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Original Article

Adherence to the Saudi dietary guidelines and its relation to colorectal polyps: A university hospital-based study

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الملخص

أهداف البحث: من المعروف أن سليلة القولون والمستقيم هي مقدمة لسرطان القولون والمستقيم. تقيم هذه الدراسة، باستخدام النقاط لقياس مدي الالتزام بتوصيات الدليل الغذائي السعودي، ما إذا كان المدخول الغذائي يعد عاملا يساعد على تشكيل سلائل القولون والمستقيم في السعودية.

طرق البحث: أجريت هذه الدراسة المقطعية في وحدة المناظير بمستشفى جامعة الملك عبد العزيز في جدة على ١٠١ مريضا من الجنسين تتراوح أعمارهم بين ٣٠-٨٦ سنوات (٦١ مريضا لا يوجد لديهم أورام في القولون والمستقيم، و٤٠ مريضا لديهم سلائل في القولون والمستقيم). تم تجميع المعلومات الديمغرافية والقياسات الجسمية والغذائية بواسطة استبانة.

النتائج: وجد أن المرضى المصابين بسلائل القولون والمستقيم أكبر سنا من غير المصابين. وكان متوسط كتلة الجسم للمجموعتين ضمن نطاق زيادة الوزن بقيمة ٢٨.٨ كجم/ م^2(انحراف معياري ٦.١) للمرضى الذين لا يعانون من السلائل في القولون والمستقيم و٢٨.٢ كجم/ م^2(انحراف معياري ٧.٨) للمرضى الذين يعانون من سلائل القولون والمستقيم. على الرغم من عدم وجود فروق في نقاط الالتزام بتوصيات الدليل الغذائي السعودي. كانت نقاط الالتزام المخصصة لتناول الخضروات أعلى بشكل ملحوظ في المرضى الذين لا يعانون من سلائل القولون والمستقيم مقارنة بالمصابين.

الاستنتاجات: أيدت هذه الدراسة الدراسات السابقة في أن الشيخوخة وانخفاض تناول الخضروات، هي عوامل خطر لتكون سرطان القولون والمستقيم. ومع ذلك، هناك حاجة إلى دراسة متعددة المراكز باستخدام عينة أكبر واستخدام بيانات هذا العمل.

الكلمات المفتاحية: سرطان القولون والمستقيم؛ السلائل؛ المدخول الغذائي؛ النظام الغذائي النباتي؛ الإرشادات الغذائية السعودية

Abstract

Objectives: Colorectal polyps are a known precursor to colorectal cancer (CRC). Using the Saudi dietary guidelines adherence scores, this study evaluated whether dietary intake can lead to the development of colorectal polyps in a Saudi cohort.

Methods: In a cross-sectional study, 101 patients of both sexes, aged 30–86 years (40 patients with colorectal polyps and 61 patients without polyps), were recruited from the endoscopy unit in a Saudi hospital. A questionnaire was administered to collect demographic data, anthropometric data, and information about dietary habits.

Results: Patients with colorectal polyps were significantly older than those without polyps ($p = 0.05$). The mean body mass index in both patient groups was within the overweight range, with a value of 28.6 ± 6.7 kg/m^2. We did not find significant differences between patients with and without colorectal polyps. Although there was no difference in the overall scores for adherence to the Saudi dietary guidelines between the two groups, the specific adherence score for vegetables was significantly higher in patients without colorectal polyps (5.0 ± 0.0 vs. 4.9 ± 0.3, $p = 0.03$).

Conclusion: Ageing and lower vegetable intake, previously reported to be risk factors for CRC, were likewise identified in this study. However, a multi-centre study with a larger sample size, utilising data from this study, is needed.

