RESEARCH COMMUNICATION

Food Intake and Colorectal Adenomas: A Case-Control Study in Malaysia

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Abstract

It is well established that almost all colorectal cancers arise from benign, neoplastic adenomatous polyps. In previous studies, intake of fruits, vegetables and legumes were found to decrease the risk for colorectal adenomas (CRA) and colorectal cancer. This case-control study aimed to evaluate the role of a variety of foods in contributing to the risk of CRA in Malaysian subjects. One hundred and eighteen subjects were recruited into case (n=59) and control (n=59) groups at Hospital Kuala Lumpur (HKL). A pre-tested quantitative food frequency questionnaire (FFQ) was used to record the types of food items and frequency consumed. Logistic regression was used to determine the crude and adjusted odds ratios of the independent variables. Soy bean and soy products were associated with a reduced risk for CRA (OR = 0.38, 95% CI = 0.15-0.98), while tubers were associated with increase in risk four-fold (OR = 4.14, 95% CI = 1.60-10.70) and red meat intake was found to increase the risk two and a half-fold (OR = 2.51, 95% CI = 1.02-6.28). Higher servings of fruits and vegetables were found to significantly decrease the risk (OR fruits= 0.47, 95% CI = 0.30-0.74; OR vegetables = 0.49, 95% = 0.29-0.80). In conclusion, our data support protective roles for soy, fruits and vegetables in the aetiology of colorectal adenomas and increase in risk in those with high intakes of red meat and tubers. Food intake of an individual may have an influence on one's risk for developing CRA. This finding warrants further investigation before the protective effect of these food items is to be accepted. New studies should explore the possibility of these associations among individuals in the general population especially with regard to different ethnic or other groups in Malaysia with low fruit and vegetable consumption.

Key Words: Colorectal adenoma - FFQ - fruits - vegetables - red meat - soy

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Introduction

Worldwide, more than ten million people are diagnosed with cancer and six million deaths occur every year (World Health Organization, 2003), while colorectal cancer (CRC) was estimated to be the third and fourth most commonly occurring cancer worldwide among men and women respectively in the year 2002. It was estimated to contribute to 9.5% and 9.3% of total cancer cases among males and females respectively in 2002 (International Association for Cancer Registries, 2002). Among Malaysians, colon cancer ranked third among cancers reported in males and females, accounting for 7.8% and 6.0% of all cancer cases in males and females respectively in 2003 (National Cancer Registry, 2003).

It is a well-known fact that almost all CRCs arise from benign adenomatous polyps (Bond, 2000). These polyps are benign growths that protrude from the inner walls of colon and rectum, and are relatively common in people over the age of 50. American Society for Gastrointestinal Endoscopy (2006) estimated that an average 60 year-old without risk factors for polyps had a 25% chance of having a polyp. Although CRCs may arise from pre-existing adenomatous polyps or adenomas, however the progress of adenoma to cancer may take five to ten years (Young et al., 2002). Although true incidence of colorectal adenomas (CRA) are difficult to be calculated, Midgley and Kerr (1999) estimated its' prevalence to be about 35% in Europe and USA, and between 10 - 15% in Asia and Africa. No Malaysian figure is available at this date. However, verbal information obtained from the experts in the field of colorectal cancer revealed that the figure may be between 10% and 20%. About 5% to 10% of adenomatous polyps are estimated to become malignant, a process that takes five to ten years (American Society for Gastrointestinal Endoscopy, 2006).

The role of diet in the aetiology of CRC remains an area of active investigation. A predominantly plant-based diet is constantly associated with decreased risk of colorectal neoplasia. Intakes of fruits and grain appear to be inversely related to risk of CRC and polyps although less consistent evidence has been observed for vegetables (Pecipans & Sandler, 1994). Similarly, a recent study by Michels et al (2006) found that frequent consumption of

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fruits was inversely related to the risk of being diagnosed with polyps, while little association was found for vegetable consumption. The authors also found legumes to be protective of colorectal adenomas (CRA). These potentially protective associations may have resulted from the high levels of dietary fibre, antioxidants and other phytochemicals in plant foods. Although the exact mechanisms are still unclear, food groups such as dietary fat (Mathew et al., 2004), fruits and vegetables especially carotenoids vegetables, cruciferous vegetables, high vitamin C fruits (Witte et al., 1996) and red meat (Breuer-Katschinski et al., 2001) have shown to decrease the risk for CRA.

