Web Material

Adherence to 5 diet quality indices and pancreatic cancer risk in a large US prospective cohort

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Web Appendix 1

The HEI-2015 score (1) is based on the 2015–2020 US Dietary Guidelines for Americans and includes 13 diet components for a total of 100 points. A HEI-2015 score of "0" is meeting no guidelines and "100" is meeting all guidelines. Details on the HEI-2015 construct validity, reliability, and criterion validity are described elsewhere (2). The nine "adequacy" components (those recommended for inclusion in a healthy diet) include total fruits, whole fruits, total vegetables, greens and beans, whole grains, dairy, total protein foods, seafood and plant proteins, and healthy fatty acids. Five points were assigned for those meeting guidelines for total fruits, whole fruits, total vegetables, and seafood and plant protein, whereas 10 points were assigned to those meeting recommendations for whole grains, total dairy, and fatty acid ratio. The four "moderation" components (those that should be consumed sparingly) include refined grains, sodium, added sugars, and saturated fats. Moderation components are reversed scored, with lower intake levels given higher scores (10 points each). Each component, except for fatty acid ratio, was energy adjusted using the density method (per 1,000 kcal or as a percentage of energy).

The AHEI-2010 score is based on clinical and epidemiologic studies of foods and nutrients that are consistently associated with reduced risk of chronic disease (3). It has 11 components scored from 0 to 10 for a total score ranging from 0 points (nonadherence) to 110 points (perfect adherence). For the six components including fruits, vegetables (excluding potatoes), nuts and legumes, whole grains, polyunsaturated fatty acid (PUFA), and eicosapentaenoic acid (EPA) + docosahexaenoic acid (DHA), higher intake corresponds to a higher score. The AHEI-2010 assigns 10 points to moderate alcohol consumption, 0 points to heavy alcohol consumption, and nondrinkers receive 2.5 points (3). For the remaining four

components, including sugar-sweetened beverages and fruit juice, red and processed meat, sodium, and *trans*-fat, higher intake corresponds to lower points.

The aMED score by Fung et al (4) assesses adherence to a traditional Mediterranean diet in the US population and includes 9 components which are scored as 0 or 1 for a total of up to 9 points. One point is scored for intake at or greater than the sex-specific cohort median for whole grains, vegetables (excluding potatoes), fruits, nuts, legumes, fish, and fatty acid ratio (MUFA: saturated fat), as well as intake less than the sex-specific median for red and processed meat. For alcohol, one point is scored for moderate intake in men (10 to 25g/d) and women (5 to 15g/d).

The two DASH scores were developed from randomized controlled feeding trials that examined the effects of diet on blood pressure (5-7). The DASH diet is high in fruits, vegetables, whole cereal products, low-fat dairy products, fish, chicken, and lean meats to be designed to be low in saturated fat and cholesterol; moderately high in protein; high in minerals (potassium, magnesium, and calcium) and fiber; and low in sodium (5-7). The DASH-Fung pattern scores 8 components from 1 to 5 for a total of up to 40 points (8). Scores are based on sex-specific quintiles and ranges from 1 point (lowest quintiles) to 5 points (highest quintiles) for whole grains, vegetables (excluding potatoes), fruits, nuts and legumes, and low-fat dairy components. For sodium, sugar-sweetened beverages, and red and processed meat, scores ranged from 1 (highest quintile) to 5 (lowest quintile). The DASH-Mellen score is nutrient-based (9). Adherence to the DASH-Mellen diet score is defined as higher nutrient intakes for protein, fiber, magnesium, calcium, and potassium and lower nutrient intakes for total fat, saturated fat, cholesterol, and sodium. The DASH-Mellen method uses absolute targets based on a 2,100-kcal diet for both men and women. Individuals who met the goal for each components received 1 point, those who met an intermediate goal [defined as the midpoint between the

DASH diet goal and the nutrient content of the DASH control diet (5)] were given a score of 0.5 for that nutrient, and those who meet neither goal receive 0 points.

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Web Table 1. Spearman's correlation coefficients in summary scores among diet quality indices in the NIH-AARP Diet and Health Study (N=535,824)[a], United States, 1995-2011[a].

	HEI-2015	AHEI-2010	aMED	DASH-Fung	DASH-Mellen
HEI-2015	1.00				
AHEI-2010	0.53	1.00			
aMED	0.49	0.54	1.00		
DASH-Fung	0.59	0.65	0.61	1.00	
DASH-Mellen	0.64	0.35	0.27	0.49	1.00

Abbreviations: AHEI-2010, Alternative Healthy Eating Index-2010; aMED, alternate Mediterranean Diet; DASH, Dietary Approaches to Stop Hypertension; HEI-2015, Healthy Eating Index-2015.

