REVIEW

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Relationship of eating habits to acute appendicitis in children: a literature review

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ABSTRACT

Introduction: Appendicitis is the inflammation of appendix vermiformis and is designated a national health priority issue by the Ministry of Health. Obstruction of the appendicitis lumen is the main etiology of acute appendicitis, and one of the risk factors is eating habits. This study aimed to determine how eating habits are at risk of causing appendicitis in children. Eating habits that were becoming the focus of this study are fiber intake, water consumption, and fast food.
Methods: This research is a literature study with the scoping review method, compiled based on PRISMA-ScR.
Results: The results obtained are four works of literature stating that low fiber intake and inadequate water consumption in children have a relationship with acute appendicitis, and one piece of literature states that there is no correlation. However, the consumption of fast food has no direct relationship to the occurrence of appendicitis.
Conclusion: In this review, a low-fiber diet was significantly correlated with an increased incidence of appendicitis in children.

Keywords: Pediatric acute appendicitis, eating habits, low-fiber diet, literature review.
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INTRODUCTION

Appendicitis is inflammation of the appendix vermiformis with a clinical picture of periumbilical pain.[1] Based on the Indonesian Ministry of Health records in 2008, the number of acute appendicitis sufferers in Indonesia was 591,819, then increased in 2009 to 596,132 people, and in 2010 to 621,435 people.[2,3] Appendix lumen obstruction is a triggering factor of appendicitis, one of which is caused by constipation due to poor eating habits.[4] MH Imanieh (2007) revealed that out of 31 appendicitis patients with constipation, 58% reported not eating fruits regularly, and only 9.7% consumed vegetables daily.[5] Imanieh concluded that the high level of constipation in patients with lower fiber intake is in line with the hypothesis that dietary fiber plays a role in reducing the incidence of appendicitis.[5]

Based on research conducted by Fitriana S (2013), it was found that the type of food consumed, especially high-fiber food, was related to the incidence of appendicitis in Regional General Hospital Kab. Pangkep.[6] Adhar Arifuddin et al. (2017) stated that patients with a bad diet had a 3,455 times greater risk of suffering from appendicitis than patients with a good diet.[3] The same was found in a study conducted by SS Phonna (2014) of 30 pediatric appendicitis patients at Regional General Hospital dr. Zainoel Abidin Banda Aceh found that 29 patients (96.7%) had the habit of consuming low-fiber foods.[7]

Based on the description above, the authors conclude that eating habits influence the occurrence of appendix lumen obstruction, which then increases the intraluminal pressure of the appendix and triggers inflammation. Therefore the authors are interested in doing a review in the form of literature studies on the relationship of eating habits to the occurrence of appendicitis in children.

METHODS

The research was conducted as a literature study with an integrative review type and a scoping review technique based on the guidelines for making scoping reviews, PRISMA-ScR.

The literature collection was carried out from September 24th to October 20th, 2020. The search was conducted by entering a keyword combination and the Boolean Search function through a search engine. Filtering is carried out in the search process by only entering literature published in the 2010-2020 period, was a research article, free full-text literature, indexed by national and international journal sites, and using Indonesian and English are included in the inclusion criteria. The researcher excludes the article, which is a duplication. Furthermore, the title, writing language, abstracts, and research samples review were conducted.

The search is done by entering a combination of keywords and the Boolean Search function through a search engine, with the first combination being (((((eating habit) OR food habit) OR food intake) OR fiber intake)) AND (((appendicitis on children) OR pediatric appendicitis) OR appendix inflammation on children)). The second keywords combination is

((Kebiasaan makan) OR konsumsi serat)) AND ((Apendisitis anak) OR radang usus buntu pada anak)) for articles using Indonesian.

Among a total of 199 pieces of literature obtained from search results on ScienceDirect, PubMed, SpringerLink, and Google Scholar, four pieces of literature were excluded because of duplication. Of the remaining 195 kinds of literature, one literature does not write in Indonesian or English, and 188 of them have irrelevant titles or abstracts. Of the six pieces of literature retained, one was excluded because it does not include the type of food consumed. Furthermore, from a total of 5 remaining literature, data extraction was carried out in each.

