

Case-control: A low-fiber diet increases the risk of appendicitis in main Qassim, Saudi Arabia hospitals 2020-2021

To Cite:

Alkhamiss A, Almosallam O, Al-abdulmonem W, Alajlan A, Alharbi B, Alodhaylah S, Aloqla A, Alzaaqi F, Alshowaiman A. Case-control: A low-fiber diet increases the risk of appendicitis in main Qassim, Saudi Arabia hospitals 2020-2021. *Medical Science*, 2022, 26, ms31e2033. doi: <https://doi.org/10.54905/diss/v26i119/ms31e2033>

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Peer-Review History

Received: 20 December 2021
Reviewed & Revised: 22/December/2021 to 12/January/2022
Accepted: 14 January 2022
Published: 16 January 2022

Peer-review Method

External peer-review was done through double-blind method.

URL: <https://www.discoveryjournals.org/medicallscience>



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ABSTRACT

Background: Appendicitis is caused by the occlusion of the appendiceal lumen; it is the most cause of abdominal surgery emergency. The low fiber diet can cause the blockage of the appendiceal lumen. It is necessary to know the impact of the low fiber diet on the risk of appendicitis. **Aim:** To assess the association between a low fiber diet and the increased risk of appendicitis. **Methods:** This study is a case-control study that was conducted at 15 main hospitals in Qassim region during the period from 01 January 2020 to 01 June 2021. The study investigated the demographics and the nutritional habits of participants related to fibers using a fat & fiber behavior questionnaire "FFBQ" survey. The data were analyzed using the SPSS program. **Results:** Two groups were included; the patient group, which included 115 appendicitis patients, and the normal control group, which included 230 participants without history of appendicitis. There was a group match regarding the demographics of all the participants. The normal control group significantly tended to consume more different types of fiber diet compared to the patients' group. Also, between the two groups, there was a significant difference regarding the overall fiber diet frequency ($P=0.0001$). **Conclusion:** A low fiber diet is a major risk factor for appendicitis; the patients suffering appendicitis consume low fiber diets compared to normal individuals.

Keywords: Appendicitis, Low fiber, Diet, Appendectomy

1. INTRODUCTION

Emergency abdominal operations are most often due to appendicitis. A blocked appendiceal lumen may lead to appendicitis, this blockage results in backing up of the mucus in the appendiceal lumen causing multiplying of

bacteria that normally live inside the appendix, then the appendix swell and become infected. Appendicitis may occur at any age; however there is a higher incidence of it in individuals in the age of 10 to 30 years old. Symptoms of appendicitis include abdominal pain, nausea, vomiting, and loss of appetite, diarrhea or constipation (Spirt, 2015). There is persistent significant morbidity (10%) and mortality (1-5%) associated with appendicitis, despite the advances in both diagnosis and treatment (Prystowsky et al., 2005).

Soft or liquid diet that is easily digested in the gastrointestinal tract is suggested for non-surgical treatment of appendicitis (Spirt, 2015). The dietary consumption varies between different countries as it is affected by several factors including prices, income, cultural traditions and preference of individual (Adam et al., 2014). In Saudi Arabia, there have been changes in lifestyles and demographics during the last three decades which affected the food intake and food choices of the Saudi Population (Adam et al., 2014), this includes shifts of structure of diet toward higher energy and reduced intakes of fruit, vegetables, dietary fibers and complex carbohydrates (Drewnowski & Popkin, 1997). Dietary fiber is necessary in childhood as it promotes the normal digestion function and prevention of childhood obesity (Anderson et al., 2009). It was reported that low fiber diet can result in obstruction of appendix lumen leading to appendicitis (Peter, 2010). Early observers suggested that the dietary intake of the fiber reduces the prevalence of several diseases and conditions such as appendicitis, gall bladder disease, peptic ulcer, hemorrhoid, and colorectal cancer (Burkett & Trowell, 1975).

2. RESEARCH METHODOLOGY

Study design & setting

It is a case control study conducted at 11 hospitals in Qassim region, Saudi Arabia. The hospitals included Buraidah Central Hospital, Almethnab General Hospital, Alrass General Hospital, King Saud Hospital, King Abdullah Specialist Hospital, Dr. Sulaiman Al Habib Hospital in Buraidah, National Qassim Hospital, Albukayriyah General Hospital, Hayat national hospital, Albdaiia General Hospital and Riyadh Alkhabra Specialist Hospital. The study was conducted over 1 year and 6 month's duration from January 2020 to June 2021.

