

**Relation between Fiber Diet and Appendicitis Incidence in Children
at H. Adam Malik Central Hospital Medan North Sumatra-Indonesia**

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Background: Appendicitis is the most occurred acute abdominal case found in children.¹ In United States of America alone, there were 250,000 cases annually. The ratio between boys and girls are 3:2, with most cases caused by late diagnosis and the morbidity factor. Previous studies found that there's a relation between eating patterns, fiber diet and food hygiene as risk factors for appendicitis.^{1,2} At the time this paper is written, there hasn't been any study that explains the relation between appendicitis and the diet pattern of children from various places in Indonesia. Another condition that further motivates this study is a common conception that children hate to consume vegetables and fruits, which contain the much-needed fiber. Obstruction of the appendix lumen is the main cause of inflammation in the appendix. Fecalith makes up one third of appendicitis cases, which consists of fats (coprosterols), inorganic salts (calcium phosphate), and organic residual (fibers).³ Other causes including obstruction process by hypertrophy of mural lymphoid follicle as a response from the inflammation of the appendix lumen.³ Obstruction of appendix lumen can be caused by low fiber diet, which causes fecalith to build up in appendix lumen.⁴ The mechanism of lumen appendix inflammation can be caused by lymphoid hyperplasia, fecalith buildup, foreign object or parasite.⁴ Therefore, a study needs to be done to determine the mortality prediction easier, more efficient, and not static, in which it's harder to measure the therapeutic response. In this case, lactate clearance is hoped to have the capability to determine the mortality rate in patients with severe sepsis. **Method:** This research is an analytic with cross-sectional design. The subjects were 35 child patients with appendicitis in RSHAM which fulfilled the criteria of severe sepsis diagnosis, and were receiving treatment in the period of January-December 2014. **Results:** Male children are the majority of the patients (62.9%) with average age of 11.89 ± 4.16 . Laparotomy is the most administered treatment (54.3%), and most of the subjects have low-fiber diet (54.3%). 19 of the subjects have perforated appendicitis (54.3%). **Conclusion:** There's a significant correlation between low-fiber diet with appendicitis incidence ($p=0.0001$). From the 19 patients with low-fiber diet, 14 of them (73.7%) have acute appendicitis. Meanwhile only 2 of the patients (12.5%) with high-fiber diet have acute appendicitis.

Keywords: appendicitis, children, fiber

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INTRODUCTION

Appendicitis is the most occurred acute abdominal case found in children.¹ In United States of America alone, there were 250,000 cases annually. The ratio between boys and girls are 3:2, with most cases caused by late diagnosis and the morbidity factor.

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Previous studies found that there's a relation between eating patterns, fiber diet and food hygiene as risk factors for appendicitis.^{1,2} At the time this paper is written, there hasn't been any study that explains the relation between appendicitis and the diet pattern of children from various places in Indonesia.

Another condition that further motivates this study is a common conception that children hate to consume vegetables and fruits, which contain the much-needed fiber.

Obstruction of the appendix lumen is the main cause of inflammation in the appendix. Fecalith makes up one third of appendicitis cases, which consists of fats (coprosterols), inorganic salts (calcium phosphate), and organic residual (fibers).³ Other causes including obstruction process by hypertrophy of mural lymphoid follicle as a response from the inflammation of the appendix lumen.³ Obstruction of appendix lumen can be caused by low fiber diet, which causes fecalith to build up in appendix lumen.⁴ The mechanism of lumen appendix inflammation can be caused by lymphoid hyperplasia, fecalith buildup, foreign object or parasite.⁴

Anamnesis and physical examination are the best way to diagnose acute appendicitis, and surgeons are expected to be able to do a diagnosis with 80-90% accuracy. For some patients, laboratory test and imaging can be useful in improving the accuracy of a diagnosis, and determining whether there is a complication of appendicitis.^{2,4}

The most important thing is the time of examination. There's a very rare chance of perforation to happen to an inflamed appendix in the first 12 hours, when clinical symptoms are not clearly visible yet. Most appendix will be perforated in 36-48 hours, and clinical symptoms that appear after 72 hours usually will be dangerous in appendicitis with complications, especially in young patients. With some additional questioning, 9% of patients will report similar case, and 4% will report more than one case.^{1,2,4}

