Colorectal cancer: case–control study of sociodemographic, lifestyle and anthropometric parameters in Riyadh

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سرطان القولون والمستقيم: دراسة حالات وشواهد للمتثابتات الاجتماعية والديموغرافية ولأنماط الحياة والمتثابتات الأنتـروبولوجية في الرياض

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الخلاصـة: قارن الباحثون في دراسة للحالات والشواهد المتغيرات الاجتماعية والديموغرافية، وأنماط الحياة وبعض المتثابتات الأنثروبيولوجية لدى 50 مريضاً أدخلوا مستشفى للإحالة في الرياض لإصابتهم بسرطان القولون والمستقيم مقابل 50 من الشواهد الذين يوافقونهم من حيث العمر والجنس. ومن بين الحالات كانت الإناث أكثر إصابة بالأعراض المعدية المعوية، وكان لدى 4٪ من الذكور سوابق عائلية لسرطان القولون والمستقيم. ولم يكن هناك اختلاف في مَنْسَب كتلة الجسم بين الحالات والشواهد، وذلك على عكس الوزن والطول؛ إلا أن ضَعف المعلومات حول النُظُم الغذائية الغنية بالألياف كان من العوامل الهامة. وقد أظهر التحليل الاسترجاعي أن كلاً من انخفاض المستوى التعليمي والبطالة وعدم القيام بتمرينات منتظمة هي عوامل اختطار هامة للإصابة بسرطان القولون والمستقيم. ويوصَى بتحسين التثقيف ورفع مستوى الوعي حول تحرِّي سرطان القولون والمستقيم.

ABSTRACT This case–control study compared sociodemographic variables, lifestyle and certain anthropometric parameters of 50 patients hospitalized with colorectal cancer with those of 50 age- and sex-matched controls at a referral hospital in Riyadh. Among cases, females were generally more affected by gastrointestinal symptoms and 4% of male patients had a family history of colorectal cancer. Unlike weight and height, body mass index did not differ between cases and controls, but poor knowledge of high-fibre diets was a significant factor. Regression analysis showed low education level, unemployment and not taking exercise regularly were significant risk factors for colorectal cancer. Better education and awareness of colorectal cancer screening is recommended.

Cancer colorectal : une étude cas/témoins des paramètres sociodémographiques, relatifs au mode de vie et anthropométriques à Riyad

RÉSUMÉ Cette étude cas/témoins a comparé les variables sociodémographiques, le mode de vie et certains paramètres anthropométriques de 50 malades hospitalisés pour un cancer colorectal, par rapport à 50 témoins appariés sur l'âge et le sexe dans un hôpital de recours de Riyad. Parmi les cas, les femmes étaient généralement plus concernées par les symptômes gastro-intestinaux et 4 % des hommes avaient des antécédents familiaux de cancer colorectal. Contrairement au poids et à la taille, l'indice de masse corporelle n'était pas différent entre les cas et les témoins, mais la méconnaissance des régimes riches en fibres était un facteur significatif. L'analyse de régression a montré que le faible niveau d'instruction, le chômage et le manque d'exercice régulier étaient des facteurs de risque significatifs du cancer colorectal. Il est recommandé de renforcer l'information et la prise de conscience à propos du dépistage du cancer colorectal.

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Introduction

According to the World Health Organization cancer is considered a leading cause of death worldwide, accounting for 7.6 million, or 13%, of all deaths from a total of 58 million deaths reported in year 2005. Although the overall prevalence of cancer is higher in developed nations, about 70% of all cancer deaths in 2005 occurred in low- and middle-income countries [*1*].

Colorectal cancer is associated with significant morbidity and mortality in the industrialized world, including the United Kingdom, United States of America and Japan [*2–5*]. Age-standardized incidence rates vary from 23–35 per 100 000 population in North America to 5–15 per 100 000 in the developing countries of Africa and Asia [*6–8*]. The disease is uncommon in Africa, Asia and South America, which might suggest a possible link with a diet rich in animal fat in developed nations [*9*].