Ethical considerations

An informed consent was attained from the all the participants. An ethical approval was obtained from each hospital before the start of the study.

Subjects

The sample included 345 participants. Among them, 115 participants had appendicitis (60 male, 55 female) and 230 (120 male, 110 female) were healthy participants without history of appendicitis. The two groups were matched in (age – gender – living area). Data collection was conducted through the same period of all cases and controls. All appendicitis cases that were operated on were grossly/histopathologically proved to be appendicitis and all controls that were matched and never operated on or were having any appendicitis symptoms. Exclusion criteria were the patients with non-approved histopathology report or appendix wasn't inflamed grossly. Patients who refuse to consent and patients more than 61 years old are also were not included in the study.

Data collection methods

The survey composed of three sections. Section "A" included demographic data "age, gender, weight, height, BMI" Section "B" enquired about the type of appendicitis "acute/perforated/none" Section "C" was investigating the dietary habits by using fat & fiber behavior questionnaire (FFBQ) (Reeves et al., 2014; Shannon et al, 1999; Coles-Rutishauser et al., 1995). The FFBQ have seven questions concerning fiber intake in the last month, each question is graded into 1 to 5 scores and the sum of this score divided by n (number of fiber questions) yielding the fiber index. The first two questions were querying about "how many serves of vegetables and fruits you usually eat at each day?". The next two questions were questioning about "how often do you eat legumes, high fiber cereal" and the last three questions were comparing "how often does the participants choose between whole meal/regular pasta, brown/white rice, and whole grain/whole meal bread". The FFBQ was translated into Arabic language and was approved and reviewed by an Arabic translator with a bachelor's degree in English and translation. The validity of the translation was checked in a pilot study.

Data analysis

The collected data were saved in an excel sheet then analyzed by SPSS program version 21. Categorical variables were represented using number and percents; whereas numerical variables were represented using mean \pm SD. Odds ratio was used to measure the association between the relative risk of appendicitis and the low fiber intake diet. P-value was considered significant at ≤ 0.05 .

3. RESULTS

This study included 345 participants; 115 were suffering appendicitis, and 230 were normal control. Regarding patients with appendicitis, the majority had non-perforated appendicitis 99 (86.1%), whereas 16(13.9%) reported having perforated appendicitis. The age range of participants was 7-61 years old, with a matched mean \pm SD age of 22.1 \pm 10.3. Regarding the age groups, also there was an age match between the two groups, where individuals with an age range of 15-19 years were more dominant in both groups. Males were more predominant in both groups with no significant difference (P=1.000); there were 60 males (52.2%) in patients' groups and 120 males (52.2%) in the normal control group. Also, In terms of BMI, there were no significant differences between the two groups; normal-weight individuals were predominant in both groups (P=0.098). Regarding the city of residency, neither group showed a significant difference; the largest proportion of patients was from Buraydah 48 (41.7%), as well as those from the control group 94(40.9%). The comparison between the demographics of the two groups is shown in table1.

Table 1 Comparison between cases and controls regarding demographics

	APPENDICITIS		P-value
	Yes N (%) (n=115)	No N (%) (n=230)	
APPENDICITIS TYPE			
Acute	99 (86.1)		
Perforated	16 (13.9)		
AGE			
Range	7 - 61	7 - 61	
Mean \pm SD	22.1 \pm 10.3	22.1 \pm 10.3	1.000#
AGE			
< 15	26 (22.6)	52 (22.6)	1.000*
15-19	28 (24.3)	56 (24.3)	
20-24	25 (21.7)	50 (21.7)	
25-29	13 (11.3)	26 (11.3)	
30 or more	23 (20.0)	46 (20.0)	
GENDER			
Male	60 (52.2)	120 (52.2)	1.000*
Female	55 (47.8)	110 (47.8)	
BMI			
Range	14.1 - 43.9	14.1 - 45.4	
Mean \pm SD	24.5 \pm 5.3	24.8 \pm 5.9	0.730#
BMI			
Underweight	11 (9.6)	22 (9.6)	0.098*
Normal weight	54 (47.0)	117 (50.9)	
Overweight	40 (34.8)	55 (23.9)	
Obese	10 (8.7)	36 (15.7)	
City			
Buraydah	48 (41.7)	94 (40.9)	1.000*
Onaizah	33 (28.7)	68 (29.6)	
Alrass	18 (15.7)	36 (15.7)	