The peak of symptoms is pain, which usually seen as periumbilical pain. It's often started with right lower quadrant (RLQ) pain. Periumbilical pain is usually a secondary colic caused by receptor pull in the appendix, and spread to the spine, specifically in the thoracic 10, through the afferent nerves. After inflammation occurred (usually in a few hours after), somatic pain receptor in the parietal peritoneum will be irritated, and the pain will be localized in the area around appendix, usually in the McBurney's point. If the appendix is located at a high point, retrocolic, retrocecal, or in the pelvis, it will cause right upper quadrant (RUQ) pain. Malrotation or situs inversus often causes pain in the epigastrium or lower left quadrant (LLQ) pain. Appendix which is located near to the urethra can cause various urological symptoms, for example dysuria, frequency, and urgency.^{1,2,5}

Most patients will complain about the loss of appetite. Nausea and loss of appetite are caused by the increasing pressure to the appendix. Regurgitation in patient is often seen as crucial development in appendicitis diagnosis. But in some patients there can be perforation occurrence without causing regurgitation. Regurgitation occurs randomly after the onset of pain. If patients regurgitated early, it's usually a secondary reflex of

the colic, and accompanied with persistent nausea. After it has developed into gangrene, or when appendix perforation occurred, nausea and pain can gradually, or even suddenly disappear. But after the inflammation has spread, secondary ileus will trigger the recurrence of nausea, because of enteric bacteria production in the small intestine. A regurgitation that occurs before abdominal pain usually not a symptom of appendicitis.^{1,2,5}

Fever related with acute appendicitis usually will occur 1°C higher than usual. A fever over 39.4°C often indicates perforation or gangrene occurrence. In general, fever is the sign of exacerbation. There's a very rare chance that a fever occurs before the pain.^{2,4}

Appendicitis-related constipation is very uncommon. Appendicitis-related diarrhea occurs less often than the constipation, but if it does, it indicates that inflammation has spread to the rectum, which is a very dangerous sign.^{1,2}

Abdominal pressure pain is the symptom that most often found in acute appendicitis. Pressure pain point is usually localized in right lower quadrant, specifically in McBurney's point.^{1,2,5}

It's very important for the examiner to be able to differentiate between patients with appendiceal colic and patients with acute appendicitis. A patient with appendiceal colic will appear uncomfortable, pale, crouching, and crying along with the pain. The patient will feel more pain if they move suddenly, and will feel nausea along with the pain. Meanwhile, a patient with acute appendicitis will keep lying down, groaning along with the pain, avoids examination, and covers their stomach. Both of these patients will have a pain point above their appendix. Applying pressure to the already bloated appendix will cause colic and amplify the pain. Appendectomy will be needed for patients with acute appendicitis. But for patients with appendiceal colic, appendectomy must be done as soon as possible.^{1,2,5}

The second most common symptom is RLQ muscle spasm and involuntary movement to cover stomach after inflammation developed. If the treatment was to be delayed, the patient will have rebound tenderness, and they will refuse to move or have an examination. Rovsing's sign is positive if the patient felt pain after a pressure was applied to left lower abdomen. Psoas sign is positive if the patient complained about pain when their right thigh was extended. Obturator sign is positive if pain occurred from passive rotation of flexed right thigh. If peritonitis occurred, tachycardia will appear, and the noisy sounds of the intestine will disappear (hypoactive).^{1,2,5}

The result of abdominal examination will be hard to determine if the appendix is retrocolic or retrocecal. The intestine wall will be protected from inflammation. Symptoms will appear later, but with

physical examination it will be clearer. Patient will usually complain about pain on the right hip. Patient with obesity will have more significant symptoms of inflammation from physical examination.^{1,2,5}

Rectal examination is an important additional examination for a patient with appendicitis suspect. If the appendix is located in the pelvis, abdomen anterior wall examination can be ignored.