Keywords: Colorectal cancer; Dietary intake; Polyps; Saudi dietary guidelines; Vegetable intake

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Introduction

Colorectal cancer (CRC) is the third most common cancer and is one of the primary cancer-related causes of mortality and morbidity worldwide.[1] In KSA, CRC is an increasing public health concern as its incidence has doubled over the past 15 years.[2,3] In KSA, CRC is now the most common cancer in men and the second most common in women (after breast cancer); it also has an earlier onset in this region compared to in developed countries.[4] The median age for the development of CRC in KSA, as measured between 1994 and 2010, was 60 years for men and 55 years for women.[4] In developed countries, the age of CRC onset as measured over the same time period was reported to be 70 years.[4,5] In addition, CRC appears to be increasing among younger people in the United States and is now one of the 10 most commonly diagnosed cancers among individuals aged 20–49 years.[6]

The aetiology of CRC is not fully understood; however, genetics, ageing, smoking, and most importantly environmental factors, such as dietary habits, obesity, and physical inactivity have been strongly associated with CRC risk.[7] High intakes of fruit and vegetables, whole grains, fibre, and dairy products have been reported to protect against CRC via the antioxidant, anti-inflammatory, prebiotic, and antibacterial properties that these foods possess.[8] In contrast, dietary patterns including high fat, protein (processed meats and saturated/animal fats), sugar, and refined carbohydrate intakes, and low vitamin D and calcium intakes, have been estimated to contribute to approximately 80% of colon cancer cases.[7–9] Overall, dietary factors account for 70–90% of all CRC cases and diet modification has been suggested by many studies as a primary prevention strategy for reducing CRC incidence.[10]

In comparison to the wealth of available evidence that supports an association between dietary habits and the risk of CRC in Western populations, research studies that evaluate the association between Saudi dietary habits and the risk of cancer are scarce. The Saudi Health Interview Survey (2015), performed across a population of 10,735 healthy Saudi nationals, concluded that the majority of the adult Saudi population did not adhere to dietary guidelines and had poor dietary practices.[11] Lower than recommended intakes of fruit and vegetables, dairy products, nuts, and fish were recorded, while higher intakes of red and processed meat, as well as sugar-sweetened foods, were noted.[11] However, whether poor adherence to dietary guidelines increases CRC risk in the Saudi population remains unclear.

Despite the increasing public health significance of CRC in KSA, little research has been conducted to evaluate the association between dietary patterns and the high incidence and early onset of CRC. Moreover, we were unable to identify any study which evaluated whether dietary intake, using Saudi dietary guidelines adherence scores, is a contributing factor to colorectal polyp development, a precursor to colorectal cancer. Therefore, this preliminary study aimed to examine the dietary habits of Saudi patients with colorectal polyps using Saudi dietary guidelines adherence scores. We hypothesised that Saudi dietary guidelines adherence scores would be low among Saudi patients with colorectal polyps.

Materials and Methods

Study design and subjects

A cross-sectional retrospective study was performed between February 2018 and March 2019. Patients were recruited from the endoscopy unit at King Abdulaziz University Hospital (KAUH) prior to colonoscopy. Male and female Saudi patients over 30 years of age were included. Pregnant and lactating women were excluded. Patients previously diagnosed with colorectal polyps or with other chronic diseases including diabetes, hyperlipidaemia, and hypertension, as well as cardiac, liver, and renal diseases, were excluded. Members of the research team performed the data collection for this project after explaining the aims and objectives of this study to each subject and receiving informed consent. Following colonoscopy, patients were assigned to the "with colorectal polyps" and "without colorectal polyps" groups based on their colonoscopy reports.

Sample size calculation

Since there were no Saudi studies that were similar in nature to use as a reference, we performed the sample size calculation based on the KAUH endoscopy unit statistics from 2018 using the online Epi Info sample size calculator (Division of Health Informatics & Surveillance, and Centre for Surveillance, Epidemiology & Laboratory Services, Georgia, USA).[12] The endoscopy unit statistics showed that approximately 1280 patients over 30 years old underwent colonoscopy in 2018. Therefore, the required sample size was calculated by estimating that 80% of patients would agree to participate in the study, with a confidence level of 80%, margin error of 5%, and design effect of 1; the total calculated sample size was 98 patients.

