for type 2 diabetes risk (Tables 6, 7, and 8), PEEs between −143% to +50% were observed. Excluding whole grains, dairy, refined grains or sodium from the HEI-2010 score, whole grains or SSBs and fruit juices from the AHEI-2010 score, red meat from the aMED score, and whole grains, red meat, low-fat dairy or SSBs and fruit juices from the DASH score led to attenuated HRs in most subgroups (PEEs: 7–50%). For DASH, the strong association with type 2 diabetes in white men and women and in Japanese American women was not due to any single food item.

Discussion

In this large cohort with three ethnic groups, high scores for the DASH were related to a 10–30% lower type 2 diabetes risk, the AHEI-2010 and the aMED showed weaker associations, and the HEI-2010 was not related to type 2 diabetes risk. In general, the associations were stronger in whites than in Native Hawaiians and Japanese Americans. This difference may be due to different consumption patterns of food components, the fact that the original indexes were developed in populations without Asians and Pacific Islanders, or underlying biologic differences in the metabolism of glucose and/or insulin [30]. The risk estimates for men and women were relatively similar in the entire study population and in whites, but the interaction terms of diet with ethnicity were only significant for men.

The current results for the AHEI-2010 and aMED index in whites agree with previous reports of a lower type 2 diabetes risk for the AHEI [18, 31] and Mediterranean dietary patterns [31], while our overall null findings for the HEI-2010 contrast the lower risk described for the HEI [18]. Yet, several other prospective studies reported null findings, e.g., the EPIC-InterAct study for the AHEI [32], the Health Professionals Follow-Up Study (HPFS) for the HEI [31], and the CARDIA study for the DQI [6]. Differences in range of index scores may partly explain discrepant findings across studies unless standardized scores are used. The HPFS described similar ranges for the aMED and DASH scores as seen for men in the MEC [31], whereas the AHEI-2010 scores were higher in the MEC than in the Nurses' Health Study and the HPFS [18]. In accordance with the literature, MEC women had higher AHEI-2010 and HEI-2010 scores than men [33], possibly the result of different eating patterns or due to reporting errors by women who want to fulfill perceived social expectations [34].

For the DASH index, two prospective studies in US populations described significant inverse associations with type 2 diabetes risk [5, 31], whereas a study in seven European countries detected no association [32]. Reasons for the discrepancy might be the use of study-specific categories in the DASH index and the consumption of foods specific to geographic environments, such as preferences for different types of meat in the US than European countries [35]. Food consumption patterns in Europe and the US vary due to food pricing, policies, and availability; for instance, the US has higher meat and sugar availability than European countries [36]. In addition, methodological approaches in creating the scores may contribute to divergent results. Several versions of the DASH score exist. We chose the definition based on Fung *et al*. [23], which is most common one used in US populations [12], whereas the definition of the DASH index in the InterAct Study [32] was based on the DASH eating plan [24]. A recent report comparing different definitions of DASH indexes concluded that all indexes capture an underlying construct inherent to the DASH diet targeted for the prevention of hypertension, but suggested that the specific index might affect results [37]. The different score definition manifested itself in the use of specific intake values as cutpoints to assign points in the InterAct study, while quintiles were applied in the MEC. Furthermore, some components forming the DASH indexes varied, e.g., in the "meat component," red and processed meats were included in our study, whereas poultry and fish were added in the InterAct study.

The underlying nutrient targets of DASH, i.e., high protein, fiber, calcium, magnesium, and potassium, and low sodium, fat, saturated fat, and cholesterol [38, 39], may explain its association with type 2 diabetes risk because high fiber, calcium, magnesium, and potassium intake appear to be protective against risk of type 2 diabetes [40–42]. In addition, a recent meta-analysis of intervention studies demonstrated improved insulin sensitivity as a result of the DASH diet independent of weight loss [43]. The better performance of the DASH may also be related to the inclusion of SBB & fruit juices, which are not part of the HEI-2010 and the aMED. As to scoring, in the AHEI-2010, HEI-2010 and DASH scores but not in the aMED score, partial adherence is rewarded. Therefore, components in AHEI-2010, HEI-2010 and DASH indexes allow for a wider range of possible scores. As the HEI-2010, AHEI-2010, and aMED indexes were not created specifically to prevent a particular disease, it is plausible that they are not associated with risk of type 2 diabetes. If future research supports the concept that adherence to the DASH diet lowers type 2 diabetes risk across ethnic groups, only one set of dietary recommendations might be given to individuals suffering from high blood pressure and type 2 diabetes.

The high percentage of mixed ethnic background for Native Hawaiians as compared to Japanese Americans and whites may have obscured associations as individuals with different admixtures may adopt diverse eating habits related to the specific admixture and individuals with multiple ancestries appear to be at higher risk for obesity and possibly other conditions [44]. In previous studies [7, 8, 42], Japanese Americans and Native Hawaiians showed different eating patterns than whites. For example, Native Hawaiians were more likely and Japanese Americans were less likely to score highly on the *a posteriori* “fat and meat” pattern, whereas both groups had higher scores on the “vegetables” pattern and lower scores on the “fruit and milk” pattern than whites [7]. Similarly, the protection of grain fiber against type 2 diabetes was more pronounced in whites than in the other groups [7, 8, 42], possibly due to the higher intake of refined grains, i.e., rice, in Japanese Americans, while whites were more likely to consume wheat, which may affect glucose metabolism differently than rice [8, 42].

