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Nutrients, Food Groups, Dietary Patterns and Risk of Pancreatic Cancer in Postmenopausal Women

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Abstract

Introduction—Identifying modifiable risk factors for pancreatic cancer is important because of its poor prognosis. Previous findings on diet are inconsistent.

Methods—Associations between intake of nutrients, food groups, dietary patterns and pancreatic cancer risk were examined among 34,642 postmenopausal women in the Iowa Women's Health Study (IWHS).

Results—No significant associations were observed between intake of nutrients and food groups or dietary patterns and pancreatic cancer.

Conclusion—Our findings do not support the hypothesis that fruits, vegetables, and red meat are associated with pancreatic cancer.

Impact Statement—Dietary intake, assessed in multiple aspects in a large prospective cohort study, was not associated with pancreatic cancer.

Keywords

Diet; nutrient; food group; dietary pattern; pancreatic cancer

Introduction

Pancreatic cancer has an extremely poor diagnosis with a 5-year survival rate of 6%, thus identifying modifiable pancreatic cancer risk factors is important (1). A number of studies have examined the link between diet and pancreatic cancer, but the findings have been inconclusive. Reduced pancreatic cancer risk has been associated with high fruit and vegetable intake and low red meat intake mostly in case-control studies, which are subject to biases (2, 3). We examined associations between dietary intake of nutrients, food groups and dietary patterns with pancreatic cancer using data from a large prospective cohort study of postmenopausal women to test our hypothesis that high fruit and vegetable intake and low red meat intake are associated with reduced pancreatic cancer risk.

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Disclosures of Potential Conflicts of Interests
No potential conflicts of interest were disclosed.

Methods

The Iowa Women's Health Study (IWHS) is a prospective cohort study of cancer among women in Iowa. In 1986, 41,836 women (42%) of the 99,826 randomly selected women aged 55 to 69 in Iowa completed a self-administered questionnaire including the Harvard food frequency questionnaire (FFQ). We excluded 3,896 women with a history of cancer at baseline (except non-melanoma skin cancer), 2,781 women with >30 items blank on FFQ or implausible energy intake (<600 or >5,000 kcal/day), 513 premenopausal women and 4 atypical pancreatic tumors (ICD-O-3 codes 81503, 82463, and 88903). Incident pancreatic cancers diagnosed in Iowa through the end of 2007 were ascertained by the Iowa Department of Health Registry. A total of 256 incident pancreatic cancers among 34,642 cohort members during the 16.3 mean person-years were included in the analysis. This study was approved by the University of Minnesota Institutional Review board.

Dietary intake of 19 nutrients and 23 food groups and dietary pattern scores were adjusted for total energy intake using residual and density methods, respectively. Dietary patterns were derived by principal component analysis using an orthogonal rotation procedure. Factor scores for six dietary patterns were computed for each study subject. Logarithmically transformed values were used for dietary exposures because of skewed distributions.

We estimated hazard ratios (HRs) and 95% confidence intervals (CIs) for pancreatic cancer in upper quintiles of dietary exposures with the lowest quintile as a reference group using Cox proportional hazard regression models. In multivariate models, age, race, education, alcohol intake, smoking status and physical activity were included as covariates. Body mass index (BMI) and diabetes might be on the causal pathway between diet and pancreatic cancer and thus were added separately from other covariates. This study had 80% power to detect a HR in the range of 1.42–1.59 for total vegetables, total fruits, red meat, total energy and carbohydrate and 1.63 for dietary patterns.

Results

Table 1 shows baseline characteristics and pancreatic cancer risk. The mean age of the participants was 61.5 years and the participants were primarily white (92.8%). Older age, current cigarette smoking, and history of diabetes were significantly associated with pancreatic cancer; women with BMI≥30 had a 10% increased risk of borderline significance. There were no associations between dietary intake of any nutrients or food groups and pancreatic cancer (Table 2). Adjusting for BMI or diabetes history did not change the results (data not shown). Similarly, no associations were observed between dietary patterns and pancreatic cancer.

Discussion

In the present study, dietary intake of nutrients, food groups and dietary patterns were not associated with pancreatic cancer. Our results indicate that dietary factors, as assessed, are not risk factors for pancreatic cancer in this population. These results are consistent with results from other large cohort study results (4–7). Strengths of this study include a large sample size, a prospective study design, and a nearly complete follow-up.

Nonetheless, nondifferential misclassification of dietary intake is possible in most cohort studies assessing dietary intake using FFQs. Furthermore, FFQs may not capture the information that might be most relevant to pancreatic cancer risk, such as food preparation methods, food additives, and contaminants. In the current study, we could not assess meat preparation such as cooking methods and doneness. These factors should be assessed in relation to pancreatic cancer in future prospective cohort studies.

In summary, our findings do not support the hypothesis that fruits, vegetables and red meat are associated with pancreatic cancer.