Study instrument

A questionnaire was completed for each individual to record demographic, anthropometric, and dietary data. The study questionnaire consisted of three sections. The first section collected demographic information including name, date of birth, gender, education level, and household income.

The second section collected anthropometric data (i.e. height, weight, and body mass index (BMI)) which were measured by the research team. Anthropometric data were measured according to standard procedures by trained researchers.[13] Weight was measured in kilograms (kg) to the nearest 0.1 kg using a calibrated digital scale; subjects were weighed wearing light clothing and without shoes. Height was measured to the nearest 0.1 cm according to the Frankfurt plane position. Weight and height were measured twice and averaged for accuracy. BMI categories were defined as follows: underweight (<18.5 kg/m^2), healthy weight (18.5–24.9 kg/m^2), overweight (25.0–29.9 kg/m^2), and obese (≥30 kg/m^2). The third section assessed dietary habits using an interview-administered food-frequency questionnaire (FFQ).[14] The questionnaire consisted of 94 food items and took approximately 30 min to complete. For each food item, patients were asked how frequently they consumed it (i.e. never, 1–3 times per month, 1–3 times per week, once per day, or 2 or more times per day).

Saudi dietary guideline scores

Scores were given according to adherence to Saudi dietary guidelines, as previously described.[15] We included 10 main components of the Saudi diet: refined cereals and bread, fruits, vegetables, legumes, fish, meat and meat products, poultry, full-fat dairy products, sweets, and oils. Each food group's consumption ratings (from 0 to 5 or the reverse) were adapted from Panagiotakos et al.[16] and were used previously to assess adherence to the Saudi dietary guidelines by Alkhaldy et al.[15] For intake of food items recommended in the Saudi dietary guidelines (i.e. unrefined cereals and bread (wholegrain bread, rice, pasta, and other grains), fruits, vegetables, legumes, and fish), a score of 0 was given when an individual reported no consumption; 1 when they reported consumption of 1–4 servings/month; 2 for 5–8 servings/month; 3 for 9–12 servings/month; 4 for 13–18 servings/month; and 5 for more than 18 servings/month. In contrast, intake of food items limited in the Saudi dietary guidelines (i.e. rare or once-monthly intake recommended; meat and meat products, poultry, full-fat dairy products, sweets, and oils) was scored according to a reverse scale (from 5, when no intake was reported, to 0, when an intake of > 18 servings/month was reported). Hence, the total scores including all 10 food groups ranged from 0 to 50. Higher scores indicate better adherence to Saudi dietary guidelines (Table 1).

Statistical analysis

Statistical analyses were performed using Microsoft Excel and SPSS statistical software (version 23, SPSS Inc., Chicago, IL, 2015). Testing for normality of data sets was performed using an Anderson-Darling test. Descriptive statistics were presented as means ± standard deviations or as frequencies (percentages). Comparisons between groups were performed using a Mann–Whitney test for non-normally distributed data, while a paired t-test and 2-sample t-test were used for normally distributed data.

All the statistical analyses were conducted using Stata version 13 statistical software.

Results

Demographics

Demographic data is presented in Table 2. A total of 101 patients (61 patients without, and 40 patients with, colorectal polyps) were included in this study. Patients were aged 30–86 years and gender distribution was approximately equal (59% male and 41% female). Patients were approximately evenly drawn from across income levels, and 54% were educated to at least bachelor's degree level. There was a significant difference between patients with and without colorectal polyps in terms of age ($p = 0.05$), but not in terms of income or educational level.

Anthropometrics

Anthropometric measurements are presented in Table 3. Mean BMIs in both patient groups were within the overweight range, with values of 28.8 ± 6.1 kg/m^2 for patients without colorectal polyps and 28.2 ± 7.8 kg/m^2 for patients with colorectal polyps. Approximately 40% of patients without colorectal polyps were obese, while 43% of patients with colorectal polyps were overweight.