We note that most dietary indexes were originally created and tested among participants of European and African American (for DASH) heritage. Therefore, foods consumed by Japanese Americans and Native Hawaiians are not as well represented in the current indexes. Native Hawaiians reported a high intake and wide range of red meat, SSB, and fruit juice. According to the subtraction analysis, these foods strongly contributed to type 2 diabetes risk in DASH, the index that was inversely associated with type 2 diabetes risk in Native Hawaiians. Thus, ethnic-specific differences in the performance of a dietary index with type 2 diabetes risk might partly be due to a high intake of foods that play a part in diabetes etiology among specific ethnic groups. These findings agree with recent meta-analyses of cohort studies describing positive associations of red meat [45] and SSBs [46] with type 2 diabetes risk [47]. Only the HEI-2010 does not specifically take into account the component “red meat,” which is a major source of saturated fat and other potentially detrimental compounds, such as heme-iron that may damage pancreatic β-cells through oxidative stress [48]. The HEI-2010 and the DASH index take into account dairy products; however, the DASH index focuses on low-fat dairy products, which had a stronger inverse association with type 2 diabetes risk than total dairy intake in a recent meta-analysis [47]. Higher consumption of low-fat dairy products may reduce intake of saturated fat and, furthermore, may stimulate the secretion of insulinotropic peptides [49].

To our knowledge, this study is the first to investigate the associations of four *a priori*-defined dietary indexes with type 2 diabetes risk simultaneously. Their application to a multiethnic population represents a unique contribution to the field although the results from ethnic groups in Hawaii may not be generalizable to the US population. Additional strengths are the prospective design of the study. The use of a QFFQ designed for the relevant ethnic populations enabled us to study heterogeneous populations with wide variations in dietary habits. The large number of incident cases of type 2 diabetes allowed us to perform subgroup analyses by sex and ethnicity. Although the validation of the QFFQ with 24-hour recalls indicated acceptable results [10], the one-time dietary assessment by self-reported QFFQ was a limitation, which may have led to imprecise estimates of long-term dietary exposure, non-differential misclassification of respondents into dietary exposure categories, and, thus, attenuated risk estimates [50]. As to possible misclassification of diabetes status, we put emphasis on specificity in disease classification to capture all cases. Therefore, it is unlikely that healthy individuals were misclassified as cases although a diabetes diagnosis may have been missed for a small proportion of cohort members.

In this large multiethnic cohort, several dietary indexes were associated with small reductions in type 2 diabetes risk. However, only the DASH index was associated with a reduction in type 2 diabetes risk across ethnic groups including Japanese Americans and Native Hawaiians. The stronger associations in whites may not indicate a true ethnic difference; they could be the result of differences in eating patterns, biologic differences in metabolism, and the development of the dietary indexes primarily in white (and African American) populations. To determine whether true ethnic differences exist, studies of dietary patterns using indexes derived from foods consumed by different ethnic groups are warranted.

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List of abbreviations

AHEI	Alternative Healthy Eating Index
aMED	Alternate Mediterranean diet score
DASH	Dietary Approaches to Stop Hypertension
DQI	Diet quality index
EPIC	European Prospective Investigation into Cancer and Nutrition
FFQ	Food Frequency Questionnaire

HEI	Healthy Eating Index
HPFS	Health Professionals Follow-Up Study
IRAS	Insulin resistance atherosclerosis study
MEC	Multiethnic Cohort
MESA	Multi-Ethnic Study of Atherosclerosis
MPED	MyPyramid Equivalents Database
PEE	Proportion of exposure effect
US	United States

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Table 1

Components and optimal quantities for scoring standards for each component of HEI-2010, AHEI-2010, aMED, and DASH score using standardized cup and ounce equivalents per 4,187 kJ from the MyPyramid Equivalents Database

Dietary quality indexes, scoring, and criteria							
HEI-2010[a]		AHEI-2010[a]		aMED[b]		DASH	
0–100 points total (12 components: 0–5, 0–10, 0–20 points (pts) each)		0–110 points total (11 components: 0-10 pts each)		0–9 points total (9 components: 0-1 pt each)		8–40 points total (8 components: 1–5 pts each)	
Component	**Criteria for extreme scores**	**Component**	**Criteria for extreme scores**	**Component**	**MEC-specific median for optimal score**	**Component**	**MEC-specific mean intake for optimal quintile**
Total vegetables (cup eq/4,187 kJ)	Min score: 0 (0 pts) Max score: ≥1.1 (5 pts)	Total vegetables (excluding potatoes) (cup eq/d)	Min score: 0 (0 pts) Max score: ≥ 2.5 (10 pts)	Total vegetables (excluding potatoes) (cup eq/d)	Men ≥ 1.66 Women ≥ 1.71	Total vegetables (excluding potatoes) (cup eq/d)	Highest quintile: Men: 4.16 Women: 4.38
Greens & beans (cup eq/4,187 kJ)	Min score: 0 (0 pts) Max score: ≥ 0.2 (5 pts)						
Total fruit (cup eq/4,187 kJ)	Min score: 0 (0 pts) Max score: ≥ 0.8 (5 pts)			Total fruit (cup eq/d)	Men ≥ 1.53 Women ≥ 1.81	Total fruit (cup eq/d)	Highest quintile: Men: 5.06 Women: 5.62
Whole fruit (cup eq/4,187 kJ)	Min score: 0 (0 pts) Max score: ≥ 0.4 (5 pts)	Whole fruit (cup eq/d)	Min score: 0 (0 pts) Max score: ≥ 2 (10 pts)				
		Nuts & legumes (oz eq/d)	Min score: 0 (0 pts) Max score: ≥ 1 (10 pts)	Nuts (oz eq/d)	Men ≥ 0.45 Women ≥ 0.34	Nuts, seeds & legumes (oz eq/d)	Highest quintile: Men: 2.57 Women: 2.03
				Legumes (oz eq/d)	Men ≥ 0.09 Women ≥ 0.07		
Seafood & plant proteins (oz eq/4,187 kJ)	Min score: 0 (0 pts) Max score: ≥ 0.8 (5 pts)			Fish (oz eq/d)	Men ≥ 0.63 Women ≥ 0.47		
Whole grains[c] (oz eq/4,187 kJ)	Min score: 0 (0 pts) Max score: ≥ 1.5 (10 pts)	Whole grains[c] (oz eq/d)	Min score: 0 (0 pts) Max score: Women: 5 oz (10 pts) Men: 6 oz (10 pts)	Whole grains[c] (oz eq/d)	Men ≥ 1.23 Women ≥ 1.32	Whole grains[c] (oz eq/d)	Highest quintile: Men: 4.23 Women: 4.11
Total protein Foods (oz eq/4,187 kJ)	Min score: 0 (0 pts) Max score: ≥ 2.5 (5 pts)						
Dairy[d] (cup eq/4,187 kJ)	Min score: 0 (0 pts) Max score: ≥ 1.3 (10 pts)					Low-fat dairy[e] (cup eq/d)	Highest quintile: Men: 2.89