This epidemiological trend is, however, changing in Asian countries, and incidence of colorectal carcinomas is on the rise [*10*]. Global geographic variations in incidence of colorectal adenoma and cancer are thought to be due to multiple factors: sociodemographic, lifestyle, environmental and genetic. Hereditary factors play a definite role, but gene–environment interactions are also important in the pathogenesis [*11*]. Approximately 70% of the risk of colorectal cancer can be related to environmental factors, and identification of these may help prevent the development of the disease [*12*].

Risk factors for colorectal cancer include diets from animal sources that are low in fibre and high in fat, hypertriglyceridaemia, physical inactivity, high body mass index (BMI), obesity, type 2 diabetes mellitus, alcohol and smoking [*13–19*]. Conversely, protective factors for colorectal cancer include physical activity, regular exercise, younger age, higher education level, hormone (estrogen) replacement therapy, intake of calcium, vitamin D, folate, some antioxidant vitamins and minerals such as gamma-tocopherol and selenium, nonsteroidal anti-inflammatory drugs and a diverse diet including yogurt and resistant starches [*20–22*]. Women who consumed diets rich in vegetables had a 20% lower risk for colon cancer than women who did not consume vegetables [*23*].

Saudi Arabia is a low-risk country for colorectal cancer [*24,25*]. The GLOBOCAN database estimated the crude incidence rate (per 100 000) at 6.0, and the crude mortality rate at 3.7; this compares with a crude incidence rate in the world of 17.6 and 15.4 for males and females respectively [*2,3*].

King Faisal Specialist Hospital and Research Centre in Riyadh is a national referral hospital and the principal centre for tumour registry and therapy. Between June 1975 and December 1989, 622 patients were registered with malignant colorectal and anal tumours (383 males, 239 females; average age 53.5 and 47.8 years, respectively). The majority of patients were of Saudi Arabian nationality. The single most common site for large bowel malignancy was the rectum.

To the author's knowledge, no study has been carried out in Saudi Arabia to investigate the association between lifestyle risk factors and colorectal cancer. Moreover, the literature is scanty compared to the industrialized world. Therefore, the objective of this case–control study was to investigate the association between certain sociodemographic and lifestyle factors and colorectal cancer.

Methods

Sample

The sample for this case–control study was 50 newly diagnosed colon cancer pa-

tients selected consecutively over the period 1 November 2003–1 November 2004 from the inpatients attending King Faisal Specialist Hospital and Research Centre. A group of 50 sex- and age-matched (± 3 years) controls were selected consecutively from those attending the outpatient departments. All cases and controls were aged over 30 years and of Saudi Arabian nationality. A case was operationalized as a newly diagnosed colon cancer patient, free from other chronic diseases such as diabetes, hyperlipidaemia or hypertension, or other cardiac, liver and renal diseases. Female cases were not pregnant or lactating. Controls were free from cancer or chronic diseases.

This research was approved by the ethics committee of the Research Centre, and all patients and controls gave informed, written consent for participation.

Data collection

A questionnaire was used to collect sociodemographic data from cases and controls that included: age; sex; region [Riyadh (Central), Eastern, Western, Northern and Southern]; marital status (married or single); education level (illiterate, primary, secondary or university); employment status (employed or unemployed); and general level of physical activity level (bedridden, mild, moderate or high activity). Questions were also asked about whether the patients took exercise and, if yes, the degree of exercise (light, moderate or heavy). Both patients and controls were also asked to name 3 foods that are high in fibre in order to assess their dietary knowledge.

In addition, any family medical history of colon cancer (grandparents, parents, siblings or cousins) was ascertained among patients. Appetite problems (poor, good or excellent) also were noted. Any gastrointestinal problems such as vomiting, diarrhoea or constipation were also recorded. These data were collected for cases only. Weight and height of patients and controls were also measured to calculate BMI.

Statistical analysis

Data analysis was done using *SPSS*, version 14.0. The frequency distribution and descriptive statistics for each variable were calculated. The chi-squared test was used to analyse categorical variables and the *t*-test for analysing continuous variables. Odds ratios (OR), and univariate and logistic regression analysis were computed to assess the significance of each variable to the outcome. *P*-value < 0.05 was considered statistically significant.