Table 1: Saudi dietary guidelines adherence scoring rubric.

Food Groups	Frequency of Consumption (Servings/Month)					
	0	1–4	5–8	9–12	13–18	>18
Food items recommended in the Saudi dietary guidelines						
Unrefined cereals and bread[a]	0	1	2	3	4	5
Fruits[b]	0	1	2	3	4	5
Vegetables	0	1	2	3	4	5
Legumes	0	1	2	3	4	5
Fish	0	1	2	3	4	5
Food items limited in the Saudi dietary guidelines						
Meat and meat products	5	4	3	2	1	0
Poultry	5	4	3	2	1	0
Full-fat dairy products	5	4	3	2	1	0
Sweets	5	4	3	2	1	0
Oils	5	4	3	2	1	0

[a] Whole-grain bread, rice, pasta etc.
[b] Fresh (e.g. apples, oranges, bananas, grapes) and dried fruits, including dates.

Table 2: Patient demographic data.

Variable	All Patients	Patients without Colorectal Polyps	Patients with Colorectal Polyps	*p*-value*
	(n = 101)	(n = 61)	(n = 40)	
Age (mean ± SD)	51.9 ± 13.9	47.0 ± 13.2	59.1 ± 11.8	0.054
≤35	16 (16)	15 (25)	1 (3)	
36–45	23 (23)	17 (28)	6 (15)	
46–55	21 (21)	14 (23)	7 (18)	
56–65	23 (23)	7 (11)	16 (40)	
66–75	14 (14)	7 (11)	7 (18)	
76–85	3 (3)	1 (2)	2 (5)	
≥86	1 (1)	0 (0)	1 (3)	
Income (SR)	(n = 97)	(n = 58)	(n = 39)	
<5000	24 (25)	13 (22)	11 (28)	0.445
5000–10,000	24 (25)	13 (22)	11 (28)	
10,000–15,000	23 (24)	15 (26)	8 (21)	
>15,000	26 (27)	17 (29)	9 (23)	
Education	(n = 101)	(n = 61)	(n = 40)	
No education	3 (3)	1 (2)	2 (5)	0.828
Primary school	14 (14)	7 (12)	7 (18)	
Intermediate school	13 (13)	8 (13)	5 (13)	
High school	16 (16)	9 (15)	7 (18)	
University	41 (41)	27 (45)	14 (35)	
Higher degree	13 (13)	8 (13)	5 (13)	

Data are presented as means ± SD or as numbers (percentages). Percentages have been rounded and may not total 100%.
SD = standard deviations; SR = Saudi Riyal.
*p-values represent comparisons between patients with and without colorectal polyps.

Table 3: Patient anthropometric measurements.

	All Patients	Patients without Colorectal Polyps	Patients with Colorectal Polyps	*p*-value*
	(n = 96: m = 57, f = 39)	(n = 59: m = 37, f = 22)	(n = 37: m = 20, f = 17)	
Variable (mean ± SD)				
Height (m)	1.7 ± 0.1	1.7 ± 0.1	1.6 ± 0.1	0.876
Weight (kg)	77.7 ± 18.6	79.7 ± 19.9	74.2 ± 15.7	0.255
BMI (kg/m^2)	28.6 ± 6.7	28.8 ± 6.1	28.2 ± 7.8	0.313
BMI category (n, %)				
Underweight	2 (2.1)	2 (3.4)	0 (0)	0.313
Healthy weight	27 (28.1)	15 (25.4)	12 (32.4)	
Overweight	35 (36.5)	19 (32.2)	16 (43.2)	
Obese	32 (33.3)	23 (39.0)	9 (24.3)	

Data are presented as means ± SDs or numbers (percentages).
SD = standard deviation; BMI = body mass index.
BMI categories are defined as: underweight (<18.5 kg/m^2), healthy weight (18.5–24.9 kg/m^2), overweight (25.0–29.9 kg/m^2), and obese (≥30 kg/m^2).
*p-values represent comparisons between patients with and without colorectal polyps.