This study aims to investigate the relationship between various food groups and the risk for CRA in Malaysian subjects.

Materials and Methods

Selection of the subjects

Cognitively sound men and women who were at least 30 years of age and had completed a colonoscopy between January 2005 and December 2005 were invited to participate in the study with informed consent. Hospital Kuala Lumpur (HKL) served as the clinical center and the source of participants for this study. Ethical approval was obtained from the Clinical Research Center, HKL and the ethics committee of the faculty prior to the commencement of the research.

The inclusion criteria for selection of cases were newly diagnosed patients with one or more histologically confirmed CRA removed through polypectomy; had no other types of polyps (hyperplastic polyps, FAP and HNPCC); free from other chronic diseases and who were not involved in other studies. It is vital for individuals with other polyps and chronic diseases to be excluded from the study, as the risk factors for such conditions have already been established and it may interfere with the results of the study. The exclusion criteria included: history of colorectal and/or any other cancers or, bowel resection, polyposis syndrome, or inflammatory bowel disease; unsatisfactory colon preparation or incomplete colonoscopy; taking cholesterol-lowering drugs and have chronic medical conditions or dietary restrictions that would substantially limit their ability to complete the study.

Three hundred and forty three patients who fulfilled these criteria were selected by the surgeon in the Surgical Department of HKL. Of these patients, 157 responded to the invitation letter that was sent and attended a briefing session. Seventy five percent or 118 of those who attended the briefing session agreed to take part in this study and gave informed consent. Fifty nine subjects who had histologically confirmed adenomatous polyps removed were recruited as cases and an equal number of subjects who were found to be negative for colorectal adenomatous polyps upon colonoscopy and fulfilled the other inclusion criteria were recruited as control subjects.

Assessment

Socio-demographic information was determined using a pre-tested questionnaire. Similarly, a pre-tested food frequency questionnaire (FFQ) was used to determine the food intake of the participants. All data were collected during a face to face interview with the subjects at HKL.

A long list of FFQ was first created based on the Kajian Diet Malaysia food frequency questionnaire, and further modified after being pre-tested. Extensive list such as this would enable us to estimate the diversity in dietary intake of the respondents. Such long list of FFQ has been used in large studies such as in the Alpha-Tocopherol, Beta-Carotene Cancer Prevention Study (Pietnen et al., 1988). However, upon data collection, the food items were then grouped into few sub-groups to facilitate the analysis.

Frequency of consumption of these food items were recorded according to a five-point scale ranging from 1 to 5; everyday (5); 4 to 6 times a week (4); 1 to 3 times a week (3); 1 to 2 times a month (4) and seasonal/rarely/never (1). The frequency of consumption of foods was reclassified into 2 categories; at least 3 times per week and less than 3 times per week for ease of statistical analysis.

Data analysis

The statistical analysis was performed using SPSS version 15.0. Descriptive statistics were used to describe the data. Independent *t*-test was used to determine differences between case and control group for continuous variables, while chi square ($\chi 2$) distribution was used to

