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NUTRIENT INTAKE PATTERNS IN GASTRIC AND COLORECTAL CANCERS

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Abstract. The purpose of the study was to present the dietary risk pattern in gastric and colorectal cancers, using the same methodological approach in a parallel hospital-based case-control study.
In all, 180 cases of colorectal cancer and 80 cases of stomach cancer, confirmed histopathologically, were enrolled from the University Hospital in Cracow.
A high intake of carbohydrates was associated with an increased risk of colorectal cancer (OR = 2.45). For stomach cancer, a moderate consumption of carbohydrates markedly increased relative risk (OR = 4.29), while a high intake of carbohydrates increased the risk by 8.73. The patterns of dietary risk factors related to intake of fats were definitively different in both cancer sites. The higher fat consumption was not associated with the higher risk of stomach cancer. A medium intake of fats increased the risk of colorectal cancer by 1.96 and that above 83 g/day by 2.20. In colorectal cancer, the significant protective effect of retinol, carotene and vitamin C has been evidenced, however, only carotene and vitamin E were inversely correlated with stomach cancer.

Key words:
Nutrients, Risk patterns, Colorectal and stomach cancers, Epidemiology

INTRODUCTION

Colorectal cancer in Poland is one of the leading causes of death from malignancies with a constant upward trend observed over the last two decades, while gastric cancer death rates have steadily been slowing down since the 1960s. This suggests that the risk patterns operating for each of the cancers may be diverse. Several case-control studies and cohort studies have shown increased gastric cancer risk with high intake of starchy foods. Most studies have consistently shown inverse associations of dietary fiber intake with cancer of stomach, as well as of colon and rectum. There was also inverse association between antioxidant vitamins, e.g. C and E, or carotenoids and gastric or colorectal cancer [1–5]. Over the last ten years, the change in dietary habits in Poland in terms of increased vegetable/fruit consumption and reduction of animal fats, may have influenced the risk patterns of gastrointestinal cancers. These changes may

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have some implications for the pattern of dietary risk factors in digestive tract cancer.

The purpose of the study was to present the dietary risk pattern in gastric and colorectal cancers, using the same methodological approach in a parallel hospital-based case-control study.

MATERIAL AND METHODS

In all, 180 (incident) cases of colorectal cancer and 80 cases of stomach cancer, confirmed histopathologically, were enrolled from the University Hospital in Cracow. The equal number of controls matched by age (± 5 years) and gender was chosen from amongst patients with no history of cancer, admitted to the same hospital for treatment of acute non-neoplastic conditions unrelated to digestive tract diseases. An interviewer-administered food frequency questionnaire, combined with quantity of foods eaten, was used to assess the usual dietary pattern for 148 beverage and food items. The dietary interview focused on the reference period that was defined as one year prior to 5 years preceding the diagnosis of cases or prior to the corresponding date of hospital admission for the controls. Basic summary statistics (mean, standard deviation, median) were calculated for both cancer sites in the case and control groups. Multiple conditional logistic regression models were used to obtain odds ratios (OR) and the corresponding 95% confidence intervals (95%CI) of various micro- and macronutrients.

RESULTS

Total energy intake and also intakes of all macronutrients were substantially higher among cases of both sites as compared to controls. On the contrary, mean intake of micronutrients was lower among the cases of both cancer sites than in controls.

As for cases, there was higher intake of energy, basic nutrients (proteins, carbohydrates and fats), in the stomach than in the colorectal cancer patients. Intakes of retinol and vitamin C have also been higher in stomach cancer cases, however, the consumption of carotene and vitamin E was reported higher in colorectal cancer cases (Table 1).

Odds ratios for colorectal and stomach cancers adjusted by the tertile nutrient intake are summarized in Table 2. They were estimated from the multiple logistic models. The first tertile was defined as reference category. The high intake of carbohydrates (3rd tertile) was associated with the increased risk of colorectal cancer (OR = 2.45) while their moderate consumption increased significantly relative risk of stomach cancer (OR = 4.29), and OR corresponding to the consumption level of the third quartile (>223.6 g/day) was 8.73 There was stronger association between high intake of disaccharides and the risk of stomach cancer (for 3rd tertile of intake, OR = 3.96) than that of colorectal cancer (OR = 1.77). Polysaccharides were positively associated only with the risk of stomach cancer (for 3rd tertile of intake OR = 3.38).