RESULT

In Table 1, there are five studies obtained from search results on ScienceDirect, PubMed, SpringerLink, and Google Scholar. There are 2 cross-sectional and retrospective studies each, while one more is a case-control study.

Table 2 describes several risk factors that can increase the occurrence of appendicitis in children, especially the daily diet and high-fiber diet.

In our research, there were 1277 samples taken from 5 studies according to the inclusion criteria (Table 3).

The results and conclusion of every study included are presented in Table 4.

DISCUSSION

Based on the results of the search, the largest number of samples was 916 samples from research conducted in Saudi Arabia by Ibrahim Ahmed Alzahrani et al.[8] Of the five existing literature; there is only one piece of literature conducted by Stefanos

Table 1. Basic Characteristics of the Study Literature

No.	Article Title	Researcher Name	Year of publication of the article	Research methods	Place of Research Articles
1	*Relationship Between Appendicitis and Lifestyle, Dietary and Hygiene in Saudi Arabia*[8]	Ibrahim Ahmed Alzahrani et al.[8]	2017	*Cross-sectional*	Saudi Arabia
2	*Relation Between Fiber Diet and Appendicitis Incidence in Children at H. Adam Malik Central Hospital Medan*[9]	Boyke Damanik et al.[9]	2016	*Cross-sectional*	Medan, Indonesia
3	*Relationship between eating habits and nutritional status on the incidence of appendicitis in children in Yogyakarta*[10]	Hanum Atikasari et al.[10]	2015	*Case-control*	Yogyakarta, Indonesia
4	*Epidemiological Aspects of Appendicitis in a Rural Setup*[11]	Hanumant P et al.[11]	2014	*Retrospective study*	India
5	*Acute Appendicitis in Preschoolers: a Study of Two Different Populations of Children*[12]	Stefanos Gardikis et al.[12]	2011	*Retrospective Study*	Greece

Table 2. Eating Habits and Obtained Risk Factors

No.	Researcher Name	Types of Eating Habits Obtained	Risk Factors for Appendicitis Causes
1	Ibrahim Ahmed Alzahrani et al.[8]	Consumption of water >6 glasses per day, consumption of vegetables per day, consumption of cereals per day, adding hot sauce to the food, following a certain eating system, consumption of fast food	Daily diet, hygiene habits, chronic medical and surgical problems
2	Boyke Damanik et al.[9]	High fiber consumption and low fiber consumption	Fiber intake
3	Hanum Atikasari et al.[10]	Eating frequency <3 times a day, complementary foods for staple foods, consumption of water per RDA, vegetable consumption <7 times per week, consumption of fast food ≥4 times a month, and consumption of instant noodles ≥4 times a month	Food habits, nutritional status
4	Hanumant P et al.[11]	Vegetarian and non-vegetarian	Diet, seasonal variations
5	Stefanos Gardikis et al.[12]	Consumption of vegetables ≥5x per week	Toilet facilities at home, hot water at home, crowded house, living in rural areas, family history of acute appendicitis, vegetable consumption

Table 3. Patient Age Groups

No.	Researcher Name	Number of Samples	Patient Age Group		
			Preschool (<6 years)	School-age (6-18 years)	> 18 years
1	Ibrahim Ahmed Alzahrani et al.[8]	916	237		679
2	Boyke Damanik et al.[9]	35	35		-
3	Hanum Atikasari et al.[10]	114 (57 non appendicitis)	-	57	-
4	Hanumant P et al.[11]	130	62 (≤20 years)		68
5	Stefanos Gardikis et al.[12]	82	82 (≤5 years)	-	-