Dietary quality indexes, scoring, and criteria

HEI-2010[a]		AHEI-2010[a]		aMED[b]		DASH	
0–100 points total (12 components: 0–5, 0–10, 0–20 points (pts) each)		0–110 points total (11 components: 0-10 pts each)		0–9 points total (9 components: 0-1 pt each)		8–40 points total (8 components: 1–5 pts each)	
Component	**Criteria for extreme scores**	**Component**	**Criteria for extreme scores**	**Component**	**MEC-specific median for optimal score**	**Component**	**MEC-specific mean intake for optimal quintile**
							Women: 2.82
PUFA+MUFA: SFA	Min score: < 1.2 (0 pts) Max score: ≥ 2.5 (10 pts)	Trans fat %	Min score: ≥ 4 (0 pts) Max score: ≤ 0.5 (10 pts)	MUFA:SFA	Men > 1.22 Women > 1.20		
		EPA+DHA (mg/d)	Min score: 0 (0 pts) Max score: 250 (10 pts)				
		PUFA %	Min score: ≤ 2 (0 pts) Max score: ≥ 10 (10 pts)				
		Alcohol (drinks/d)	Min score: ≥3.5 and ≥2.5 (men and women)[f] Max score: 0.5–2 and 0.5–1.5 (men and women) (10 pts)	Alcohol (g/d)	Min score: <10 and >25 or <5 or >15 (men and women), Max score: 10–25 and 5–15 (men and women)		
		Red & processed meat[g] (oz eq/d)	Min score: ≥1.5 (0 pts) Max score: 0 (10 pts)	Red & processed meat[g] (oz eq/d)	Men < 1.32 Women < 2.04	Red & processed meat[g] (oz eq/d)	Lowest quintile: Men: 0.61 Women: 0.38
Refined grains[g] (oz eq/4,187 kJ)	Min score: ≥ 4.3 (0 pts) Max score: ≤ 1.8 oz (10 pts)						
Empty calories[g,j] % of calories	Min score: ≥ 50 (0 pts) Max score: ≤ 19 (20 pts)						
		SSB & fruit juice[g,h] (g/d)	Min score: ≥1 (0 pts) Max score: 0 (10 pts)			SSB & fruit juice[g,i] (g/d)	Lowest quintile: Men: 0.49 Women: 0
Sodium[g] (g/4,187 kJ)	Min score: ≥ 2.0 (0 pts) Max score: ≤ 1.1 (10 pts)	Sodium[f]	Min score: Highest decile Max score: Lowest decile (mean intake (g/day): 1.34 and 1.08 (men and women))			Sodium[g] (g/d)	Lowest quintile: Men: 1.7 Women: 1.4

DHA= docosahexaenoic acid, EPA= eicosapentaenoic acid, eq = equivalents, MUFA = monounsaturated fatty acids, oz = ounce, PUFA = polyunsaturated fatty acids, SFA = saturated fatty acids, SSB = sugar-sweetened beverages

1 cup= 237 mL

1 ounce= 28 g

For each component, minimum to maximum score points are indicated. The resulting component scores were summed to create the total score points, for which minimum and maximum are specified.

[a]AHEI-2010, HEI-2010: For intermediate intakes, score values were proportionally scored.

[b]aMED: One point is scored for intake at or greater than the sex-specific median and 0 score for intakes below the median for whole grains, vegetables (excluding potatoes), fruit, nuts, legumes, fish, and FA ratio (MUFA:SFA); and 1 point is given for intakes less than the sex-specific median and 0 score for intakes at or greater for red and processed meat.

[c]Does not include popcorn, wheat germ, or wheat bran.

[d]Foods included in this definition: whole milk, other cheese (American, cheddar, or cream cheese), and cottage cheese.

[e]Foods included in this definition: cottage cheese; low-fat cheese; low-fat/1% or 2% milk; non-fat/skim milk or butter milk; yogurt; and ice milk, frozen yogurt, sherbet.

[f]Moderate drinkers (amounts in table) received maximum points, non-drinkers received 2.5 points, and heavy drinkers (over amounts in table) received progressively lower points.

[g]Components were reverse scored such that higher intake is associated with a lower score.

[h]Foods included in this definition: other fruit juices or fruit drinks; orange or grapefruit juice; and regular sodas.