Patterns of dietary risk factors related to intake of fats were definitively different in both cancer sites. A higher fat consumption was not associated with stomach cancer, while an opposite situation was observed in the colorectal cancer series. A medium intake of fats (65–83 g/day) increased the risk of colorectal cancer by 1.96 and that above 83 g/day by 2.20. It is of interest that besides total fats, also specific components of fats have been shown to be associated with a higher risk of colorectal cancer. Of the fatty acids, high consumption of saturated fatty acids (≥33.78 g/day) was associated with OR = 1.75 and the corresponding high intake of monounsaturated fatty acids (≥27.61 g/day) with OR = 2.09. In colorectal cancer, the significant protective effects of retinol, carotene and vitamin C have been evidenced, however, only carotene and vitamin E were inversely correlated with stomach cancer.

DISCUSSION

The study confirmed a different risk pattern of dietary factors in colorectal and stomach cancers. Among macronutrients, high intake of fat appeared to be a risk factor for colorectal cancer, while a high intake of carbohydrates was particularly associated with stomach cancer. It should be stressed that not only total fat, but also intake of satu-

Table 1. Unadjusted mean nutrient intakes among cases of colorectal and stomach cancers compared with controls

Nutrients		Colorectal cancer		Stomach cancer	
		Cases (n = 180)	Controls (n = 180)	Cases (n = 80)	Controls (n = 80)
Energy kJ/day	Mean	9185.20	7928.75	9605.11	8729.00
	SD	3126.23	1978.86	3228.96	2437.66
Proteins	Mean	78.40	69.71	83.11	78.53
g/day	SD	30.72	17.69	33.04	24.04
Carbohydrates	Mean	243.00	208.71	259.55	219.70
g/day	SD	81.44	61.79	88.64	66.36
Monosaccharides	Mean	23.54	21.27	22.92	20.46
g/day	SD	11.64	14.40	9.92	9.28
Disaccharides	Mean	84.78	69.14	96.85	71.07
g/day	SD	46.78	31.15	52.11	33.43
Polysaccharides	Mean	131.86	118.25	135.66	126.04
g/day	SD	48.79	41.17	45.67	41.81
Fats	Mean	85.67	73.16	87.31	83.88
g/day	SD	36.97	19.39	36.40	28.54
Saturated	Mean	34.25	29.19	35.25	31.82
fatty acids g/day	SD	15.29	8.31	14.84	10.83
Monounsaturated	Mean	28.67	24.59	29.15	28.28
fatty acids g/day	SD	13.43	7.10	12.24	10.13
Polyunsaturated	Mean	11.77	10.20	11.38	12.31
fatty acids g/day	SD	4.95	2.72	5.22	4.95
Retinol	Mean	0.90	1.05	1.06	1.15
mg/day	SD	0.61	0.65	0.66	1.01
Carotene	Mean	2.77	3.06	2.30	2.78
mg/day	SD	2.42	4.12	1.28	1.23
Vitamin E	Mean	10.43	9.93	8.02	9.97
mg/day	SD	6.23	9.94	3.81	4.50
Vitamin C	Mean	81.55	89.42	85.94	75.66
mg/day	SD	52.11	91.65	29.70	31.94

SD – Standard deviation.

rated and monounsaturated fatty acids played a role in the occurrence of colorectal cancer. However, polyunsaturated fatty acids were not associated with the colorectal cancer risk. Thus our data support a hypothesis that besides the total amount of fat, the type of dietary fat is also a matter of importance to the etiology of colon cancer. A recent prospective study in women provided evidence that a high intake of animal fat, but not vegetable oil, increases the risk of colon cancer [6]. The results of our study of the association between fat consumption and the occurrence of colorectal cancer is in good agreement with both studies carried out by Willet et al. and the studies on animal models [7].

As for carbohydrates, our data are consistent with other studies of the role of carbohydrates or starchy foods in the occurrence of stomach cancer, which showed positive association with cooked cereals, and carbohydrate-rich foods [8–15]. Furthermore, our study confirmed that not only total amount of carbohydrates matters, but specific

Table 2. Adjusted* ORs and 95% confidence intervals of colon and stomach cancers by nutrient tertile intakes