Table 1. Socio-demographic Characteristics

Variable		Cases (n=59)	Controls (n=59)
Gender	Male	42 (71.2)	33 (55.9)
	Female	17 (28.8)	26 (44.1)
Age (years)	<40	1 (1.7)	4 (6.8)
	40-49	8 (13.6)	15 (25.4)
	50-59	17 (28.8)	20 (33.9)
	60-69	25 (42.4)	15 (25.4)
	> 69	8 (13.6)	5 (8.5)
Mean ± SD*		59.3 ± 9.34	55.0 ± 11.2
Ethnicity	Malay	18 (30.5)	18 (30.5)
	Chinese	27 (45.8)	21 (35.6)
	Indian	13 (22.0)	19 (32.2)
	Others	1 (1.7)	1 (1.7)
Marital Status	Single	5 (8.5)	5 (8.5)
	Married	50 (84.7)	51 (86.4)
	Widowed/ Divorced	4 (6.8)	3 (5.1)
Education Status	Primary	19 (32.2)	18 (30.5)
	Secondary	24 (40.7)	26 (44.0)
	Pre-University	3 (5.1)	3 (5.1)
	Tertiary	13 (22.0)	12 (20.3)
Occupation	Unemployed / retired	39 (66.1)	35 (59.3)
	Blue collar	9 (15.3)	13 (22.0)
	Businessmen	3 (5.1)	1 (1.7)
	Government	2 (3.4)	4 (6.8)
	Professionals	3 (5.1)	5 (8.5)
	Others	3 (5.1)	1 (1.7)
Household income (RM)			
	Mean ± SD	2,638±1,703	2,175±1,121
Personal income (RM)			
	Mean ± SD	1,113±937	1,214±399

* significant at $p < 0.05$

determine the association between categorical variables with the study groups. Binary logistic regression was used to determine the odds ratio of the variables, while controlling for age, ethnicity, gender, BMI, waist circumference, height, physical activity, energy intake, current drinking and smoking status. All statistical tests were two-tailed and $p < 0.05$ regarding the 95% confidence interval was set as the level of significance.

Results

Sociodemographic data

Table 1 presents the comparison socio-demographic data of the cases and controls. Of 59 case subjects, 42 (71.2%) were males and the rest (28.8%) were females. As opposed to this, 33 males (55.9%) and 26 females (44.1%) were in the control group. The majority of respondents in this study were above 50 years. The mean age of total case subjects was 59.3±9.3 years and it was significantly higher than the mean age of total controls (55.0 ±11.2 years). The majority of the study participants were Chinese and married. A similar distribution of subjects in both groups was seen for educational status categories. The majority of the participants in either group were either unemployed or retired. The next biggest occupational group was the blue collar job category, which is mainly made up of drivers, tailors, labourers and general workers. The majority of the respondents were found in the low-income group with monthly personal income of <RM500.

Food intake

Fruits: Slightly more cases consumed citrus fruits (54.2%) and imported fruits (59.3%) at least three times a week while more controls consumed local fruits (81.4%) and dried/preserved fruits (16.9%) (Table 2). Nevertheless, association between fruit groups and the study groups seems to be insignificant. The odds ratio suggest a decrease in risk with more frequent consumption of citrus, local and dried fruits, and an increase in risk with consumption of imported fruits, though none were found to be significant. The mean servings of fruits consumed by the controls (0.93 ± 1.28 servings) were slightly higher than what is being consumed by the cases (0.62 ± 0.89 servings), and the increase in mean servings of fruits found to decreased the risk by 53% (OR = 0.47, 95% CI = 0.30 – 0.74).

Vegetables: Table 3 presents the frequency, mean servings and odds ratio of vegetable intake. The number of respondents who consumed coloured vegetables and herbs/spices/fungi regularly (≥ 3 times/week) was the same in both groups. The consumption of green, cruciferous and leguminous vegetables were higher in the control group. None of the differences were significant except for tubers intake where the percentage of the case subjects significantly more than the controls ($p<0.05$). Green, crucifererous and leguminous vegetables suggested reductions of the risk (OR between 0.37 and 0.91), while tubers were found to significantly increase the risk by almost four-fold after adjusting for potential confounders (OR = 4.14, 95% CI = 1.60 – 10.70). The mean serving of