[a]All *P*-value < 0.0001.

Web Table 2. Sex-combined association of diet quality indices and pancreatic ductal adenocarcinoma, stratified analysis by smoking (N = 515,725) in the NIH-AARP Diet and Health Study, United States, 1995-2011[a]

	Never smoker or quit >10 years ago (n = 382,628)		Current Smoker or quit <10 years ago (n = 133,097)		$P_{interaction}$
Diet quality	Case, n/ Person-years	Multivariable-Adjusted HR (95% CI)[a]	Case, n/ Person-years	Multivariable-Adjusted HR (95% CI)[a]	
HEI-2015					0.29
Quintile 1 (lowest)	334/ 852,814	1 (Referent)	289/ 1,352,026	1 (Referent)	
Quintile 2	427/ 1,001,297	1.06 (0.92, 1.22)	208/ 1,375,685	0.94 (0.79, 1.13)	
Quintile 3	429/ 1,077,466	0.97 (0.84, 1.12)	174/ 1,388,345	0.94 (0.78, 1.13)	
Quintile 4	437/ 1,130,297	0.93 (0.81, 1.07)	140/ 1,397,974	0.86 (0.71, 1.06)	
Quintile 5 (highest)	462/ 1,191,615	0.91 (0.79, 1.05)	113/ 1,411,751	0.83 (0.66, 1.03)	
Continuous[b]		1.00 (0.99, 1.00)		0.99 (0.99, 1.00)	
P_{trend}[b]		0.06		0.03	
AHEI-2010					0.11
Quintile 1 (lowest)	357/ 933,094	1 (Referent)	252/ 1,355,872	1 (Referent)	
Quintile 2	388/ 1,012,695	0.98 (0.85, 1.13)	197/ 1,374,542	0.90 (0.75, 1.09)	
Quintile 3	431/ 1,059,142	1.03 (0.90, 1.19)	174/ 1,386,033	0.88 (0.73, 1.07)	
Quintile 4	455/ 1,096,036	1.05 (0.92, 1.21)	159/ 1,396,290	0.87 (0.72, 1.07)	
Quintile 5 (highest)	458/ 1,152,521	1.01 (0.88, 1.16)	142/ 1,413,044	0.90 (0.73, 1.10)	
Continuous[b]		1.00 (1.00, 1.01)		1.00 (0.99, 1.00)	
P_{trend}[b]		0.59		0.16	
aMED					0.23
Quintile 1 (lowest)	432/ 1,046,777	1 (Referent)	294/ 1,541,494	1 (Referent)	
Quintile 2	411/ 959,591	1.02 (0.89, 1.17)	192/ 1,306,028	0.92 (0.77, 1.11)	
Quintile 3	411/ 1,089,611	0.89 (0.78, 1.02)	189/ 1,426,297	0.92 (0.77, 1.11)	
Quintile 4	497/ 1,314,572	0.92 (0.80, 1.05)	167/ 1,656,987	0.81 (0.66, 0.98)	
Quintile 5 (highest)	338/ 842,938	0.89 (0.76, 1.03)	82/ 994,976	0.82 (0.64, 1.05)	
Continuous[b]		0.98 (0.95, 1.01)		0.96 (0.92, 0.99)	
P_{trend}[b]		0.13		0.02	
DASH-Fung					
Quintile 1 (lowest)	479/ 1,175,726	1 (Referent)	326/ 1,750,679	1 (Referent)	0.11
Quintile 2	376/ 975,954	0.91 (0.80, 1.04)	181/ 1,318,561	0.90 (0.75, 1.08)	
Quintile 3	433/ 1,102,932	0.92 (0.80, 1.04)	189/ 1,424,111	0.99 (0.82, 1.18)	
Quintile 4	386/ 963,828	0.92 (0.81, 1.06)	130/ 1,201,939	0.90 (0.73, 1.11)	
Quintile 5 (highest)	415/ 1,035,049	0.91 (0.80, 1.05)	98/ 1,230,490	0.81 (0.65, 1.02)	
Continuous[b]		1.00 (0.98, 1.01)		0.98 (0.96, 1.00)	
P_{trend}[b]		0.42		0.03	
DASH-Mellen					0.01
Quintile 1 (lowest)	504/ 1,278,058	1 (Referent)	356/ 1,857,530	1 (Referent)	
Quintile 2	430/ 1,072,813	0.99 (0.87, 1.12)	209/ 1,454,368	0.87 (0.74, 1.04)	
Quintile 3	457/ 1,126,108	1.00 (0.88, 1.13)	161/ 1,445,390	0.80 (0.66, 0.96)	
Quintile 4	337/ 863,806	0.96 (0.84, 1.11)	110/ 1,069,644	0.85 (0.68, 1.05)	
Quintile 5 (highest)	361/ 912,705	0.97 (0.85, 1.12)	88/ 1,098,849	0.74 (0.58, 0.94)	
Continuous[b]		0.99 (0.97, 1.02)		0.94 (0.90, 0.98)	
P_{trend}[b]		0.87		0.002	