[i]Foods included in this definition: other fruit juices or fruit drinks, and regular sodas.

[j]Energy (kJ) from solid fat, added sugars, alcohol.

Table 2

Participants characteristics by dietary index categories in men [a]

	HEI-2010			AHEI-2010			aMED			DASH		
	C1	C3	C5	C1	C3	C5	C1	C3	C5	C1	C3	C5
Index points	51.7 (7.0)	66.2 (2.9)	80.6 (5.9)	51.5 (6.4)	64.9 (2.6)	77.6 (5.9)	2 (1)	4 (0)	7 (0)	18 (3)	24 (2)	30 (3)
n	8,383	8,384	8,383	8,383	8,384	8,383	7,403	8,074	5,154	8,157	9,652	9,605
Age at cohort entry (years)	54 (14)	59 (17)	62 (16)	54 (15)	59 (17)	62 (16)	56 (16)	58 (17)	61 (17)	54 (14)	60 (16)	62 (17)
Ethnicity (%)												
White	17.8	18.7	24.6	21.4	19.5	19.8	17.9	19.2	12.8	10.5	23.7	32.0
Native Hawaiian	24.8	19.1	15.9	22.3	21.1	14.9	18.4	19.9	11.1	26.2	22.7	15.6
Japanese American	19.2	21.4	18.5	17.2	19.9	22.9	16.6	19.3	12.4	24.5	22.5	18.0
BMI (kg/m^2)	25.3 (5.0)	25.2 (4.5)	24.5 (4.2)	25.3 (4.9)	25.3 (4.6)	24.5 (4.3)	25.3 (4.7)	25.3 (4.6)	24.6 (4.3)	25.4 (4.9)	25.3 (4.5)	24.4 (4.2)
Energy intake (kJ)	9,538 (5,439)	9,479 (4,974)	9,035 (4,480)	8,855 (4,986)	9,525 (5,200)	9,634 (4,375)	7,289 (3,693)	9,023 (4,358)	11,752 (5,405)	8,884 (4,622)	9,282 (5,150)	9,948 (4,827)
Physical activity (hours / week)	1.6 (0.4)	1.7 (0.3)	1.7 (0.3)	1.6 (0.4)	1.7 (0.3)	1.7 (0.3)	1.6 (0.3)	1.7 (0.3)	1.7 (0.4)	1.6 (0.4)	1.7 (0.3)	1.7 (0.3)
Smoking (% never smoker)	23.2	31.8	47.1	26.6	33.3	38.0	28.8	31.2	39.8	23.9	32.3	53.6
Education (% graduated college)	28.6	37.3	43.7	31.9	37.2	41.1	33.7	36.6	40.5	26.9	37.8	45.6
Red meat intake (g / 4,187 kJ / day)	32.7 (21.7)	28.4 (19.3)	15.4 (15.6)	32.7 (21.0)	27.4 (19.3)	16.6 (16.9)	33.7 (20.8)	27.3 (20.1)	17.5 (17.2)	38.3 (19.5)	27.0 (16.9)	13.7 (13.5)
No regular soda consumption (%)	22.6	31.9	51.5	18.9	32.2	54.5	29.5	34.1	41.6	13.8	34.0	56.7
Alcohol intake < 1 drink / month (%)	38.3	37.1	38.5	41.7	38.8	29.1	42.8	36.7	30.3	36.5	36.6	38.3
Coffee intake < 1 cup / day (%)	14.0	13.8	19.2	15.7	14.7	15.6	14.6	14.4	16.2	13.7	14.1	18.5

C1= lowest index category, C3= bottom index category, C5= highest index category.

[a] Unless otherwise indicated, values represent medians with interquartile ranges.

1 cup= 237 mL

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Table 3

Participants characteristics by dietary index categories in women[a]

	HEI-2010			AHEI-2010			aMED			DASH		
	C1	C3	C5	C1	C3	C5	C1	C3	C5	C1	C3	C5
Index points	55.9 (7.5)	70.9 (2.8)	83.7 (5.1)	53.2 (6.2)	65.9 (2.4)	77.7 (5.2)	2 (1)	4 (0)	6 (1)	18 (3)	24 (2)	30 (3)
n	9,453	9,453	9,453	9,453	9,453	9,453	8,902	8,954	12,781	8,387	11,447	10,898
Age at cohort entry (years)	53 (14)	58 (16)	63 (15)	53 (14)	58 (16)	62 (15)	54 (16)	58 (16)	61 (16)	53 (13)	58 (16)	62 (16)
Ethnicity (%)												
White	17.4	20.0	23.2	21.7	19.4	19.4	20.4	18.6	25.9	9.9	24.9	31.0
Native Hawaiian	25.2	19.7	16.0	23.3	20.6	15.4	18.7	19.0	28.2	25.6	23.1	17.4
Japanese Americans	18.4	20.6	20.3	16.3	20.1	23.5	17.3	19.3	27.8	20.0	24.3	19.9
BMI (kg/m^2)	24.1 (6.3)	23.5 (5.5)	22.7 (4.8)	24.1 (6.3)	23.5 (5.5)	22.7 (5.0)	23.7 (5.7)	23.4 (5.6)	23.2 (5.3)	24.3 (6.2)	23.5 (5.7)	22.6 (5.0)
Energy intake (kJ)	7,469 (4,430)	7,478 (3,982)	7,511 (3,785)	6,582 (3,659)	7,612 (4,333)	8,185 (3,747)	5,552 (2,621)	7,260 (3,312)	9,655 (4,626)	6,732 (3,471)	7,448 (4,145)	8,369 (4,124)
Physical activity (hours / week)	1.6 (0.4)	1.6 (0.3)	1.6 (0.3)	1.6 (0.4)	1.6 (0.3)	1.6 (0.3)	1.6 (0.3)	1.6 (0.3)	1.6 (0.3)	1.6 (0.4)	1.6 (0.3)	1.6 (0.3)
Smoking (% never smoker)	47.9	58.3	62.7	50.3	58.8	61.1	51.5	57.2	61.8	50.5	59.2	60.9
Education (% graduated college)	25.3	32.8	36.0	29.4	32.0	34.4	29.2	31.0	33.9	23.9	32.6	37.7
Red meat intake (g / 4,187 kJ / day)	29.7 (21.6)	22.4 (17.5)	12.1 (13.1)	28.9 (21.5)	21.9 (18.3)	13.6 (14.4)	29.2 (20.8)	21.9 (18.8)	15.7 (15.9)	35.7 (18.7)	21.7 (15.1)	10.3 (10.6)
No regular soda consumption (%)	32.3	48.1	64.0	30.6	47.8	65.7	42.9	48.2	50.6	22.8	48.6	68.8
Alcohol intake < 1 drink / month (%)	66.1	64.0	63.5	67.4	65.5	58.8	68.0	64.7	60.5	69.4	64.1	60.3
Coffee intake < 1 cup / day (%)	17.8	17.1	21.0	20.4	16.8	19.3	17.4	18.2	19.1	17.7	17.4	20.6