A large and hard mass could be found in the pelvis without the relation to peritoneal, or in other word, inflamed appendix in the pelvis could be rectally felt. In young age patients, all of pelvis could be examined from rectal examination. Pelvic examination must be done on sexually active patient.^{1,2,5}

While going through the digestion tract, fiber from consumed food will have a lot of chance to interact with subtracts and digestion byproduct that will be absorbed later. After most of the nutrition are absorbed by the small intestine, the rest will go to the large intestine. At that time, fermentation process and microbe proliferation are happening. From the fermentation process, the resulting gas will push the feces to the distal (excretion organ). That's why the feces won't be held there for long and won't harden too fast. Unfermented fiber will increase fecal mass because the fiber particle can absorb and retain water. The increase of fecal mass from the microbe proliferation and water absorption will accelerate the feces excretion reflex from the rectum. Feces structure will be soft and there won't be too much rectal muscle contraction, so the blood flow in the vena won't be constricted. The combination of soluble and insoluble fiber can ease defecation because of bulk-forming laxative effect. When there's too little fiber, fecal mass will be too light to be pushed out by peristaltic movement. That's why daily food intake must include enough fiber and water. The recommended daily fiber intake is around 28-35 grams. Fiber intake is considered enough if defecation is done easily without pushing too hard. Besides enough fiber intake, routine exercise is recommended, especially for people who have hemorrhoid history in their family.⁶

MATERIAL AND METHODS

This study is an analytic with cross-sectional design. The subjects were 35 child patients with appendicitis in RSHAM which fulfilled the criteria of severe sepsis diagnosis, and were receiving treatment in the period of January-December 2014. Fiber diet data were obtained with the use of questionnaire from the patients.

RESULTS

In this study, there were 35 patients in inclusion criteria. Male children are the majority of

the patients (62.9%) with average age of 11.89 ± 4.16. Laparotomy is the most administered treatment (54.3%), and most of the subjects have low-fiber diet (54.3%). 19 of the subjects have perforated appendicitis (54.3%).

Table 1. Gender Frequency Distribution

Gender	Frequency	%
Male	22	62.9
Female	13	37.1
Total	35	100

Table 2. Descriptive Respondent Age Statistics

Age (in years)	
Mean	11.89
Standard Deviation	4.16
Minimum	3
Maximum	17
95% CI	10.46-13.32

Table 3. Treatment Action Frequency Distribution

Treatment Action	Frequency	%
Appendectomy	16	45.7
Laparotomy	19	54.3
Total	35	100

Table 4. Fiber Diet Frequency Distribution

Fiber Diet	Frequency	%
Low	19	54,3
High	16	45,7
Total	35	100

Table 5. Appendicitis Type Frequency Distribution

Appendicitis Type	Frequency	%
Acute Appendicitis	16	45,7
Perforated Appendicitis	19	54,3
Total	35	100

Table 6. Correlation between Fiber Diet and Appendicitis Type

Fiber Diet	Acute Appendicitis	Perforated Appendicitis	p
Low	14 (73,7)	5 (26,3)	0,0001
High	2 (12,5)	14 (87,5)	

There's a significant correlation between low-fiber diet with appendicitis case (p=0.0001). From the 19 patients with low-fiber diet, 14 of them (73.7%) have acute appendicitis. Male patients are more than the females. Average age of

the patients included in this study is 11.89 years with a standard deviation of 4.16 years. The youngest was 3 years old and the oldest was 17 years old. As a treatment action, laparotomy was done more than appendectomy. Most of the subjects have a low-fiber diet. Operation result shows that most of the subjects have perforated appendicitis.

Analysis result has shown that there's significant correlation between low-fiber diet and appendicitis incidence ($p=0.0001$). From 19 subjects with low-fiber diet, 73.7% of them suffered from acute appendicitis. Meanwhile, it only happened to 12.5% of subjects with high-fiber diet.

DISCUSSION

There are numerous studies that conclude there's a correlation between eating patterns, fiber diet and food hygiene as risk factors of appendicitis incidence.^{1,2} But there hasn't been any study that explains the correlation between appendicitis incidence and diet pattern in children from various places in Indonesia.