Bukayriyah	10 (8.7)	20 (8.7)	
Badaiah	5 (4.3)	10 (4.3)	
Riad	1 (0.9)	2 (0.9)	

*Chi-square test. #t-test

The participants were asked ten questions to investigate their dietary habits (table 2). There was a significant difference between the appendicitis group and the control group regarding the number of serving vegetables eaten daily (P=0.0001). The control group's percentage was significantly higher (33.9%) reported eating 3-4 serves. A significantly higher proportion of control groups reported eating one or two serves of fruits (P=0.0001). According to this study, the frequency of eating legumes varied significantly between the two groups (P=0.005). The largest proportions of the normal control group participants significantly reported using high-fiber cereals for breakfast (P=0.0001). The two groups showed no significant variation regarding eating spaghetti or pasta (P=0.788). Regarding preferring brown rice over white rice, the patient group significantly did not prefer it, whereas the control group significantly tended to prefer it rarely (P=0.046). Regarding preferring raw bread to white bread, the patient group significantly tended not to prefer it, whereas the largest proportions of the control group tended significantly to prefer it sometimes, usually, and always (P=0.0001). The overall fiber diet was significantly higher among the control group and significantly lower among the patient group (P=0.0001) (figure 1). The total fibers index was higher among control group which appear to be 2.73 than case group in which total fiber index was 2.21. There was a significant difference between the two groups regarding the benefit of appendices (P=0.022) (figure 2). The two groups equally reported that the current month of investigation had matched the past 11 months (P=0.811).

Table 2 Comparison between cases and controls regarding dietary habits

	APPENDICITIS		P value
	Yes N (%) (n=115)	No N (%) (n=230)	
“How many servings of vegetables do you eat each day?”			0.0001
0 serves	21 (18.3)	11 (4.8)	
1-2 serves	78 (67.8)	123 (53.5)	
3-4 serves	11 (9.6)	78 (33.9)	
5-6 serves	5 (4.3)	12 (5.2)	
Seven or more serves	0 (0)	6 (2.6)	
“How many servings of fruit do you eat each day?”			0.0001
0 serves	35 (30.4)	19 (8.3)	
One serves	64 (55.7)	83 (36.1)	
Two serves	9 (7.8)	90 (39.1)	
Three serves	7 (6.1)	29 (12.6)	
Four or more serves	0 (0)	9 (3.9)	
How much do you usually eat legumes, such as cooked beans, lentils, peas, dried beans, or mixed legumes?			0.005*
Never	19 (16.5)	25 (10.9)	
Less than once / week	54 (47.0)	90 (39.1)	
1-2 days/week	21 (18.3)	77 (33.9)	
3-5 days/week	12 (10.4)	31 (13.5)	
6-7 days/week	9 (7.8)	6 (2.6)	
How much do you usually take high-fiber cereals for breakfast?			

Never	35 (30.4)	21 (9.1)	0.0001
Less than once / week	32 (27.8)	54 (23.5)	
1-2 days/week	20 (17.4)	69 (30.0)	
3-5 days/week	21 (18.3)	65 (28.3)	
6-7 days/week	7 (6.1)	21 (9.1)	
How often do you prefer spaghetti or wholemeal pasta over spaghetti or regular pasta?			
Never	41 (35.7)	75 (32.6)	0.788*
Rare	27 (23.5)	55 (23.9)	
Sometimes	17 (14.8)	46 (20.0)	
Usually	19 (16.5)	32 (13.9)	
Always	11 (9.6)	22 (9.6)	
How often do you prefer brown rice over white rice?			
Never	66 (57.4)	101 (43.9)	0.046*
Rare	15 (13.0)	50 (21.7)	
Sometimes	16 (13.9)	48 (20.9)	
Usually	14 (12.2)	19 (8.3)	
Always	4 (3.5)	12 (5.2)	
How often do you prefer raw bread to white bread?			
Never	48 (41.7)	45 (19.6)	0.0001
Rare	22 (19.1)	40 (17.4)	
Sometimes	14 (12.2)	52 (22.6)	
Usually	19 (16.5)	48 (20.9)	
Always	12 (10.4)	45 (19.6)	
Overall Fiber diet frequency			
Low	81 (70.4)	97 (42.2)	0.0001
High	34 (29.6)	133 (57.8)	
Do you think there is a benefit of appendices?			
Yes	47 (40.9)	124 (53.9)	0.022*
No	68 (59.1)	106 (46.1)	
? Out of 10, How much do you think this month has matched to the past 11 months			
Range	1 - 10	1 - 10	0.811#
Mean ± SD	7.5 ± 2.0	7.6 ± 1.8	