C1= lowest index category, C3= bottom index category, C5= highest index category.

[a]Unless otherwise indicated, values represent medians with interquartile ranges.

1 cup= 237 mL

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Table 4

Association between 4 dietary indexes and type 2 diabetes risk in men [a]

Index category (C) (min/max limits)	All men		White men		Native Hawaiian men		Japanese American men	
	N (cases) / N (total)	Multivariate HR (95% CI)	N (cases) / N (total)	Multivariate HR (95% CI)	N (cases) / N (total)	Multivariate HR (95% CI)	N (cases) / N (total)	Multivariate HR (95% CI)
HEI-2010								
C1 (21–57)	1,244 / 8,383	1.00	270 / 2,855	1.00	226 / 1,227	1.00	597 / 3,388	1.00
C2 (57–63)	1,281 / 8,384	1.00 (0.93,1.08)	263 / 2,755	1.00 (0.84,1.19)	221 / 1,106	1.06 (0.88,1.28)	666 / 3,727	1.00 (0.90,1.12)
C3 (63–69)	1,206 / 8,384	0.99 (0.92,1.08)	258 / 3,009	0.97 (0.81,1.15)	195 / 946	1.17 (0.96,1.42)	632 / 3,780	0.95 (0.85,1.07)
C4 (69–76)	1,088 / 8,384	0.94 (0.87,1.03)	278 / 3,502	0.96 (0.81,1.14)	163 / 882	1.04 (0.85,1.28)	575 / 3,489	0.95 (0.84,1.07)
C5 (76–100)	972 / 8,383	0.93 (0.85,1.01)	269 / 3,945	0.89 (0.74,1.06)	128 / 788	0.95 (0.76,1.19)	514 / 3,264	0.97 (0.86,1.10)
HEI-2010 / SD[b]	5,791 / 41,918	0.97 (0.94,1.00)	1,338 / 16,066	0.94 (0.89,0.99)	933 / 4,949	0.98 (0.91,1.05)	2,984 / 17,648	0.99 (0.95,1.03)
AHEI-2010								
C1 (25–56)	1,217 / 8,383	1.00	352 / 3,431	1.00	210 / 1,104	1.00	527 / 3,039	1.00
C2 (56–62)	1,256 / 8,384	1.00 (0.92,1.08)	279 / 3,197	0.83 (0.71,0.97)	222 / 1,092	1.07 (0.88,1.29)	621 / 3,353	1.06 (0.94,1.19)
C3 (62–67)	1,168 / 8,384	0.93 (0.86,1.01)	264 / 3,131	0.85 (0.73,1.00)	221 / 1,043	1.10 (0.91,1.33)	585 / 3,506	0.96 (0.85,1.08)
C4 (67–73)	1,117 / 8,384	0.90 (0.83,0.98)	239 / 3,125	0.82 (0.70,0.97)	147 / 975	0.80 (0.64,0.99)	616 / 3,702	0.96 (0.85,1.08)
C5 (73–101)	1,033 / 8,383	0.88 (0.81,0.96)	204 / 3,182	0.74 (0.62,0.88)	133 / 735	0.97 (0.77,1.21)	635 / 4,048	0.94 (0.83,1.06)
AHEI-2010 / SD[b]	5,791 / 41,918	0.95 (0.92,0.97)	1,338 / 16,066	0.90 (0.85,0.95)	933 / 4,949	0.96 (0.90,1.03)	2,984 / 17,648	0.96 (0.93,1.00)
aMED								
C1 (0–2)	1,090 / 7,403	1.00	281 / 2,876	1.00	187 / 908	1.00	516 / 2,929	1.00
C2 (3–3)	1,036 / 6,990	0.99 (0.91,1.08)	255 / 2,582	1.04 (0.88,1.24)	159 / 803	0.90 (0.73,1.12)	525 / 3,050	0.98 (0.87,1.11)
C3 (4–4)	1,110 / 8,074	0.92 (0.84,1.00)	248 / 3,077	0.85 (0.71,1.01)	178 / 983	0.81 (0.66,1.01)	589 / 3,410	0.99 (0.87,1.11)
C4 (5–6)	1,896 / 1,4297	0.87 (0.80,0.95)	426 / 5,480	0.82 (0.69,0.96)	303 / 1,704	0.81 (0.66,1.00)	985 / 6,070	0.91 (0.81,1.02)
C5 (7–9)	659 / 5,154	0.89 (0.80,0.99)	128 / 2,051	0.72 (0.57,0.90)	106 / 551	0.89 (0.68,1.17)	369 / 2,189	0.99 (0.85,1.15)
aMED / SD[b]	5,791 / 41,918	0.95 (0.92,0.98)	1,338 / 16,066	0.90 (0.84,0.95)	933 / 4,949	0.95 (0.88,1.03)	2,984 / 17,648	0.98 (0.93,1.02)
DASH								
C1 (9–19)	1,441 / 8,157	1.00	190 / 1,686	1.00	279 / 1,297	1.00	826 / 4,327	1.00
C2 (20–22)	1,270 / 8,554	0.91 (0.84,0.98)	274 / 2,691	0.90 (0.75,1.08)	217 / 1,134	0.93 (0.78,1.12)	657 / 3,986	0.87 (0.79,0.97)
C3 (23–25)	1,355 / 9,652	0.91 (0.85,0.99)	360 / 3,812	0.87 (0.72,1.04)	204 / 1,122	0.90 (0.75,1.09)	666 / 3,963	0.91 (0.82,1.01)
C4 (26–27)	744 / 5,950	0.86 (0.78,0.94)	214 / 2,734	0.74 (0.61,0.91)	112 / 623	0.86 (0.68,1.08)	352 / 2,201	0.90 (0.79,1.03)