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Table 1

Baseline characteristics and risk of pancreatic cancer

	Cases (n=256)	Person-years	Incidence rate[a]	HR[b] (95% CI)	p[c]
Age (mean ± SD)					
< 60	74 (28.9%)	215,407	34.4	1.0	< 0.0001
60 – < 65	91 (35.6%)	199,979	45.5	1.4 (1.0 – 1.8)	
≥ 65	91 (35.6%)	147,910	61.5	1.9 (1.4 – 2.6)	
BMI (mean ± SD)					
< 25	123 (48.0%)	271,774	45.3	1.0	0.35
25 – < 30	78 (30.5%)	191,675	40.7	0.9 (0.7 – 1.2)	
≥ 30	55 (21.5%)	99,847	55.1	1.1 (1.0 – 1.2)	
Race					
White	250 (99.6%)	552,869	45.2	1.0	0.52
Others	1 (0.4%)	4,457	22.4	0.5 (0.1 – 3.7)	
Education					
< High school	47 (18.4%)	101,635	46.2	1.0	0.81
High school	106 (41.4%)	239,376	44.3	1.0 (0.7 – 1.4)	
> High school	103 (40.2%)	222,285	46.3	1.0 (0.7 – 1.5)	
Cigarette smoking					
Never smoker	161 (63.9%)	377,586	42.6	1.0	0.001
Former smoker	40 (15.9%)	103,947	38.5	1.0 (0.7 – 1.4)	
Current smoker	51 (20.2%)	74,271	68.7	1.9 (1.4 – 2.5)	
Alcohol intake					
No	136 (53.1%)	309,944	43.9	1.0	0.36
Yes	120 (48.9%)	253,352	47.4	(0.9 – 1.4)	
Physical activity					
Low	130 (51.0%)	259,284	50.1	1.0	0.17
Moderate	64 (25.1%)	154,389	41.5	0.8 (0.6 – 1.1)	
High	61 (23.4%)	141,059	43.2	0.9 (0.6 – 1.2)	
History of diabetes					
No	232 (91.3%)	531,889	43.6	1.0	0.007

	Cases (n=256)	Person-years	Incidence rate[a]	HR[b] (95% CI)	p^c
Yes	22 (8.7%)	27,667	79.5	1.9 (1.2 – 3.0)	

[a] Per 100,000 person-years

[b] Age-adjusted hazard ratio and 95% confidence interval

[c] Wald chi-square test

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Table 2

Dietary intake of nutrients, food groups and dietary patterns and risk of pancreatic cancer

	Quintiles of dietary intake or dietary pattern scores					*p* for trend
	1 (lowest)	**2**	**3**	**4**	**5 (highest)**	
Nutrient intake						
Total calorie						
Median (kcal/d)	1,107	1,449	1,718	2,027	2,567	
Cases	56	50	51	44	55	
Age-adjusted HR	1.0	0.88 (0.60–1.28)	0.89 (0.61–1.30)	0.77 (0.52–1.15)	0.96 (0.66–1.39)	0.77
Multivariate HR[a]	1.0	0.90 (0.61–1.32)	0.86 (0.58–1.27)	0.81 (0.54–1.21)	0.97 (0.66–1.42)	0.81
Carbohydrate						
Median (g/d)	141.0	182.0	203.3	222.0	252.7	
Cases	53	74	43	44	42	
Age-adjusted HR	1.0	1.32 (0.93–1.88)	0.75 (0.50–1.12)	0.75 (0.50–1.12)	0.71 (0.47–1.07)	0.008
Multivariate HR[a]	1.0	1.38 (0.96–1.99)	0.83 (0.55–1.25)	0.84 (0.56–1.27)	0.81 (0.53–1.23)	0.06
Vitamin C						
Median (mg/d)	82.40	137.50	184.25	271.80	678.55	
Cases	53	55	47	54	47	
Age-adjusted HR	1.0	0.99 (0.68–1.45)	0.84 (0.57–1.25)	0.98 (0.67–1.44)	0.87 (0.59–1.29)	0.53
Multivariate HR[a]	1.0	1.09 (0.73–1.62)	0.97 (0.65–1.46)	1.16 (0.78–1.72)	0.99 (0.66–1.49)	0.84
Vitamin E						
Median (mg/d)	5.2	6.9	8.7	22.1	241.0	
Cases	56	51	59	51	39	
Age-adjusted HR	1.0	0.88 (0.60–1.29)	1.03 (0.71–1.48)	0.89 (0.61–1.30)	0.68 (0.45–1.02)	0.05
Multivariate HR[a]	1.0	0.93 (0.63–1.38)	1.07 (0.73–1.57)	0.95 (0.65–1.41)	0.76 (0.50–1.16)	0.13
Food group intake						
Total vegetables						
Median (servings/wk)	11.5	17.5	22.0	28.0	40.0	
Cases	48	43	53	56	56	
Age-adjusted HR	1.0	0.89 (0.59–1.35)	1.09 (0.74–1.61)	1.14 (0.78–1.68)	1.16 (0.79–1.70)	0.26
Multivariate HR[a]	1.0	0.82 (0.53–1.26)	1.13 (0.76–1.68)	1.15 (0.77–1.71)	1.21 (0.81–1.80)	0.14