*Chi-square test. #t-test

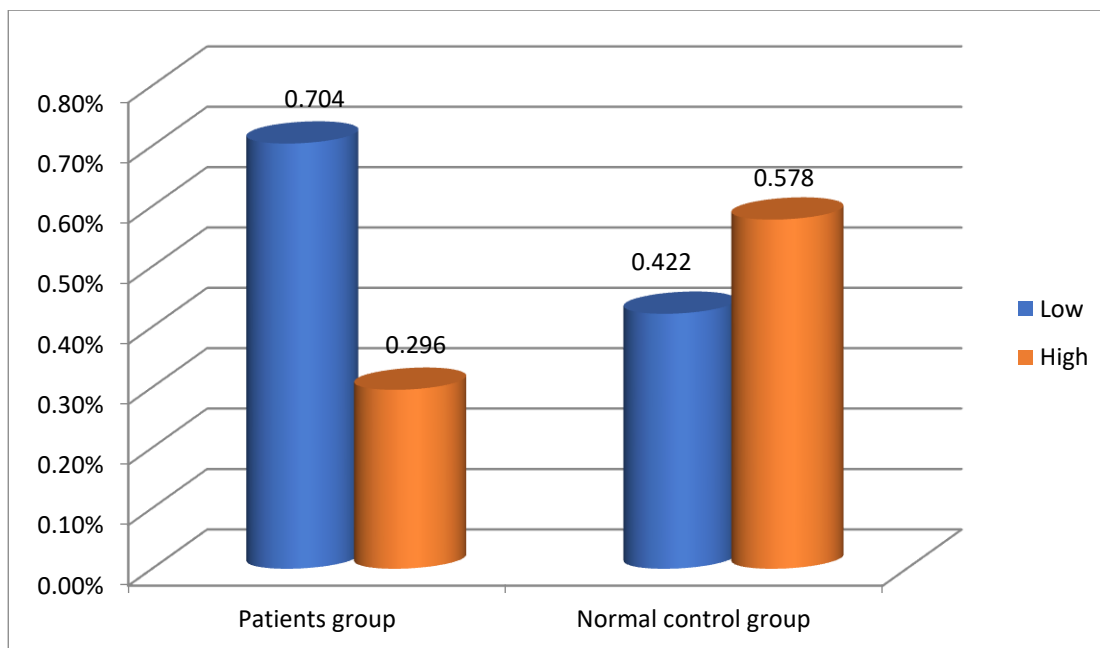


Figure 1 The overall fiber diet frequency among the two groups

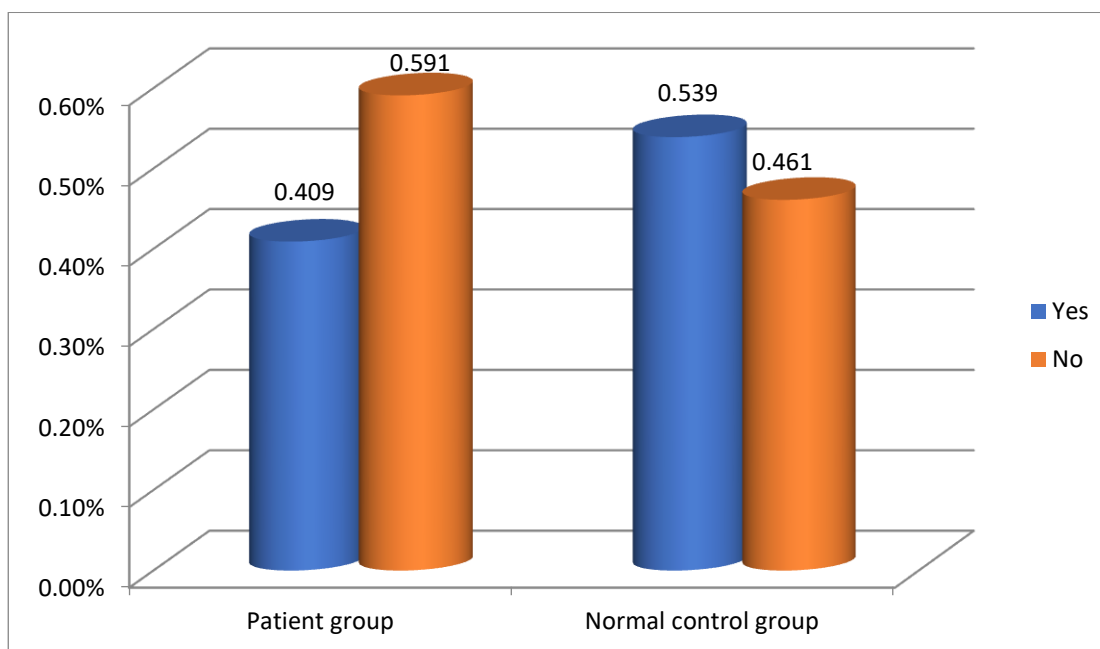


Figure 2 The answers of the two groups about the question "Do you think there is a benefit of appendices?"

4. DISCUSSION

Saudi Arabia has witnessed dramatic changes in the lifestyle and demographics during the last three decades, which considerably affected the influence of food choice and food intake (Kuhnlein, 1989). One study from Saudi Arabia included 864 volunteers from various social media platforms. The study found that 41.4% of the participants reported that they do not consume food rich in fibers (Alosayfir et al., 2018). We enrolled the study in two groups in order to investigate the increased risk of appendicitis due to a low fiber diet. The majority of appendicitis patients tended to consume fewer servings of vegetables and fruits compared to the normal control group. The association between appendicitis and a low-fiber diet was proposed for the first time in 1920 by Rendle Short (Short, 1920). Alzahrani et al., (2017) reported a significant reduction in consuming fibers in the deity of appendicitis patients; few percent reported consuming frequent daily vegetables, fruits, and grains.

One study from Indonesia was conducted on 35 child patients with appendicitis showed that majority of patients 54% had low fiber diet. According to the study, low fiber diet intake among children was considerably associated with appendicitis incidence (P=0.0001) (Damanik et al., 2016). Earlier case control study reported that certain foods such as green vegetables and tomatoes

protect children against appendicitis through fiber associated mechanisms (Nelson et al., 1986). It was stated that the American Health Foundation recommended five grams daily for fiber diet value for children of two years of age and above, and the value is increased gradually up to 35-35 grams per day for individuals with 20 years and older (Damanik et al., 2016).