Table 2. Frequencies, Means and Odds Ratios for Fruit Intake

Sub-groups		Cases (N=59)	Controls (N=59)	Crude OR (95% CI)	Adjusted OR[1] (95% CI)
Citrus fruits	< 3 times/week	27 (45.8)	29 (49.2)	1.00	1.00
	≥ 3 times/week	32 (54.2)	30 (50.8)	0.87 (0.42 - 1.80)	0.76 (0.33 - 1.72)
Local fruits	< 3 times/week	18 (30.5)	11 (18.6)	1.00	1.00
	≥ 3 times/week	41 (69.5)	48 (81.4)	0.52 (0.22 - 1.23)	0.57 (0.22 - 1.52)
Imported fruits	< 3 times/week	24 (40.7)	28 (47.5)	1.00	1.00
	≥ 3 times/week	35 (59.3)	31 (52.5)	1.32 (0.64 - 2.73)	1.17 (0.49 - 2.78)
Dried and	< 3 times/week	51 (86.4)	49 (83.1)	1.00	1.00
preserved fruits	≥ 3 times/week	8 (13.6)	10 (16.9)	0.77 (0.28 - 2.11)	0.47 (0.13 - 1.61)
Mean serving size ± SD		0.62 ± 0.89	0.93 ± 1.28	0.46 (0.30 - 0.71)*	0.47 (0.30 - 0.74)*

[1]adjusted for age, ethnicity, gender, physical activity, height, BMI, waist circumference, energy intake, current drinking and smoking habit; * significant at $p < 0.05$

Table 3. Frequencies, Means and Odds Ratios for Vegetable Intake

Sub-groups		Case (N=59)	Controls (N=59)	Crude OR (95% CI)	Adjusted OR[1] (95% CI)
Green vegetables	< 3 times/week	9 (15.3)	6 (10.2)	1.00	1.00
	≥ 3 times/week	50 (84.7)	53 (89.8)	0.63 (0.21 - 1.90)	0.37 (0.10 - 1.37)
Cruciferous	< 3 times/week	24 (40.7)	15 (25.4)	1.00	1.00
vegetables	≥ 3 times/week	35 (59.3)	44 (74.6)	0.50 (0.23 - 1.09)	0.52 (0.21 - 1.27)
Herbs/spices/	< 3 times/week	10 (16.9)	10 (16.9)	1.00	1.00
fungi	≥ 3 times/week	49 (83.1)	49 (83.1)	1.00 (0.24 - 4.20)	1.40 (0.26 - 7.55)
Coloured	< 3 times/week	8 (13.6)	8 (13.6)	1.00	1.00
vegetables	≥ 3 times/week	51 (86.4)	51 (86.4)	1.00 (0.35 - 2.87)	0.91 (0.26 - 3.16)
Tubers*	< 3 times/week	14 (23.7)	28 (47.5)	1.00	1.00
	≥ 3 times/week	45 (76.3)	31 (52.5)	2.90 (1.32 - 6.38)*	4.14 (1.60 - 10.70)*
Leguminous	< 3 times/week	18 (30.5)	13 (78.0)	1.00	1.00
	≥ 3 times/week	41 (69.5)	46 (22.0)	0.64 (0.28 - 1.47)	0.54 (0.20 - 1.45)
Mean serving size ± SD		1.51 ±- 1.08	1.68 ± 1.10	0.46 (0.29 - 0.73)*	0.49 (0.29 - 0.80)*

[1]adjusted for age, ethnicity, gender, physical activity, height, BMI, waist circumference, energy intake, current drinking and smoking habit; * significant at $p < 0.05$

Table 4. Frequencies, Means and Odds Ratios for Cereal and Cereal Product Intake

Sub-groups		Cases (N=59)	Controls (N=59)	Crude OR (95% CI)	Adjusted OR[1] (95% CI)
Rice-based	< 3 times/week	14 (23.7)	11 (18.6)	1.00	1.00
	≥ 3 times/week	45 (76.3)	48 (81.4)	0.24 (0.03 - 2.19)	0.20 (0.02 - 2.68)
Wheat- based	< 3 times/week	24 (40.7)	24 (40.7)	1.00	1.00
	≥ 3 times/week	35 (59.3)	35 (59.3)	1.00 (0.48 - 2.09)	1.06 (0.45 - 2.52)
Bread	< 3 times/week	14 (23.7)	10 (16.9)	1.00	1.00
	≥ 3 times/week	45 (76.3)	49 (83.1)	1.52 (0.62 - 3.78)	1.53 (0.51 - 4.62)
Breakfast cereals	< 3 times/week	38 (64.4)	36 (61.0)	1.00	1.00
	≥ 3 times/week	21 (35.6)	23 (39.0)	0.87 (0.41 - 1.83)	1.20 (0.50 - 2.89)
Local fast-food	< 3 times/week	35 (59.3)	27 (45.8)	1.00	1.00
type of cereals	≥ 3 times/week	24 (40.7)	32 (54.2)	1.73 (0.83 - 3.59)	1.96 (0.74 - 5.23)
Mean serving size ± SD		5.98 + 1.70	5.69 + 2.13	1.08 (0.90 - 1.31)	1.10 (0.89 - 1.36)