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	All men		White men		Native Hawaiian men		Japanese American men	
Index category (C) (min/max limits)	**N (cases) / N (total)**	**Multivariate HR (95% CI)**	**N (cases) / N (total)**	**Multivariate HR (95% CI)**	**N (cases) / N (total)**	**Multivariate HR (95% CI)**	**N (cases) / N (total)**	**Multivariate HR (95% CI)**
C5 (28–39)	981 / 9,605	0.79 (0.73,0.87)	300 / 5,143	0.63 (0.52,0.76)	121 / 773	0.79 (0.63,0.99)	483 / 3,171	0.90 (0.80,1.02)
DASH / SD[b]	5,791 / 41,918	0.93 (0.90,0.96)	1,338 / 16,066	0.83 (0.78,0.89)	933 / 4,949	0.94 (0.88,1.01)	2,984 / 17,648	0.97 (0.93,1.01)

Values are hazard ratios (HR) and 95% confidence intervals (CI). Dietary indexes were divided into five sex-specific categories using the lowest category as reference category (C1, lowest, C5, highest index category). Additionally, dietary pattern scores were assessed as continuous variable (calculated as index divided by respective standard deviation (SD)).

[a]Model 2: Stratified by age, adjusted for physical activity (hours/week), smoking (current smoker, past smoker, never smoker), education years (<12, 12, 13–15, and ≥16 years), total energy intake (kJ/day) and body mass index (BMI; <22, 22-<25, 25-<30, and ≥30 kg/m^2). Models including men of all ethnicities combined were additionally adjusted for ethnicity (white, Japanese American, and Native Hawaiian).

[b]*p* for ethnicity by score interaction for men, HEI-2010: 0.03, AHEI-2010: 0.003, aMED 0.008, DASH: <0.001

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Table 5

Association between 4 dietary indexes and type 2 diabetes risk in women [a]