Dietary assessment

There was no significant difference in total adherence scores between the two groups (Table 4). However, the specific adherence score for vegetables was significantly higher in patients without colorectal polyps ($p = 0.03$).

Correlations Between the Saudi Dietary Guidelines Adherence Scores and Main Study Variables

Relationships between the total scores for adherence to the Saudi dietary guidelines and the main study variables (i.e. age, gender, education, income, and BMI) were analysed

Table 4: Patient scores for adherence to the Saudi dietary guidelines.

	All Patients (n = 101)		Patients without Colorectal Polyps (n = 61)		Patients with Colorectal Polyps (n = 40)		*p*-value*
	Mean	SD	Mean	SD	Mean	SD	
Unrefined cereals and bread	3.9	2.1	4.0	1.4	3.9	2.8	0.196
Fruits	4.8	0.8	4.9	0.7	4.8	1.0	0.337
Vegetables	5.0	0.2	5.0	0.0	4.9	0.3	0.031
Legumes	2.9	1.9	2.9	1.9	3.0	1.9	0.901
Fish	2.1	1.5	2.0	1.6	2.3	1.5	0.312
Meat and meat products	2.3	1.4	2.4	1.4	2.2	1.4	0.488
Poultry	0.6	1.0	0.5	1.1	0.6	1.0	0.481
Full-fat dairy products	0.7	1.5	0.8	1.6	0.6	1.3	0.651
Sweets	1.2	1.7	1.0	1.6	1.4	1.8	0.308
Oils	0.3	0.8	0.2	0.6	0.4	1.1	0.742
Total adherence to Saudi dietary guidelines	23.7	4.2	23.7	3.8	23.9	4.7	0.856

SD = standard deviation.
*p-values represent comparisons between patients with and without colorectal polyps.

using the Pearson correlation. A relationship was found only between the age of patients and the total Saudi dietary guidelines adherence scores ($R^2 = 0.35$; $p < 0.001$).

Discussion

This study was conducted to evaluate whether dietary patterns play a role in increasing the risk of colorectal polyp development, a precursor to CRC. Conducting this research is an important preliminary step in obtaining an increased understanding of the dietary patterns among the Saudi population that may potentially affect their risk of CRC. This study found two significant differences between the two patient groups. Patients with colorectal polyps were significantly older (by a mean of 12 years) than those without polyps. Ageing has previously been reported to be a risk factor for CRC.[17] The risk of CRC increases after the age of 40, rising sharply after age 50, with more than 90% of CRCs occurring in people aged 50 or older.[17] In this study, about two-thirds of patients with colorectal polyps were older than 56 years, while three-quarters of those without polyps were younger than 56 years. Several causative factors linked to increased CRC risk among older people have been reported, namely 1) difficulty in chewing leading to alternative food choices and lower fibre consumption[18]; 2) longer intestinal transit times[19]; 3) increase in irritable bowel syndrome and diverticulosis, both of which are linked to variations in gut microbiota[20,21]; and 4) lower physical activity levels which may result in an increase or decrease in bowel movements.[22]

Here, we did not find a significant difference in total dietary adherence scores between groups; however, there was a difference in adherence to recommended vegetable intake ($p = 0.03$). Patients without colorectal polyps were more compliant with dietary guidelines regarding vegetable intake than those with polyps. This could be due to the effects of ageing on taste acuity, sense of smell, gastrointestinal problems, and emotions which influence appetite and in turn reduce vegetable intake. In addition, ageing is accompanied by compromised oral health, such as gum disease, tooth loss, and decay, which are reported to be associated with reduced intake of vegetables.[23] Many case–control and cohort studies have reported an association between consumption of vegetables and decreased risk of CRC due to vegetables' antioxidant, anti-carcinogenic, anti-inflammatory, and antimicrobial properties that could have effects on ageing and decrease the risk of chronic diseases such as CRC.[17,24,25] Moreover, such foods contain high amounts of dietary fibre which reduces intestinal transit time and increases fecal bulking and viscosity, resulting in an improved colonic environment. Colonic fermentation of dietary fibre by microflora produces short-chain fatty acids (SCFA) (acetate, propionate and butyrate) and lowers faecal pH level.[26] In addition, the SCFA butyrate has been reported to be a cancer-prevention agent.[26,27]