Nutrients Tertile	Colon cancer**			Chi² for trend	Stomach cancer**			Chi² fortrend
	1	2	3		1	2	3	
Proteins	<62.9	<78.27	≥78.27	0.01	<62.9	<78.27	≥78.27	0.02
g/day	1.00	1.26	1.05	p = 0.92	1.00	1.69	1.36	p = 0.89
	–	0.70–2.26	0.57–1.92		–	0.62–4.64	0.44–3.61	
Carbohydrates	<180.0	<223.6	≥223.6	13.22	<180.0	<223.6	≥223.6	11.45
g/day	1.00	1.10	2.45	p < 0.001	1.00	4.29	8.73	p < 0.001
	–	0.57–2.13	1.39–4.32		–	1.12–16.47	2.21–34.57	
Monosaccharides	<17.20	<20.74	≥20.74	5.64	<17.20	<20.74	≥20.74	3.66
g/day	1.00	0.52	1.68	p = 0.018	1.00	1.81	1.55	p = 0.056
	–	0.28–0.96	1.00–2.81		–	0.64–5.13	0.96–6.00	
Disaccharides	<55.39	<77.6	≥77.6	5.52	<55.39	<77.6	≥77.6	7.59
g/day	1.00	0.82	1.77	p = 0.019	1.00	2.24	3.96	p = 0.006
	–	0.45-1.49	1.01–3.09		–	0.78–6.37	1.39–11.24	
Polysaccharides	<100.1	<134.6	≥134.6	1.73	<100.1	<134.63	≥134.63	3.98
g/day	1.00	1.59	1.51	p = 0.19	1.00	2.69	3.38	p = 0.046
	–	0.90–2.83	0.85–2.70		–	0.85–8.52	1.08–10.62	
Fats	<65.21	<83.14	≥83.14	5.80	<65.21	<83.14	≥83.14	0.56
g/day	1.00	1.96	2.20	p = 0.016	1.00	1.38	1.55	p = 0.45
	–	1.07–3.61	1.19–4.06		–	0.47–4.03	0.54–4.47	
Saturated	<25.56	<33.78	≥33.78	3.80	<25.56	<33.78	≥33.78	0.25
fatty acids	1.00	1.62	1.75	p = 0.051	1.00	1.09	1.30	p = 0.62
g/day	–	0.90–2.83	1.01–3.04		–	0.39–3.04	0.45–3.77	
Monounsaturated	<21.43	<27.61	≥27.61	5.27	<21.43	<27.61	≥27.61	0.15
fatty acids	1.00	1.88	2.09	p = 0.022	1.00	1.50	1.31	p = 0.70
g/day	–	1.03–3.44	1.15–2.81		–	0.55–4.12	0.50–3.44	
Polyunsaturated	<9.16	<11.51	≥11.51	3.85	<9.16	<11.51	ł11.51	0.30
fatty acids	1.00	0.85	1.67	p = 0.050	1.00	0.81	0.74	p = 0.58
g/day	–	0.48–1.51	0.95–2.94		–	0.30–2.15	0.26–2.08	
Retinol	<0.64	<1.24	≥1.24	6.0	<0.64	<1.24	≥1.24	1.26
g/day	1.00	0.88	0.50	p = 0.014	1.00	1.84	0.78	p = 0.26
	–	0.53–1.48	0.28–0.89		–	0.76–4.48	0.32–1.93	
Carotene	<2.22	<2.99	≥2.99	12.67	<2.22	<2.99	≥2.99	5.15
mg/day	1.00	0.24	0.39	p < 0.001	1.00	0.35	0.42	p = 0.023
	–	0.13–0.44	0.21–0.70		–	0.14–0.89	0.17–1.02	
Vitamin E	<7.75	<10.05	≥10.05	0.13	<7.75	<10.05	≥10.05	4.32
mg/day	1.00	0.66	0.88	p = 0.72	1.00	0.38	0.38	p = 0.038
	–	0.37–1.18	0.51–1.52		–	0.14–1.02	0.15–0.98	
Vitamin C	<66.05	<85.11	≥85.11	7.26	<66.05	<85.11	≥66.05	0.99
mg/day	1.00	0.36	0.42	p = 0.007	1.00	0.35	0.87	p = 0.32
	–	0.19–0.66	0.23–0.75		–	0.13–0.91	0.30–2.51	

* Adjusted to education, total energy, fiber intake and occupational physical activity level.
** Information per single cell: 1st line: range of tertile; 2nd line odds ratio; 3rd line: 95% confidence interval.

higher intake of disaccharides and monosaccharides is also of importance.

Our findings confirmed as well the protective effect of antioxidant vitamins against colorectal and stomach cancers which act as intracellular antioxidants. Vitamin C appeared to be protective in both cancer sites. A lower vitamin E intake was inversely associated only with stomach cancer. It may result from the fact that vitamin E not only protects polyunsaturated fatty acids in cell membranes from oxidative damage but also inhibits the formation of nitrosamines in stomach, especially at low pH. Colorectal cancer was inversely associated with retinol and carotene intake, whereas stomach cancer only with carotene consumption. As carotene is associated strongly with retinol it is not clear whether the effect of retinol was due to low intake of preformed vitamin A, or to carotenoids, or to both.

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