[1]adjusted for age, ethnicity, gender, physical activity, height, BMI, waist circumference, energy intake, current drinking and smoking habit

Table 5. Frequencies, Means and Odds Ratios for Meat, Poultry and Legume Intake

Sub-groups		Cases (N=59)	Controls (N=59)	Crude OR (95% CI)	Adjusted OR[1] (95% CI)
White meat	< 3 times/week	11 (18.6)	13 (22.0)	1.00	1.00
	≥ 3 times/week	48 (81.4)	46 (78.0)	1.23 (0.50 - 3.03)	1.60 (0.57 - 4.54)
Red meat	< 3 times/week	33 (55.9)	37 (62.7)	1.00	1.00
	≥ 3 times/week	26 (44.1)	22 (37.3)	1.33 (0.63 - 2.78)	2.51 (1.00 - 6.28)
Eggs	< 3 times/week	25 (42.4)	18 (30.5)	1.00	1.00
	≥ 3 times/week	34 (57.6)	41 (69.5)	0.58 (0.28 - 1.27)	0.55 (0.23 - 1.34)
Fresh fish	< 3 times/week	16 (27.1)	14 (23.7)	1.00	1.00
	≥> 3 times/week	43 (72.9)	45 (76.3)	0.84 (0.37 - 1.92)	1.10 (0.42 - 2.90)
Processed fish	< 3 times/week	46 (78.0)	48 (81.4)	1.00	1.00
	≥ 3 times/week	13 (22.0)	11 (18.6)	1.23 (0.50 - 3.03)	0.89 (0.28 - 2.77)
Fresh seafood	< 3 times/week	33 (55.9)	39 (66.1)	1.00	1.00
	≥ 3 times/week	26 (44.1)	20 (33.9)	1.54 (0.73 - 3.24)	1.64 (0.68 - 3.93)
Preserved seafood	< 3 times/week	45 (76.3)	52 (88.1)	1.00	1.00
	≥ 3 times/week	14 (23.7)	7 (11.9)	2.31 (0.86 - 6.23)	2.43 (0.79 - 7.53)
Nuts	< 3 times/week	31 (52.5)	28 (47.5)	1.00	1.00
	≥ 3 times/week	28 (47.5)	31 (52.5)	0.82 (0.40 - 1.68)	0.73 (0.31 - 1.76)
Soy bean and	< 3 times/week	24 (40.7)	18 (30.5)	1.00	1.00
its products	≥ 3 times/week	35 (59.3)	41 (69.5)	0.64 (0.30 - 1.37)	0.38 (0.15 - 0.98)*
Seeds	< 3 times/week	47 (79.7)	45 (76.3)	1.00	1.00
	≥ 3 times/week	12 (20.3)	14 (23.7)	0.48 (0.09 - 2.74)	0.20 (0.03 - 1.56)
Mean serving size ± SD		2.43 + 1.59	2.33 + 1.02	1.06 (0.81 - 1.39)	1.03 (0.76 - 1.38)

[1]adjusted for age, ethnicity, gender, physical activity, height, BMI, waist circumference, energy intake, current drinking and smoking habit; * significant at $p < 0.05$

vegetables also was higher in the controls (0.93 + 1.28 servings) than cases (1.51 + 1.08 servings). High number of vegetables servings taken in diet found to significantly decrease the risk by about 52% (OR = 0.49, 95% = 0.29 – 0.80).