	All women		White women		Native Hawaiian women		Japanese American women	
Index category (C) (min/max limits)	**N (cases) / N (total)**	**Multivariate HR (95% CI)**	**N (cases) / N (total)**	**Multivariate HR (95% CI)**	**N (cases) / N (total)**	**Multivariate HR (95% CI)**	**N (cases) / N (total)**	**Multivariate HR (95% CI)**
HEI-2010								
C1 (20–61)	1,237 / 9,453	1.00	180 / 2,742	1.00	309 / 1,648	1.00	531 / 3,702	1.00
C2 (61–68)	1,220 / 9,454	1.01 (0.93,1.09)	202 / 2,765	1.17 (0.96,1.43)	252 / 1,383	0.92 (0.78,1.09)	610 / 4,150	1.05 (0.93,1.18)
C3 (68–74)	1,055 / 9,453	0.91 (0.84,0.99)	188 / 3,151	0.98 (0.79,1.20)	217 / 1,286	0.92 (0.77,1.10)	536 / 4,143	0.93 (0.82,1.05)
C4 (74–80)	1,001 / 9,454	0.93 (0.85,1.01)	195 / 3,471	1.00 (0.81,1.23)	197 / 1,175	0.95 (0.79,1.14)	497 / 4,024	0.93 (0.82,1.06)
C5 (80–100)	913 / 9,453	0.92 (0.84,1.01)	171 / 3,669	0.92 (0.74,1.14)	158 / 1,043	0.90 (0.73,1.10)	511 / 4,089	1.01 (0.89,1.15)
HEI-2010 / SD[b]	5,426 / 47,267	0.97 (0.95,1.00)	936 / 15,798	0.96 (0.90,1.03)	1,133 / 6,535	0.97 (0.92,1.04)	2,685 / 20,108	0.99 (0.95,1.04)
AHEI-2010								
C1 (30–58)	1,152 / 9,453	1.00	226 / 3,432	1.00	293 / 1,525	1.00	461 / 3,274	1.00
C2 (58–63)	1,130 / 9,454	1.01 (0.93,1.09)	213 / 3,286	1.05 (0.87,1.27)	238 / 1,440	0.85 (0.71,1.01)	512 / 3,651	1.05 (0.92,1.19)
C3 (63–68)	1,133 / 9,453	0.99 (0.91,1.08)	192 / 3,058	1.02 (0.84,1.24)	246 / 1,349	0.95 (0.79,1.13)	554 / 4,032	1.03 (0.91,1.17)
C4 (68–74)	1,091 / 9,454	0.96 (0.88,1.05)	171 / 2,961	0.94 (0.77,1.16)	193 / 1,215	0.79 (0.65,0.96)	614 / 4,426	1.06 (0.93,1.21)
C5 (74–100)	920 / 9,453	0.88 (0.80,0.97)	134 / 3,061	0.78 (0.62,0.97)	163 / 1,006	0.87 (0.71,1.06)	544 / 4,725	0.94 (0.82,1.07)
AHEI-2010 / SD[b]	5,426 / 47,267	0.95 (0.92,0.98)	936 / 15,798	0.92 (0.86,0.98)	1,133 / 6,535	0.93 (0.87,0.99)	2,685 / 20,108	0.98 (0.94,1.02)
aMED								
C1 (0–2)	1,018 / 8,902	1.00	208 / 3,216	1.00	199 / 1,222	1.00	473 / 3,487	1.00
C2 (3–3)	867 / 7,846	0.95 (0.87,1.04)	159 / 2,690	0.89 (0.72,1.09)	168 / 1,010	0.96 (0.78,1.18)	433 / 3,360	0.97 (0.85,1.11)
C3 (4–4)	1,095 / 8,954	1.02 (0.93,1.11)	184 / 2,933	0.97 (0.79,1.19)	235 / 1,243	1.04 (0.85,1.27)	545 / 3,877	1.05 (0.93,1.20)
C4 (5–5)	1,013 / 8,784	0.96 (0.88,1.06)	154 / 2,874	0.79 (0.63,1.00)	209 / 1,218	0.95 (0.76,1.17)	524 / 3,797	1.04 (0.91,1.19)
C5 (6–9)	1,433 / 12,781	0.92 (0.84,1.02)	231 / 4,085	0.87 (0.70,1.09)	322 / 1,842	0.94 (0.76,1.17)	710 / 5,587	0.97 (0.84,1.11)
aMED / SD[b]	5,426 / 47,267	0.97 (0.94,1.00)	936 / 15,798	0.93 (0.86,1.00)	1,133 / 6,535	0.97 (0.90,1.05)	2,685 / 20,108	1.00 (0.95,1.05)
DASH								
C1 (9–19)	1,265 / 8,387	1.00	129 / 1,568	1.00	314 / 1,675	1.00	637 / 4,025	1.00
C2 (20–22)	1,188 / 9,408	0.91 (0.84,0.98)	212 / 2,627	1.08 (0.86,1.35)	217 / 1,342	0.85 (0.71,1.01)	606 / 4,357	0.89 (0.80,1.00)
C3 (23–25)	1,297 / 1,1447	0.85 (0.79,0.93)	225 / 3,932	0.80 (0.64,1.00)	294 / 1,509	1.00 (0.84,1.18)	624 / 4,887	0.83 (0.74,0.94)
C4 (26–27)	732 / 7,127	0.82 (0.75,0.90)	153 / 2,778	0.80 (0.62,1.02)	136 / 870	0.79 (0.64,0.98)	362 / 2,848	0.85 (0.75,0.98)

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Index category (C) (min/max limits)	All women		White women		Native Hawaiian women		Japanese American women	
	N (cases) / N (total)	Multivariate HR (95% CI)	N (cases) / N (total)	Multivariate HR (95% CI)	N (cases) / N (total)	Multivariate HR (95% CI)	N (cases) / N (total)	Multivariate HR (95% CI)
C5 (28–39)	944 / 10,898	0.77 (0.70,0.84)	217 / 4,893	0.69 (0.55,0.88)	172 / 1,139	0.84 (0.68,1.03)	456 / 3,991	0.81 (0.71,0.93)
DASH / SD[b]	5,426 / 47,267	0.91 (0.88,0.94)	936 / 15,798	0.86 (0.79,0.92)	1,133 / 6,535	0.94 (0.88,1.01)	2,685 / 20,108	0.93 (0.89,0.97)

Values are hazard ratios (HR) and 95% confidence intervals (CI). Dietary indexes were divided into five sex-specific categories using the lowest category as reference category (C1, lowest, C5, highest index category). Additionally, dietary pattern scores were assessed as continuous variable (calculated as index divided by respective standard deviation (SD)).

[a]Model 2: Stratified by age, adjusted for physical activity (hours/week), smoking (current smoker, past smoker, never smoker), education years (<12, 12, 13–15, and ≥16 years), total energy intake (kJ/day) and body mass index (BMI; <22, 22–<25, 25–<30, and ≥30 kg/m^2). Models including women of all ethnicities combined were additionally adjusted for ethnicity (white, Japanese American, and Native Hawaiian).