From this study were obtained 22 male child patients (62.9%) and 13 female child patients (37.1%) that are suffered from appendicitis, with average age of 11.89 years. The youngest one was 3 years old and the oldest was 17 years old. Based on the epidemiological data, appendicitis incidence occurred around 1% of children under the age of 15, with incidence peak on 10-12 years old. The risk of perforated appendix lumen occurrence is higher in the children compared to the adults. Perforated appendix in hospitalized children is reported around 20-76%. This high percentage is caused by the difficulty of communicating to children with no education (i.e. not going to school).¹ In this study was found 19 patients (54.3%) with perforated appendix and required immediate laparotomy.

The American Health Foundation recommends 5 grams per day of fiber diet value for children of age 2 and above, and gradually increased up to 25-35 grams per day for age 20 and above based on the age. Indonesia's Ministry of Health has made a policy about recommended dietary allowances that recommend 16 grams of fiber intake daily, and gradually increased up to 30 grams per day based on age for both men and women.

Many studies have investigated the average value of fiber diet in children of age 1-18 based on the recommendation of World Health Organization (WHO). There's some that concluded the average for both male and female is 4 grams per day. And some concluded that it is 3 grams per day.^{7,8} In children of age 12-18, it's concluded that the average is 14 grams per day. While others concluded for in children of age 15-18 is 7 grams

per day. In Indonesia, there hasn't been any study that's reported the results, therefore the standard for the amount of fiber intake for children of age 1-18 is adopted from the Ministry of Health's regulation, which is 16 grams per day for children of age 1-3 and gradually increased up to 30 grams per day based on age.⁹

In this study, the total of both acute and perforated appendicitis patients are 35 children, with average age of 11.89 years old. With low-fiber diet, total acute appendicitis patients are 14 children (73.7%), and total perforated appendicitis patients are 5 children (26.3%). While with high-fiber diet, total acute appendicitis patients are 2 children (12.5%), and total perforated appendicitis patients are 14 children (87.5%). This shows a significant correlation between low-fiber diet and appendicitis incidence in children, with sample size of 19 children (73.7%), especially in children with acute appendicitis.¹⁰

CONCLUSION

Based on the study done in H. Adam Malik General Hospital, Medan, it can be concluded that there's a significant correlation between low-fiber diet and appendicitis incidence ($p=0.0001$). From 19 subjects with low fiber intake, 73.7% of them suffered from acute appendicitis, while it's only 12.5% of the patients with high-fiber diet that suffered from it.

REFERENCES

1. Anderson, K.D., Parry, R.L., 1998. Appendicitis. *Pediatric Surgery 5th Edition*: 1369-79.
2. Sawin, R.S., 2004. Appendix and Meckel's Diverticulum. *Principles and practice of pediatric surgery 2nd edition*: 1269-81.
3. Robert B.S. "Epidemiologic Features of Appendicitis". Department of Surgery, Institute of Health, Ahmadu Bello University Teaching Hospital, Zaria, Nigeria. *Appendicitis – A Collection of Essays from Around the World*, www.intechopen.com
4. Peter D.S., 2010. Appendicitis. *Pediatric Surgery 5th edition*: 549-56.
5. Stevenson R.J., 2003. Appendicitis. *Operative Pediatric Surgery 1st Edition*: 671-89.
6. Shils E.M., Moshe S.A., Catharine R., Benjamin C., Robert J.C., 2005. *Modern Nutrition in Health and Disease 10th edition*.
7. Johnson K.R., 2000. Changing eating and physical activity pattern of US children. *Proceedings of the Nutrition Society*. 59(2):295-301.
8. Livingstone M.B., Robson P.J., 2000. Measurement of dietary intake in children. *Proceedings of the Nutrition Society*. 59(2):279-93

9. Nelson M., 2000. Childhood nutrition and poverty. *Proceedings of the Nutrition Society*. 59(2):307-15.
10. Wabitsch M., 2000. Insight from cellular and genetic research. *Proceedings of the Nutrition Society*: 325-30.