Cereals and cereal products: An equal number of subjects in both groups consumed noodles/wheat-based cereals and its products (Table 4). However, higher percentage of the controls took rice-based cereals and its products, and breakfast cereals in their diet more often than the cases (76.3% vs 81.4% and 35.6% vs 39.0% respectively). Bread and local fast-food types of cereals were consumed relatively more by the controls than the cases, although the differences were not significant. Generally cereals and cereal-based products found to insignificantly increase the risk with an exception to rice and rice-based products, and breakfast cereals. Mean intake of cereals and cereal products was 5.98 ± 1.70 servings in the case group and it was slightly lower in the control group (5.69 ± 2.13 servings), but the means do not differ between the study groups and do not significantly contribute the risk.

Meats, poultry and legumes: While consumption of foods in the white meat group was found to be almost similar (81.4% of the cases vs 78.0% of the controls), more cases (44.1%) consumed red meat more frequently than the controls (37.3%) (Table 5). Generally the frequency of red meat intake was lower in both groups as compared to the white meat. Though both types of meat were suggested to increase the risk, with significant increase in risk with frequent consumption of red meat (OR = 2.51, 95% CI = 1.02 – 6.28).

Fresh fish intake was found to be almost equally consumed by controls (76.3%) and cases (72.9%). Processed fish, fresh and preserved seafood were all consumed more by the cases than controls but again, the differences were not significant. Processed fish, fresh and processed seafood were found to increase the risk but it was not significant. Almost 58% of the case subjects and 70% of the control subjects took eggs in their diet at least

Table 6. Frequencies, Means and Odds Ratios for Dairy Product Intake

Sub-groups		Cases (N=59)	Controls (N=59)	Crude OR (95% CI)	Adjusted OR[1] (95% CI)
Fresh milk	< 3 times/week	48 (81.4)	48 (81.4)	1.00	1.00
	≥ 3 times/week	11 (18.6)	11 (18.6)	1.00 (0.40 - 2.53)	0.77 (0.26 - 2.29)
Powdered milk	< 3 times/week	25 (42.4)	35 (59.3)	1.00	1.00
	≥ 3 times/week	34 (57.6)	24 (40.7)	1.98 (0.95 - 4.13)	1.33 (0.57 - 3.12)
Canned milk	< 3 times/week	48 (81.4)	47 (79.7)	1.00	1.00
	≥ 3 times/week	11 (18.6)	12 (20.3)	1.11 (0.05 - 2.77)	0.76 (0.22 - 2.62)
Dairy products	< 3 times/week	52 (88.1)	50 (84.7)	1.00	1.00
	≥ 3 times/week	7 (11.9)	9 (15.3)	1.85 (0.51 - 6.70)	3.36 (0.64 - 7.66)
Mean serving size ± SD		1.42 + 1.16	1.49 + 0.93	0.94 (0.66 - 1.33)	0.93 (0.63 - 1.38)

[1]adjusted for age, ethnicity, gender, physical activity, height, BMI, waist circumference, energy intake, current drinking and smoking habit

three times a week but difference was not significant. There was a surprising but insignificant decrease in the risk with frequent consumption of eggs.

Nuts such as groundnuts, chickpea and red gram were consumed more often by the control subjects as compared to the case group, but the difference was not significant. Similarly, the controls were found to consumed soybean and its products, and seeds more frequently. Soy bean and soy products were demonstrated to lower the risk for CRA by 62% (OR = 0.38, 95% CI = 0.15 – 0.98) after adjusting for confounders.

The mean intake of meats, legumes and poultry by the case group (2.43 ± 1.59 servings) was found not to be significantly different from the mean intake of the control group (2.33 ± 1.02 servings) when tested at $p<0.05$, and do not influence the risk for CRA.