Abbreviations: AHEI-2010, Alternative Healthy Eating Index-2010; aMED, Alternate Mediterranean Diet; CI, confidence interval; DASH, Dietary Approaches to Stop Hypertension; HEI-2015, Healthy Eating Index-2015; HR, hazard ratio.

[a]Multivariable models adjusted for age at baseline (years, continuous), sex (for sex-combined analysis), BMI (<25, 25-<30, ≥30 kg/m^2, and missing), diabetes (yes vs. no), and total energy intake (kcal/day).

[b]HRs (95% CI) and P_{trend} per one-standard deviation increase.

Web Table 3: Sex-combined HRs (95% CI) for associations between diet quality indices and risk of pancreatic ductal adenocarcinoma, 5-year lagged analysis (N=535,824) in the NIH-AARP Diet and Health Study, United States, 1995-2011[a,b]

Diet quality	Quintile 1 (lowest)	Quintile 2	Quintile 3	Quintile 4	Quintile 5 (highest)	Continuous[c]	P_{trend}[c]
HEI-2015							
Cases, n/Person-years	490/1,381,961	497/1,405,477	477/1,418,110	466/1,428,003	482/1,441,311		
Age- and sex-adjusted[b]	1 (Referent)	0.96 (0.85, 1.09)	0.89 (0.79, 1.02)	0.85 (0.75, 0.96)	0.84 (0.74, 0.96)	0.99 (0.99, 1.00)	0.001
Multivariable adjusted[c]	1 (Referent)	0.96 (0.85, 1.09)	0.90 (0.79, 1.02)	0.85 (0.75, 0.97)	0.84 (0.74, 0.96)	1.00 (0.99, 1.00)	0.02
AHEI-2010							
Cases, n/Person-years	461/1,382,976	463/1,402,206	498/1,415,642	495/1,426,896	495/1,447,141		
Age- and sex-adjusted[b]	1 (Referent)	0.96 (0.85, 1.10)	1.02 (0.90, 1.15)	1.00 (0.88, 1.13)	0.97 (0.85, 1.10)	1.00 (1.00, 1.00)	0.73
Multivariable adjusted[c]	1 (Referent)	0.96 (0.85, 1.09)	1.01 (0.89, 1.15)	0.99 (0.88, 1.13)	0.97 (0.86, 1.11)	1.00 (1.00, 1.00)	0.98
aMED							
Cases, n/Person-years	561/1,576,667	484/1,334,444	483/1,456,534	520/1,692,529	364/1,014,687		
Age- and sex-adjusted[b]	1 (Referent)	1.01 (0.89, 1.14)	0.91 (0.81, 1.03)	0.86 (0.76, 0.97)	0.93 (0.82, 1.07)	0.98 (0.96, 1.00)	0.05
Multivariable adjusted[c]	1 (Referent)	1.00 (0.88, 1.12)	0.90 (0.79, 1.01)	0.83 (0.73, 0.94)	0.90 (0.78, 1.03)	0.98 (0.95, 1.00)	0.04
DASH-Fung							
Cases, n/Person-years	624/1,789,183	454/1,348,202	497/1,454,320	424/1,225,818	413/1,257,338		
Age- and sex-adjusted[b]	1 (Referent)	0.93 (0.83, 1.05)	0.93 (0.83, 1.05)	0.93 (0.82, 1.05)	0.87 (0.77, 0.99)	0.99 (0.98, 1.00)	0.07
Multivariable adjusted[c]	1 (Referent)	0.92 (0.81, 1.03)	0.91 (0.80, 1.02)	0.90 (0.79, 1.02)	0.84 (0.74, 0.95)	0.99 (0.98, 1.00)	0.12
DASH-Mellen							
Cases, n/Person-years	682/1,892,871	484/1,483,584	492/1,477,061	372/1,095,107	382/1,126,238		
Age- and sex-adjusted[b]	1 (Referent)	0.88 (0.78, 0.99)	0.89 (0.79, 1.00)	0.90 (0.79, 1.02)	0.89 (0.78, 1.00)	0.98 (0.96, 1.00)	0.07
Multivariable adjusted[c]	1 (Referent)	0.88 (0.78, 0.99)	0.89 (0.80, 1.00)	0.91 (0.80, 1.03)	0.90 (0.79, 1.02)	0.99 (0.96, 1.01)	0.25