Results

The sociodemographic and other characteristics of participants are shown in Table 1. The majority of patients (76%) and controls (86%) were aged 30–60 years; when age was dichotomized into 30–60 years and > 60, there was no significant association between age and colorectal cancer ($P > 0.05$). This was expected because controls and cases were age-matched.

Similar proportions of controls (50%) and cases (48%) were from the Riyadh region and when this geographical variable was categorized into Riyadh versus other regions, chi-squared analysis revealed no significant association between region and colorectal cancer ($P > 0.05$).

The majority of the patients (86%) and the controls (82%) were married; marital status did not differentiate between cases and controls with regard to colorectal cancer ($P > 0.05$).

When education was dichotomized into illiterate/primary and secondary/university level, it was found that a significant proportion of cases were less educated than

Table 1 **General characteristics of colon cancer cases and controls by sex**

Variable	Controls						Cases						OR
	Males (*n* = 25)		Females (*n* = 25)		Both sexes (*n* = 50)		Males (*n* = 25)		Females (*n* = 25)		Both sexes (*n* = 50)		
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	
Age (years)													
30–40	6	24	10	40	16	32	6	24	9	36	15	30	
41–50	5	20	7	28	12	24	5	20	7	28	12	24	
51–60	8	32	7	28	15	30	7	28	4	16	11	22	
61–70	3	12	1	4	4	8	4	16	5	20	9	18	
> 70	3	12	0	0	3	6	3	12	0	0	3	6	
Region													
Riyadh	12	48	13	52	25	50	11	44	13	52	24	48	
Eastern	4	16	5	20	9	18	5	20	5	20	10	20	
Western	2	8	2	8	4	8	2	8	2	8	4	8	
Northern	2	8	4	16	6	12	2	8	4	16	6	12	
Southern	5	20	1	4	6	12	5	20	1	4	6	12	
Marital status													
Married	20	80	21	84	41	82	23	92	20	80	43	86	
Single	5	20	4	16	9	18	2	8	5	20	7	14	
Education													8.3[a]
Illiterate	3	12	3	12	6	12	10	40	12	48	22	44	
Primary	2	8	3	12	5	10	8	32	5	20	13	26	
Secondary	6	24	7	28	13	26	2	8	1	4	3	6	
Higher	14	56	12	48	26	52	5	20	7	28	12	24	
Employment status													3.7
Employed	23	92	15	60	38	76	18	72	5	20	23	46	
Unemployed	2	8	10	40	12	24	7	28	20	80	27	54	
Activity level													
Bedridden	0	0	0	0	0	0	0	0	1	4	1	2	
Mild	7	28	5	20	12	24	3	12	2	8	5	10	
Moderate	11	44	17	68	28	56	22	88	22	88	44	88	
High	7	28	3	12	10	20	0	0	0	0	0	0	
Exercise													8.3
Yes	9	36	15	60	24	48	3	12	2	8	5	10	
No	16	64	10	40	26	52	22	88	23	92	45	90	
Type of excercise													8.5[b]
Light	6	67	7	46	13	54	3	100	2	100	5	100	
Moderate	1	11	7	46	8	33	0	0	0	0	0	0	
Heavy	2	22	1	6	3	13	0	0	0	0	0	0	

Table 1 **General characteristics of colon cancer cases and controls by sex** *(concluded)*

Variable	Controls						Cases						OR
	Males (*n* = 25)		Females (*n* = 25)		Both sexes (*n* = 50)		Males (*n* = 25)		Females (*n* = 25)		Both sexes (*n* = 50)		
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	
Knowledge of higher fibre foods (no. of items named)													17.0[c]
0	1	4	2	8	3	6	15	60	11	44	26	52	
1	6	24	13	52	19	38	0	0	3	12	3	6	
2	6	24	7	28	13	26	4	16	6	24	10	20	
3	12	48	3	12	15	30	6	24	5	20	11	22	

[a]*Illiterate/primary versus secondary/higher;* [b]*Light versus moderate/heavy;* [c]*0 versus ≥ 1 items.*
OR = odds ratio.

the control group (OR = 8.3, $P < 0.05$). Employment status also differentiated significantly between controls and patients, with more cases being unemployed (54% versus 24%) (OR = 3.7, $P < 0.05$).