Regarding the benefits of appendices, we found that a significantly higher percentage of the normal control group thought there are benefits for the appendices, whereas more than one-half of appendicitis patients reported no benefits for appendices. In a previous Saudi study, only 41.1% reported the knowledge of some information about appendicitis (Alosayfir et al., 2018). Our findings and the previous findings (Alosayfir et al., 2018) indicate that the knowledge regarding the benefits of appendices and appendicitis is low, and there should be awareness programs among the population in order to increase their awareness about appendicitis and reduce the incidence and complications of appendicitis.

5. CONCLUSION

A low fiber diet is a significant risk factor for appendicitis; the patients suffering appendicitis consume low fiber diets compared to normal individuals. This ensures the role of a fiber diet to avoid the obstruction of appendices and their inflammation.

Strength, limitation, and Recommendations

The strength of the current study is that this study is one of the not many studies conducted to investigate the correlation between the low fiber diet and the increased risk of appendicitis. The limitation is retrospective nature of the study and the small sample size. We recommend further prospective studies to be conducted on this subject on a larger sample size and to involve several regions in Saudi Arabia.

Author's Contributions

Abdullah Al-khamiss (AK), Osamah Al-mosallam (OM), was responsible for the conceit of the research idea and the study design. Waleed Al-abdulmonem (WA) AjlanAl-ajlan (AJ), Bader Al-harbi (BH), was responsible for the concept and design, data analysis and interpretation, and the initial draft of the manuscript. Sulaiman Al-odhaylah (SO), Asim Al-showaiman (AS), Abdulhakeem Al-oqla (AO), Faisal Al-zaaqi (FZ), contributed to writing the methods section, data collection and critical review of the manuscript draft.

Ethical approval

Ethical approval was taken from Ministry of Health, Qassim Regional Research Ethics Committee, and Registered at National Committee of Bio & Med. Ethics (NCBE) Registration No. H-04-Q-001. Ethical approval number 1441-1166000, dated Monday, February 3, 2020.

Consent

All participants have signed a written consent form.

Funding

The study did not receive any external funding

Conflict of interests

The authors declare that there are no conflicts of interests.

Data and materials availability

All data associated with this study are present in the paper.

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