Approximately 70% of our study participants were classified by BMI as either overweight or obese. However, no significant difference in BMI between the two groups was noted, likely due to our small sample size. Further study evaluating a larger number of participants is needed, as many studies have reported a relationship between BMI and CRC.[28–31] A recent meta-analysis of 38 prospective cohort studies reported a strong association between BMI and CRC with an 8% increase in CRC incidence per 5 kg/m^2 increase in BMI.[28] Moreover, CRC risk further increased with a BMI above 27 kg/m^2 and exhibited a stronger association with BMI among men than among women.[28]

Despite the small sample size, this study is important because it is the first to examine adherence to the Saudi dietary guidelines and its relationship to CRC risk. Therefore, the results of this study could help identify dietary patterns of the Saudi population that may be associated with the risk of CRC and in this way could contribute to the work of future studies. In addition, the data from this study could be used to calculate the sample size for future studies. However, as with most cross-sectional studies, our study has some limitations. First, its cross-sectional nature makes it difficult to assess causality of reported associations. Second, in this study there was no defined strategy for distribution of the questionnaire to patients in the endoscopy unit before their colonoscopy, so we could not define the number of patients who declined to participate in the study; therefore, we were unable to

calculate the response rate. Third, the distribution of the two groups was not equal as we recruited patients (meeting the study criteria) before their colonoscopy procedure and then, after the procedure, checked their colonoscopy report to allocate them to the group with or without colorectal polyps, as appropriate. Future studies need to consider this limitation during the recruitment process to track the variables that could affect group-matching, such as number of patients and gender. Fourth, the FFQ used in this study was not comprehensive and thus not all food items that may be commonly consumed were included.

Conclusions

In summary, even though there was no difference in overall scores for adherence to the Saudi dietary guidelines between the two groups, the lower adherence score for vegetables in the colorectal polyps group suggests that a low intake of vegetables could increase colorectal polyp development among Saudis. Ageing, a previously published risk factor associated with colonic polyps, was also detected as a significant variable in this study. Further studies focusing on diet among Saudis are necessary in order to validate our findings and provide further insight into dietary risk factors associated with colorectal polyp development/CRC among Saudis. Such knowledge and awareness could help reduce the prevalence of CRC in KSA.

Recommendations

More research taking a large-scale longitudinal approach is required to determine the association between the Saudi lifestyle, including diet and physical activity, and CRC risk, which is an increasing public health concern in KSA. In addition, further investigation is warranted in order to design effective dietary interventions as a primary preventive approach to reducing the incidence and early onset of CRC in KSA. Lastly, there is currently no validated FFQ available specifically for the Saudi older population, updated to include all of the Western food items that have begun to be consumed by Saudis in recent years; therefore, it is important to validate such a questionnaire in future research.

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Conflict of interest

There is no conflict of interest.

Ethical approval

This study was approved by the Unit of Biomedical Ethics Research Committee at King Abdulaziz University (KAU) (Jeddah, KSA) (Reference No. 61–16). All participants gave informed written consent.

Authors contributions

All authors made substantial contributions to the study. Conceptualization, AAA, YAQ, MHM, and ESA; methodology, AAA, YAQ, MHM, ESA, MAA, and HAJ; data collection, YAQ, ESA, MHM, MAA, and HAJ; data entry and analysis, AAA; preparing the first draft of the manuscript, AAA, YAQ, and MHM; reviewing and editing the manuscript, ESA, MAA, and HAJ; supervision, YAQ; project administration AAA. All authors approved the final version of the manuscript. All authors have critically reviewed and approved the final draft and are responsible for the content and similarity index of the manuscript.

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