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Cancer Epidemiology, Biomarkers & Prevention

*Null Results in Brief*

# 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 risk of pancreatic cancer.

**Impact:** Dietary intake, assessed in multiple aspects in a large prospective cohort study, was not associated with pancreatic cancer. *Cancer Epidemiol Biomarkers Prev; 20(4); 711–4. ©2011 AACR.*

## 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.

## 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 years 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 nonmelanoma skin cancer), 2,781 women with greater than 30 items blank on FFQ or implausible energy intake (<600 or >5,000 kcal/d), 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 6 dietary patterns were computed for each study subject. Logarithmically transformed values were used for dietary exposures because of skewed distributions.

We estimated HRs and 95% 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 an HR in the range of 1.42 to 1.59 for total vegetables, total fruits, red meat, total energy, and carbohydrate and 1.63 for dietary patterns.

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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), y | | | | | |
| <60 | 74 (28.9%) | 215,407 | 34.4 | 1.0 | <0.0001 |
| 60 to <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 to <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 | | | | | |
| Less than 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) | |
| Greater than 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 |
| Yes | 22 (8.7%) | 27,667 | 79.5 | 1.9 (1.2–3.0) | |

[a]Per 100,000 person-years.
[b]Age-adjusted HR and 95% CI.
[c]Wald $\chi^2$ test.

## 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 of 30 or greater 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 2.** Dietary intake of nutrients, food groups and dietary patterns and risk of pancreatic cancer

| | Quintiles of dietary intake or dietary pattern scores | | | | | $P_{trend}$ |
|---|---|---|---|---|---|---|
| | 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 |
| 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 HR* | 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 |

*(Continued on the following page)*

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Table 2. Dietary intake of nutrients, food groups and dietary patterns and risk of pancreatic cancer (Cont'd)

| | Quintiles of dietary intake or dietary pattern scores | | | | | $P_{trend}$ |
|---|---|---|---|---|---|---|
| | 1 (lowest) | 2 | 3 | 4 | 5 (highest) | |
| 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 | | | | | | |
| 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 |

Note: HRs and 95% CIs in parentheses.

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

## Disclosure of Potential Conflicts of Interest

No potential conflicts of interest were disclosed.

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