Milk and milk products: Fresh milk was found to be consumed by equal number of cases and controls, while the intake of canned milk and dairy products were almost equal in both groups (Table 6). All types of milk and milk product with an exception of powedered milk was consumed by equal number of cases and controls. All sub-groups in this food group were suggested to insignificantly increase the risk with an exception of fresh milk. The mean serving sizes of milk and milk products do not differ significantly between groups and was not significantly related to the risk for CRA.

Discussion

Consumption of higher servings of fruits and vegetables decreased the risk for CRA among the study subjects. The presumed beneficial effects of fruit and vegetables have been the core of many large-scale public health campaigns, such as the well-known “Five a Day” program, and guidelines on cancer prevention, especially CRC (National Cancer Institue, 2006). Consumption of fruits and vegetables may confer protection from colorectal adenomas, but the observational and interventional evidence is inconclusive.

A high-fruit, low-meat diet appears to be protective against CRA compared with a dietary pattern of increased vegetable and meat consumption (Austin et al., 2007). After adjusting for potential confounders, the high vegetable-moderate meat cluster (OR = 2.17, 95% CI = 1.20 – 3.90) and high meat cluster (OR = 1.70, 95%CI = 1.04 – 2.80) were at significantly increased odds of having had an adenoma compared with the high fruit-low meat cluster.

Specifically high carotenoid vegetables, cruciferare and high vitamin C fruits were found to decrease the polyp prevalence (Witte et al., 1996). Although such trend was seen in this case-control, the decrease in the risk was not significant. Michels et al. (2006) on the other hand, found a decrease in the risk for CRA only with frequent consumption of fruits, not vegetables among the subjects enrolled in the Nurses’ Health Study.

On the other hand, a three year endoscopic follow-up study concluded that fruits and vegetables may play an early but weak role in the development of CRC by influencing adenoma growth and recurrence (Almendingen et al., 2004). The researchers found a weak inverse association between adenoma growth and fruits and berries (adjusted OR = 0.3, 95% CI = 0.1 – 0.9), and another weak association between adenoma recurrence and vegetables intake (crude OR = 0.4, 95% CI = 0.1 – 0.9).

Tubers were found to increase the risk for CRA among the participants of this study. While the most common tuber consumed by the subjects was potatoes, sengkuang, beetroot and yam were the other food items in this group. While published data on the relationship between tubers and the risk is limited, potatoes were associated with a decreased risk in a study by Benito et al (1993) which however, was not statistically significant (OR highest vs. lowest quartile = 0.53).

The protective effect of vegetable intake on the recurrence of adenomas but not on the appearance of new adenoma suggest that vegetables may have a stronger role in the prevention of progression of adenomas to carcinomas rather than in preventing the initial appearance of adenomatous polyps. While many studies found an inverse link between high plant-based food intake and the risk for adenomas, there are several studies that did not found any relationship. Thus further investigations are warranted before the protective effect of these food items can be established.

Frequent consumption of soybean and its products (fresh tau hoo, tau hoo pok, Japanese tau hoo, Fu Chok and tau foo far, tempe) reduced the risk for CRA by more than half. Soy normally presented in a limited number of forms, primarily miso (fermented soybean paste usually used in soup) and/or tofu (soybean curd). Miso soup, was suggested to reduce the risk for colon adenomas in a study done in Japan (Kono et al., 1993), However the decrease in the risk with frequent consumption of miso soup was not significant (OR = 0.87, 95% CI = 0.55 - 1.37).

Higher servings of tofu, a soy product which commonly used in Malaysian diet, found to significantly decrease the risk for CRA (0.48, 0.24-0.95) in a study done in South Carolina (Witte et al., 1996). Nagata et al (2001) also found that the intake of soy products found to decrease the risk of CRA in men and were positively associated with risk of adenoma in women, but these associations were not statistically significant. Nagata et al. however, did not specific the type of soy products included in the study.

Soy foods and soybean constituents have received considerable attention for their potential role in reducing cancer risk (Corpet & Tache, 2002). Soy isoflavones have been proposed to play a key role in soy's anti-cancer functions (Guo et al., 2004) and Yanagihara et al. (1993) and Wenzel et al. (2000) among others, reported that genistein inhibits colon cancer cell proliferation and stimulates apoptosis in vitro. However, due to the limited questionnaires, most studies probably underestimated total soy food intake, and the fact that most of these studies were retrospective could lead to the problem of recall bias, which could over- or under-estimate the true risk.