When the general activity levels bedridden and mild were pooled and analysed against moderate and high activity levels it was observed that general activity was not significantly associated with cancer ($P > 0.05$). However, a significantly higher proportion of patients reported not taking regular exercise (90% versus 52%) (OR = 8.3, $P < 0.05$) and likewise significantly more controls did moderate or heavy amounts of exercise (OR = 8.5, $P < 0.05$).

A significantly higher proportion of cancer patients had poor knowledge of foods rich in fibre compared with controls (52% versus 6% could not name any high-fibre foods) (OR = 17, $P < 0.05$).

The medical history of patients is shown on Table 2. Only 4% of the cases had a family history of colorectal cancer. For diarrhoea there was slight trend towards female sex with colon cancer ($P = 0.058$). No other symptoms differentiated between the sexes ($P > 0.05$). In general, however, women with colorectal carcinoma tended to have more gastrointestinal symptoms.

When the means of male cases and controls were compared and likewise female cases and controls using *t*-test analysis, there were significant differences in all anthropometric indicators for males (mean weight, height and BMI were all significantly lower in cancer cases) ($P < 0.05$) (Table 3). However, for females only height was significantly different ($P > 0.05$).

Table 4 shows the results of the logistic regression model when all sociodemographic factors were put into the model. Unemployment, low education level and not taking exercise were the significant factors after controlling for other variables.

Discussion

In this case–control study, the majority of cases and controls were between 30 and 60 years of age, which is consistent with the results of other studies [*24,26*]. As age was matched between the cases and controls, there was no differentiation between them with regard to colon cancer. However, the disease tends to be more frequent in late middle-age populations in both sexes compared to other age bands. Colon cancer is less prevalent in postmenopausal than

Table 2 **Medical history of the colon cancer cases by sex**

Variable	Male		Female		Both sexes	
	No.	%	No.	%	No.	%
Family history						
Yes	2	8	0	0	2	4
No	23	92	25	100	48	96
Appetite						
Poor	2	8	5	20	7	14
Good	8	32	12	48	20	40
Excellent	15	60	8	32	23	46
Diarrhoea						
Yes	4	16	10	40	14	28
No	21	84	15	60	36	72
Vomiting						
Yes	0	0	2	8	2	4
No	25	100	23	92	48	96
Constipation						
Yes	8	32	11	44	19	38
No	17	68	14	56	31	62

premenopausal women and these sex- and age-divergent variations are explained by, among other factors, obesity [*13*].

Almost half the cases in this study were from Riyadh, which is in agreement with another study [*24*]. This regional trend was attributed to the fact that this study was conducted only in Riyadh and so most of the referrals were from Riyadh and the surrounding areas. However, there are reported geographical variations with regard to the epidemiology of colon cancer worldwide, which are mostly explained by dietary and lifestyle factors. The prevalence of colon cancer is higher in industrialized nations than in the developing world [*6,7,9,10*].

A significantly greater proportion of controls had higher education levels com-

Table 3 **Anthropometric measurements of cases and controls by sex**

Variable	Controls			Cases			*P*-value
	Mean	SD	Range	Mean	SD	Range	
Weight (kg)							
Male	83.8	13.3	56–110	67.0	18.5	38–111	0.001
Female	69.0	14.5	41–94	63.1	14.4	41–94	0.158
Height (cm)							
Male	171.3	7.0	160–185	165.5	8.0	147–180	0.009
Female	158.6	6.0	145–171	152.0	7.6	126–166	0.002
Body mass index (kg/m^2)							
Male	28.5	3.7	22–35	24.30	5.8	16–39	0.004
Female	27.3	5.5	16–37	27.16	5.4	20–38	0.918

SD = standard deviation.