	Quintiles of dietary intake or dietary pattern scores					*p* for trend
	1 (lowest)	**2**	**3**	**4**	**5 (highest)**	
Total fruits						
Median (servings/wk)	6.5	12.5	16.5	21.0	29.5	
Cases	51	53	61	48	43	
Age-adjusted HR	1.0	0.96 (0.65–1.41)	1.10 (0.75–1.59)	0.85 (0.57–1.27)	0.77 (0.51–1.15)	0.15
Multivariate HR[a]	1.0	1.12 (0.75–1.67)	1.27 (0.86–1.88)	1.02 (0.67–1.55)	0.98 (0.64–1.50)	0.71
Total vegetables and fruits						
Median (servings/wk)	22.0	32.0	4.0	48.0	64.5	
Cases	51	46	58	47	54	
Age-adjusted HR	1.0	0.85 (0.57–1.27)	1.07 (0.73–1.55)	0.85 (0.57–1.27)	1.00 (0.68–1.46)	0.97
Multivariate HR[a]	1.0	0.95 (0.63–1.43)	1.15 (0.77–1.71)	1.00 (0.66–1.51)	1.18 (0.79–1.77)	0.38
Red meat						
Median (servings/wk)	2.0	3.5	5.0	7.0	9.0	
Cases	54	43	52	55	52	
Age-adjusted HR	1.0	0.79 (0.53–1.18)	0.95 (0.65–1.39)	1.00 (0.69–1.46)	0.96 (0.65–1.40)	0.78
Multivariate HR[a]	1.0	0.85 (0.57–1.28)	0.99 (0.67–1.47)	1.06 (0.72–1.55)	0.97 (0.65–1.44)	0.79
Dietary pattern scores						
High vegetable						
Cases	49	43	58	50	56	
Age-adjusted HR	1.0	0.89 (0.59–1.34)	1.20 (0.82–1.76)	1.05 (0.71–1.56)	1.23 (0.84–1.81)	0.06
Multivariate HR[a]	1.0	0.83 (0.54–1.26)	1.19 (0.81–1.75)	1.04 (0.69–1.56)	1.25 (0.84–1.87)	0.03
Low fat						
Cases	56	50	48	52	50	
Age-adjusted HR	1.050	0.82 (0.56–1.20)	0.76 (0.52–1.12)	0.80 (0.54–1.17)	0.76 (0.52–1.12)	0.23
Multivariate HRa	1.0	0.93 (0.62–1.38)	0.90 (0.60–1.36)	0.95 (0.63–1.42)	0.97 (0.64–1.47)	0.99
Mediterranean						
Cases	54	50	39	53	60	
Age-adjusted HR	1.0	0.96 (0.65–1.41)	0.77 (0.51–1.16)	1.09 (0.75–1.59)	1.32 (0.91–1.92)	0.07
Multivariate HR[a]	1.0	0.92 (0.62–1.36)	0.69 (0.44–1.06)	1.00 (0.67–1.49)	1.27 (0.84–1.90)	0.14
High fiber						

	Quintiles of dietary intake or dietary pattern scores					*p* for trend
	1 (lowest)	**2**	**3**	**4**	**5 (highest)**	
Cases	54	56	44	56	46	
Age-adjusted HR	1.0	0.97 (0.66–1.41)	0.73 (0.49–1.09)	0.92 (0.63–1.34)	0.73 (0.49–1.09)	0.20
Multivariate HR[a]	1.0	1.04 (0.71–1.53)	0.79 (0.52–1.19)	1.08 (0.73–1.60)	0.85 (0.56–1.29)	0.74
High sweet						
Cases	50	48	59	59	40	
Age-adjusted HR	1.0	0.89 (0.60–1.32)	1.08 (0.74–1.58)	1.08 (0.74–1.57)	0.74 (0.49–1.12)	0.11
Multivariate HR[a]	1.0	0.93 (0.63–1.39)	1.05 (0.71–1.55)	1.09 (0.74–1.60)	0.74 (0.48–1.13)	0.10
High fruit						
Cases	52	52	55	49	48	
Age-adjusted HR	1.0	0.97 (0.66–1.42)	1.03 (0.70–1.50)	0.91 (0.61–1.34)	0.91 (0.62–1.35)	0.28
Multivariate HR[a]	1.0	0.96 (0.65–1.42)	1.05 (0.72–1.55)	0.94 (0.63–1.40)	0.96 (0.64–1.43)	0.41

Hazard ratios (HRs) and 95% confidence intervals (CIs) in parentheses

[a]Adjusted for age (continuous), race, education (< high school, high school, > high school), alcohol intake (yes/no), smoking (current, past, never smoker), physical activity (low, moderate, high)