[b]*p* for ethnicity by score interaction for women, HEI-2010: 0.54, AHEI-2010: 0.55, aMED: 0.91, DASH: 0.42

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Table 6

β-coefficients for developing type 2 diabetes for increase of one SD in the HEI-2010 score and proportion of exposure effect (PEE) explained after alternate subtraction of its components as well as subsequent adjustment for food items related to type 2 diabetes in white men [a]

Dietary variables	β-coefficients	PEE (%)
Original HEI-2010 score	−0.06	
HEI without total vegetables	−0.06	0
HEI without greens & beans	−0.06	0
HEI without total fruit	−0.06	0
HEI without whole fruit	−0.06	0
HEI without whole grains	−0.04	33
HEI without dairy products	−0.05	17
HEI without total protein foods	−0.07	−17
HEI without seafood and plant proteins	−0.06	0
HEI without PUFA+MUFA:SFA ratio	−0.07	−17
HEI without refined grains	−0.03	50
HEI without sodium	−0.05	17
HEI without empty calories[b]	−0.11	−83

[a]stratified by age, adjusted for physical activity (hours/week), smoking (current smoker, past smoker, never smoker), education years (<12, 12, 13–15, and ≥16 years), body mass index (BMI; <22, 22-<25, 25-<30, and ≥30 kg/m^2) and total energy intake (kJ /day).

[b]Empty calories: Energy from solid fat, added sugars, alcohol

Table 7

β-coefficients for developing type 2 diabetes for increase of one SD in the aMED score and proportion of exposure effect (PEE) explained after alternate subtraction of its components in all men and white men [a]

Dietary variables	β-coefficients	PEE (%)	β-coefficients	PEE (%)
	all men		white men	
Original aMED score	−0.05		−0.11	
aMED without total vegetables	−0.05	0	−0.11	0
aMED without total fruits	−0.06	−20	−0.13	−18
aMED without nuts	−0.04	20	−0.09	18
aMED without legumes	−0.05	0	−0.11	0
aMED without fish	−0.05	0	−0.11	0
aMED without whole grains	−0.05	0	−0.09	18
aMED without MUFA/SFA ratio	−0.06	−20	−0.13	−18
aMED without alcohol	−0.04	20	−0.11	0
aMED without red meat	−0.07	−40	−0.07	36

[a] stratified by age, adjusted for physical activity (hours/week), smoking (current smoker, past smoker, never smoker), education years (<12, 12, 13–15, and ≥16 years), body mass index (BMI; <22, 22-<25, 25-<30, and ≥30 kg/m^2) and total energy intake (kJ /day). Models including men of all ethnicities combined were additionally adjusted for ethnicity (white, Japanese American, and Native Hawaiian).

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Table 8

β-coefficients for developing type 2 diabetes for increase of one SD in the AHEI-2010 and DASH score and proportion of exposure effect (PEE) explained after alternate subtraction of its components[a]

Dietary variables	β-coefficients	PEE (%)	β-coefficients	PEE (%)	β-coefficients	PEE (%)	β-coefficients	PEE (%)	β-coefficients	PEE (%)
	all men		**white men**		**all women**		**white women**		**Native Hawaiian women**	
Original AHEI-2010 score	−0.05		−0.11		−0.05		−0.08		−0.07	
AHEI without total vegetables	−0.05	0	−0.11	0	−0.06	−20	−0.09	−13	−0.09	−29
AHEI without whole fruits	−0.06	−20	−0.12	−9	−0.05	0	−0.07	13	−0.06	14
AHEI without whole grains	−0.05	0	−0.09	18	−0.04	20	−0.07	13	−0.06	14
AHEI without SSB[a] and fruit juices	−0.05	0	−0.08	27	−0.04	20	−0.06	25	−0.05	29
AHEI without nuts & legumes	−0.05	0	−0.11	0	−0.06	−20	−0.09	−13	−0.08	−14
AHEI without *trans* fat	−0.06	−20	−0.12	−9	−0.06	−20	−0.09	−13	−0.07	0
AHEI without EPA+DHA	−0.06	−20	−0.13	−18	−0.08	−60	−0.11	−38	−0.11	−57
AHEI without PUFAs	−0.06	−20	−0.12	−9	−0.06	−20	−0.11	−38	−0.07	0
AHEI without alcohol	−0.05	0	−0.12	−9	−0.04	20	−0.06	25	−0.05	29
AHEI without sodium	−0.05	0	−0.11	0	−0.05	0	−0.07	13	−0.07	0
AHEI without red meat	−0.04	20	−0.11	0	−0.04	20	−0.07	13	−0.06	14
	all men		**white men**		**all women**		**white women**		**Japanese American women**	
Original DASH score	−0.07		−0.19		−0.09		−0.15		−0.07	
DASH without total vegetables	−0.07	0	−0.17	11	−0.11	−22	−0.16	−7	−0.08	−14
DASH without total fruits	−0.17	−143	−0.21	−11	−0.09	0	−0.16	−7	−0.08	−14
DASH without nuts, seeds & legumes	−0.07	0	−0.16	16	−0.08	11	−0.16	−7	−0.06	14
DASH without low-fat dairies	−0.07	0	−0.16	16	−0.08	11	−0.14	7	−0.06	14
DASH without whole grains	−0.07	0	−0.17	11	−0.09	0	−0.14	7	−0.08	−14
DASH without sodium	−0.07	0	−0.19	0	−0.09	0	−0.15	0	−0.07	0
DASH without SSB[a] & fruit juices	−0.07	0	−0.16	16	−0.08	11	−0.12	20	−0.06	14
DASH without red meat	−0.05	29	−0.16	16	−0.08	11	−0.14	7	−0.06	14

[a]stratified by age, adjusted for physical activity (hours/week), smoking (current smoker, past smoker, never smoker), education years (<12, 12, 13–15, and ≥16 years), body mass index (BMI; <22, 22-<25, 25-<30, and ≥30 kg/m^2) and total energy intake (kJ /day). In models including men or women of all ethnicities combined, additional adjustment for ethnicity (white, Japanese American, and Native Hawaiian) was performed.

b sugar-sweetened beverages

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