Table 4 **Logistic regression model for the effect of different sociodemographic variables on the colorectal cancer**

Variable	*P*-value	OR	95% CI	
			Lower	Upper
Region (Riyadh versus others)	0.876	0.97	0.67	1.41
Marital status (married versus single)	0.510	0.58	0.11	2.97
Education (illiterate/primary versus secondary/university)	0.002	2.40	1.38	4.18
Employment (unemployed versus employed)	0.035	0.29	0.09	0.92
Activity level (bedridden/mild versus moderate/high)	0.324	0.60	0.22	1.66
Regular exercise (no versus yes)	0.002	0.14	0.04	0.47
Knowledge of high-fibre diet (score 0 versus 1/2/3)	0.304	0.76	0.45	1.29
Constant	0.029	265.4		

OR = odds ratio; CI = confidence interval.

pared to patients with colon cancer, which is in agreement with other research [*23,27*]. Reportedly, younger age, diverse diets and higher education protect individuals from developing colon cancer. The other disadvantage of poor education is that the patients are usually seen at an advanced stage of colorectal cancer in Saudi Arabia, and this epidemiological trend is attributed to poor patient awareness of the disease. This may change in the future, however, as a result of improvements in the levels of education and employment and the extensive awareness campaigns about cancer screening in this country. Early identification by screening is recommended for improving survival rates and overall outcomes in colorectal cancer. In line with other research [*28*], it is suggested that effective preventive strategies to control colorectal cancer should include efforts to improve public knowledge of the risk and protective factors linked with colorectal cancer. Concerted efforts at all levels, governmental and nongovernmental, should be continued to encourage regular screening in the middle-aged population at risk. The results of this study showed a greater number of patients were unemployed, which suggests that continuing stress coupled with unemployment might trigger colon cancer.

The present study showed that 90% of the cancer cases did not take regular exercise; there is strong evidence from other studies that physical activity reduces the risk of colon cancer and it is highly efficient in prevention of other cancers [*18,21,29*]. Similarly, lack of physical activity or a sedentary lifestyle is associated with increased risk of colon cancer. Physical activity reduces bowel transit time, which shortens the duration of contact between faecal carcinogens and colon mucosa [*30*]. In this study, the majority of the cases had no knowledge of a high-fibre diet, which has been shown to be protective against the development of colorectal cancer. Increasing knowledge of cancer may reduce negative public perceptions of the disease, which may encourage people to participate in cancer screening and lifestyle modifications [*10,31,32*].

The present study showed that 4% of the cases had a family history of colorectal cancer, which is in agreement with other research showing that a family history of colorectal cancer increases the risk

of having this disease [*10,13,14,26*]. As reported, the implication of this finding is that patient-reported family cancer histories for first-degree relatives are accurate and valuable for colon cancer and breast cancer risk assessment [*33*].

The frequency of poor appetite, diarrhoea, vomiting and constipation were in agreement with others [*34,35*]. An implication of this finding is that the emergence of a cluster of such symptoms should alert the individual to consult physicians to exclude any potential colon cancerous diseases.

There is converging evidence that markers of obesity have been associated with higher risk of colorectal cancer [*13,36*]. The findings of this study were not consistent with this: BMI was significantly higher among the control group. The explanation may be that, although cases were newly diagnosed, they were in the advanced stages of carcinoma and this would reduce their weight, and therefore BMI. Though this is not in agreement with the literature, it is still suggested that colorectal cancer prevention programmes should aim to reduce obesity both by encouraging regular exercise and consumption of diets rich in fibres, fruits, fresh vegetables and resistant starches.

The limitations of this study come mainly from the small sample size (50 cases and 50 controls), which may be justified by the low incidence of the disease in the population. In addition, the study was limited to only 1 hospital, which was the largest referral hospital in Saudi Arabia for oncology patients. This may introduce an element of selection bias for both cases and controls. Also, the use of waist circumference and waist–hip ratio would be a better measure than BMI because these are more indicative of visceral obesity and are sex-specific.

In conclusion, lower education and being unemployed, together with taking no regular exercise, were risk factors for colon cancer in this referral hospital in Saudi Arabia. Therefore, improving education, employment and exercise, and encouraging a diverse diet, may protect people from developing colorectal cancer in Saudi society. In the light of this study and reviewed literature, the following recommendations are made: an education programme to enhance public awareness of the protective role of regular exercise and physical activity against colon cancer; inclusion of active lifestyle education programmes in health promotion activities at primary health care centres; screening for patients over 50 years of age with average risk factors for the disease; and additional studies recruiting larger samples from different regions of Saudi Arabia to determine the relationship between sociodemographic, lifestyle, genetics and anthropometric parameters with colorectal cancer risk.

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