Table 4. Results and Conclusions of Literature Research

No.	Researcher Name	Results	Conclusion
1	Ibrahim Ahmed Alzahrani et al.[8]	Of the 916 appendicitis patients, only 277 patients consumed more than 6 glasses of water per day, 756 patients consumed vegetables once a day, 800 patients consumed fruit once a day, 735 patients consumed cereal once a day, 199 patients preferred to add hot sauce to their diet, 861 patients did not follow a specific dietary system, and 808 patients ate food from fast-food restaurants. On the question of a clean lifestyle, 83 patients said they did not wash their hands before eating, 313 patients consumed snacks from peddlers, 424 patients used shared bathrooms, and 427 patients still used the old Arabic toilet. On questions regarding medical conditions, 755 patients did not suffer from chronic constipation, five patients had been diagnosed with inflammatory bowel disease, 54 patients with inflammation of the respiratory tract, 40 patients with parasitic infection of the gastrointestinal tract, eight patients with colon tumors, 32 patients with appendix tumors, 29 patients had experienced abdominal injuries, and 44 patients had undergone right quadrant abdominal surgery.	This study shows the poor diet of patients with acute appendicitis, including low water consumption and lack of fiber intake in their daily diet, so that most patients with acute appendicitis do not defecate every day. A moderate hygiene lifestyle increases the likelihood of acute appendicitis. In the question of medical and surgical conditions, there is only a small prevalence among acute appendicitis patients.
2	Boyke Damanik et al.[9]	The majority of the patients were boys with a mean age of 11.89. Of the 35 pediatric appendicitis patients, 19 had a low fiber consumption habit (14 with acute appendicitis and 5 with perforated appendicitis).	This study showed a significant relationship between low fiber consumption habits and the incidence of appendicitis in children ($p = 0.0001$).
3	Hanum Atikasari et al.[10]	Of the 57 children with appendicitis, 55 children had poor eating habits, and two children had good eating habits, with details: 25 children ate <3 times a day, 53 children only ate staple foods with side dishes/vegetables, 48 children consumed water <RDA, 45 children consumed vegetables <7 times per week, 28 children consumed fast food ≥4 times per month, and 53 children consumed instant noodles ≥4 times per month. A total of 17 children with appendicitis had poor nutritional status, 35 with normal nutritional status, and 5 with excess nutrition.	Food habits and nutritional status significantly related to the incidence of appendicitis in children ($p = 0.001$) ($p = 0.042$).
4	Hanumant P et al.[11]	Among 130 appendicitis patients, the largest age group was 11-20 years, with 58 patients. The incidence of appendicitis was more common in non-vegetarians; there were only 20 appendicitis patients who were vegetarians, 70 patients were non-vegetarians, and 40 were mixed. The highest peak of appendicitis is in spring, and the lowest is in summer.	The results showed that appendicitis was more common in people with low fiber consumption than in non-vegetarians.
5	Stefanos Gardikis et al.[12]	Of 82 preschool children, 43 are Muslim, and 39 are Orthodox Christian. A total of 15 children do not have sink facilities in their house toilets (12 Muslims, 3 Christians), 16 children do not have hot water facilities in their house (11 Muslims, 5 Christians), and 32 children live in a crowded house (26 Muslim, 6 Christian), 58 children live in rural areas (39 Muslim, 19 Christian), 34 children have a family history of acute appendicitis (19 Muslim, 15 Christian), and 72 children consume vegetables ≥5 times per week (37 Islam, 35 Christian).	This study showed that the prevalence of acute appendicitis is higher in Muslim preschool children. The hygiene of the home environment is associated with the incidence of acute appendicitis in preschool children. However, the family's vegetable consumption and a history of acute appendicitis do not show a significant relationship with acute appendicitis in preschool children.