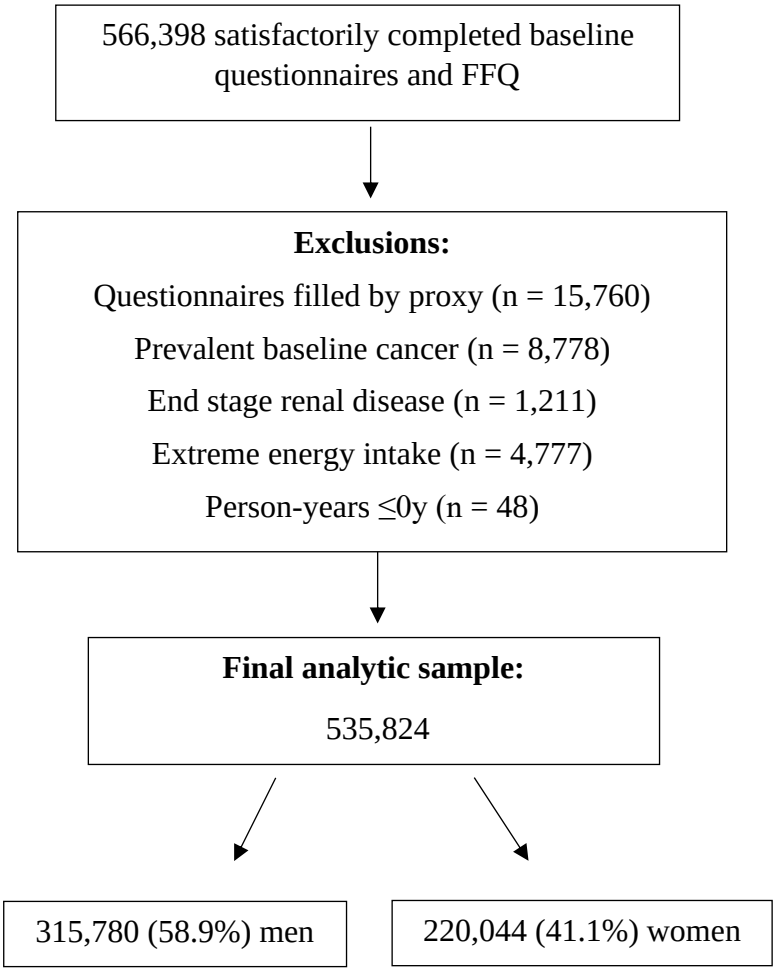
Abbreviations: AHEI-2010, Alternative Healthy Eating Index-2010; aMED, Alternate Mediterranean Diet; CI, confidence interval; DASH, Dietary Approaches to Stop Hypertension; HEI-2015, Healthy Eating Index-2015; HR, hazard ratio.

[a]Estimated using Cox proportional hazard regression model with person-years as the underlying time metric. HRs compares the risk of developing pancreatic ductal adenocarcinoma for participants in each quintile of diet quality score compared to participants in the lowest quintile (lower adherence).

[b]Multivariable models adjusted for age at baseline (years, continuous), sex (for sex-combined analysis), smoking status (never smoker, quit >10 years ago, quit 5-9 years ago, quit 1-4 years ago, quit <1 years or current smoker ≤20 cigarettes/day, quit <1 year or current smoker >20 cigarettes/day, and missing), BMI (<25, 25-<30, ≥30 kg/m^2, and missing), diabetes (yes vs. no), and total energy intake (kcal/day).

[c]HRs (95% CI) and P_{trend} per one-standard deviation increase.

Web Figure 1. Flowchart for study subject selection in the NIH-AARP Diet and Health Study, United States, 1995-2011



Abbreviations: FFQ, food frequency questionnaire.