Red meat

There was a slight but non-significant increase in the risk with higher intake of white meat, while a two and a half-fold significant increase was found with the intakes of red meat. High meat intake has been suggested to promote the growth colon adenomas (Kono et al., 1993), where the adjusted odds ratio for the higher tertile of meat consumption was 2.38 compared to the lowest.

A German case-control study which compared patients with previous adenomas with hospital and population controls found a positive association between red meat intake and risk for CRA but not for fat or protein from red meat (Breuer-Katschinski et al., 2001). Those in the highest quintile of red meat intake were found to have more than threefold increase in risk (OR – 3.6, 95% CI = 1.7 – 7.5) when compared to hospital controls, and more than fourfold increase in risk (OR = 4.4, 95% CI = 1.6 – 12.1) when compared to population controls.

Sinha et al. (1999) suggested besides total red meat intake, cooking method such as well-done, grilled red meat also may increases the risk of CRA. There was an increased risk of 11% per 10g/day of red meat consumption (OR = 1.11, 95% CI = 0.96 – 1.26) and high-temperature cooking methods increased the risk even further. Consumption of about 10g/day of grilled red meat was associated with 26% risk (OR = 1.26, 95% CI = 1.06 – 1.50) and 15% per 10g/day (OR = 1.15, 95% CI = 0.97 – 1.36) for pan-fried red meat. These results are consistent with the hypothesis that carcinogenic compounds such as heterocyclic amines and polycyclic aromatic hydrocarbons, formed by high-temperature cooking techniques, may contribute to the risk of developing colorectal tumours.

Robertson et al (2005) demonstrated that specific meats may have different effects on risk as the risk for advanced adenoma was increased for processed meat (RR = 1.75, 95% CI = 1.02 - 2.99) and decreased for chicken (RR = 0.61, 95% CI = 0.38 - 0.98). Oddly, another study by Senesse et al. (2002) found that consumption of lean meat actually was associated with a reduced risk of small adenomas (OR for 4th vs. 1st quartile = 0.3, 95% CI = 0.2 – 0.6) and large adenomas (OR = 0.4, 95% CI = 0.3 - 0.7) compared with controls. This only concludes that foods associated with CRA may be poorly understood due to variation in types of food and food preparation method, among other factors.

The current evidence, although little, is consistently proving that red meat intake affects risk for CRA but not for CRC. Although there are no study reported on Malaysians' risk for adenomas and intake of red meat, current evidence should be taken into consideration, as Malaysian diets are increasingly becoming more westernized.

This study is not without limitations. The study population was relatively small, and it is possible that some associations were not detected due to insufficient power. The fact that it focused on subjects in the Klang Valley may limit the extrapolation of these findings to the entire Malaysian population. Therefore, confirmation of these results by other studies is necessary. The possibility that the associations may be confounded or modified by other genetic or dietary factors could not be excluded. The cases and controls have not been matched by age, which may affect the results in our study. However, the controls were recruited from the same population as the adenoma cases. Further, our controls have been screened and found polyp free by colonoscopy and the risk of any of them having colorectal cancer at the time of inclusion is not very likely.

Conclusion and recommendation

A large portion of patients with history of adenomas were found in the 60 - 69 years age group, with the mean age of the respondents in the case group higher than the controls. As increasing age has been associated with higher risk for CRA and subsequently CRC, this finding matched the available facts. Higher servings of fruits and vegetables decreased the risk for CRA, while frequent consumption of soy bean and soy products was found to decrease the risk as well. Frequent consumption of red meat and tubers increased the risk for CRA in the study subjects. Once these food groups are established as a risk factor for CRA in Malaysians, it should be intervened. An intervention study focusing on behavioural change may be able to improve one's risk for colorectal adenomas, thus subsequently reducing his/her risk for developing colorectal cancer in the future.

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