Gardikis et al., which specifically takes preschool children as a sample. Two works of literature take a sample of children in general, and two other pieces of literature take samples of all ages.[12]

The majority of appendicitis patients, based on research conducted by Ibrahim Ahmed Alzahrani et al. are in the 18-25 years age group for 359 patients, the second largest is under 18 years for 237 patients.[8] Based on research conducted by Hanum Atikasari et al., most appendicitis sufferers came from the age group 6-12 years for 42 patients.[10] Research data conducted by Hanumant P et al. stated that most people with appendicitis were at the age of 11-20 years for 58 people.[11] In the study conducted by Boyke Damanik et al., only the highest sample ages (17) and the lowest (3) were recorded with an average age of 11.89, but it did not explain which age group had the most appendicitis.[9] Like Gardikis et al., who did not list the largest number of appendicitis patients, this study only mentioned the number of preschool children diagnosed with appendicitis.[12]

Among the five literature reviewed, only 3 mentioned specific frequency based on the type of intake. The other 2, conducted by Boyke Damanik et al. and Hanumant P et al., only mentioned the types of eating habits.[9,11] Only Hanum Atikasari et al. mentioned the consumption of instant noodles in appendicitis patients.[10] Research conducted by Ibrahim Ahmed Alzahrani et al. and Stefanos Gardikis et al. includes *hygiene lifestyle* as a variable, but the indicators measured are different.[8,12]

Ibrahim Ahmed Alzahrani et al. stated that the lack of consumption of water and the lack of fiber in their daily diet cause most acute appendicitis patients not to defecate every day. In this study, it was found that among the 916 acute appendicitis patients in the study sample, there were only 277 patients who consumed more than six glasses of water per day. Seven hundred fifty-six patients ate vegetables once a day, 800 consumed fruit once daily, and 736 ate cereals once daily. Also mentioned in this study is the consumption of fast food. Eight hundred eight patients consume fast food, but the frequency of consumption is not stated. In this study, the largest age group was young adults (18-25 years), while children (<18 years) were the second largest. This study also did not specify the responses of respondents per age group.[8]

In a study by Boyke Damanik et al., they only discussed fiber intake and its relationship to appendicitis. The classification standard for fiber consumption is adopted from the Ministry of Health Regulation, which is 16 grams per day for children aged 1-3 years and increases to 30 grams per day. It was found that 19 patients had low fiber consumption from a total of 35 samples of pediatric appendicitis patients aged 3 to 17 years, with an average age of 11.89. This study concluded a significant correlation between the low fiber intake and the incidence of appendicitis in children ($p = 0.0001$).[9]

Research conducted by Hanum Atikasari et al. stated that the frequency of eating 57 samples of children with appendicitis less than three times a day was for 25 children. Fifty-three of them only consume 1 type (side dish/vegetable) as a companion to their staple food. Only nine children whose daily water intake fulfills the Recommended Dietary Allowance (RDA). There are 45 children whose weekly vegetable consumption is less than seven times. A total of 28 children consume fast food more than four times per month, and more than 53 children consume instant noodles more than four times per month. Hanum Atikasari et al. explained that the consumption of fast food and instant noodles often causes an imbalance in the intake of vitamins and minerals, which causes a decrease in immunity and increases the risk of infection. However, it is not explained how it is directly related to appendicitis. This study concluded that poor eating habits were related to the incidence of appendicitis in children ($p < 0.05$).[10]

Hanumant P Lohar et al., in their research, stated that appendicitis was more common in non-vegetarians. It reached 70 cases out of 130 samples studied. There were 40 cases of appendicitis with a mixed diet and only 20 cases in vegetarians. In this study, Hanumant P Lohar et al. linked vegetarians as people with high fiber consumption and non-vegetarians as people with low fiber consumption.[11]

In contrast to the previous literature results, Stefanos Gardikis et al. research stated that among 82 preschool-age children, 72 consume vegetables more than five times per week. The results of this study did not indicate a relationship between eating habits and appendicitis in children.[12]

In our study, there are weaknesses, the number of studies that can be analyzed is only five articles, and the level of evidence is still relatively low (levels C and D).

CONCLUSION

Bad eating habits can cause constipation, but researchers found no literature discussing that poor eating habits can lead to fecalith formation. Lack of fiber and water consumption in children can increase the risk of appendicitis.

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CONFLICT OF INTEREST

No potential conflicts of interest were declared

AUTHOR CONTRIBUTION

All authors have the same role in manuscript preparation, searching and validating data, compiling the discussion, and revising this final manuscript.

ETHICAL CLEARANCE

Not applicable

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