Original Article

Characteristics of Pediatric Patients with Diarrhea in Indonesia: A Laboratory-based Report

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Abstract:

Background: Diarrhea is still a common health problem in Indonesia, with high morbidity and mortality rate. The severity of diarrhea is associated with age, nutritional status, and cause of diarrhea. This study aims to describe the characteristics and laboratory findings, particularly stool analysis, in pediatric patients with diarrhea.

Methods: A retrospective study was conducted using data from patients aged 0 to 18 with diarrhea who underwent stool analysis in Cipto Mangunkusumo Hospital between 2012 and 2016.

Results: The average age of children with diarrhea was 45 months, with most patients (55,6%) being under two years old children. More than half of the patients were boys (58.8%). Two-thirds of the patients (67%) presented with watery stool diarrhea. The interpretation of stool analysis indicated that nearly half of the patients (48%) experienced diarrhea due to bacterial infection, followed by fat malabsorption (20.8%). Similar results were also seen in the stool analysis of children aged 0-24 months, with the prevalence of bacterial infection (35.2%) and fat malabsorption (30.2%) being the most commonly identified etiology of diarrhea.

Conclusion: In Indonesia, children under two and male gender were more frequently reported to experience diarrhea. The primary manifestation of pediatric diarrhea was watery stools, while the most common etiology was bacterial infections.

Keywords: diarrhea, stool analysis, pediatric patients

Introduction

The high morbidity and mortality rates of diarrhea remain a major concern in developing countries, including Indonesia. Diarrhea is the recurrent passage of watery stools that occurs at least three times in 24 hours. The disease is further classified as acute diarrhea, which occurs for less than seven days; prolonged diarrhea, occurring for 7-14 days; and persistent diarrhea that last for more than 14 days.[1]

The severity of diarrhea is associated with the age of the patient, nutritional status, and the underlying cause of diarrhea.[1] According to RISKESDAS 2013, infant is the main age group that suffered from diarrhea. In addition, diarrhea in this particular age group primarily occurred at the age of 12-23 months (7.6%), majorly in the male gender (5.5%), and commonly in patients who lived in the countryside (6.2%).[2]

A cross-sectional study conducted by Hendrawati et al. reported that more than 25% of children with diarrhea also suffered from malabsorption syndrome, with the prevalence of lactose and fat malabsorption were 11% and 51%, respectively. Furthermore, this study found that 19% of 3480 stool specimens of pediatric patients show signs of maldigestion. Food allergy may also lead to malabsorption. In addition, previous study found that the prevalence of cow's milk allergy in patients with diarrhea in Indonesia was 3%.[3,4]

The purpose of this study was to identify the characteristics and laboratory findings of pediatric patients based on their stool analysis profile treated in Cipto Mangunkusumo Hospital.

Methods

This research was a retrospective, cross-sectional study conducted in Cipto Mangunkusumo Hospital, Jakarta, Indonesia. Patients aged 0 to 18 years old who suffered from diarrhea and underwent stool examination in the Laboratory of Gastrohepatology Division, Department of Child Health, Cipto Mangunkusumo Hospital were included in this study. Meanwhile, subjects with incomplete medical records were excluded. Stool analysis and other supporting data were obtained from the medical records documented in 2012 – 2016. Other supporting data include age, gender, history of bacterial infection, fungal infection, food maldigestion, carbohydrate maldigestion, protein maldigestion, lactose malabsorption, fat malabsorption, and suspected cow milk allergy.

Bacterial infection was considered positive if the stool leucocyte count was higher than +2 or 10-20 leucocytes per high magnification field.[3] Meanwhile, the diagnosis of fungal infection was noted in samples with positive appearance of fungal. Food maldigestion was indicated by the presence of meat or vegetable fibers in the stool, while carbohydrate maldigestion was considered positive in the existence of amylum.[3,5] The presence of the protein molecule indicated protein maldigestion.[5] Furthermore, the diagnosis of lactose malabsorption was established in samples with fecal pH less than 6, or if the fecal reducing substance results read as 0, trace (1/4% glucose), + (1/2% glucose), ++ (3/4% glucose), +++ (1% glucose), and ++++ (2% glucose).[6,7] Fat malabsorption was confirmed if the amount of fat exhibited positive 2 (++) in the microscopic examination.[3] Lastly, cow's milk allergies were suspected in patients with

erythrocyte counts in stool > 5. The data collected were then quantified using SPSS version 21.

All data, including other personal information provided and gathered, was kept confidential. This research had received ethical permission no. 964/UN2.F1.D1/KBK/PDP.01/2016.

Result

Subjects Demographics
From 2012 until 2016, stool analysis was performed on 1031 pediatric patients with diarrhea in Cipto Mangunkusumo Hospital. The age ranged between 0 to 18 years old, with the average age of 45 months. Most of the patients were children under two years old (55.6%). Furthermore, more than half of the patients (58.8%) were male.

Table 1. Characteristics of study subjects

Characteristics	n (%)
Gender	
Male	606 (58.8)
Female	423 (41)
Age	
<24 months	573 (55.6)
24-59 months	191 (18.5)
>60 months	262 (25.4)

Consistency of the Stool
The stool analysis results demonstrated various stool characteristics such as consistency, and laboratory findings. Among the 857 patients, 67% of the patients presented with watery stool diarrhea.

Table 2. Consistency of stool analysis in this study

Consistency	n (%)
Normal	155 (15)
Solid	11 (1.1)
Liquid	691 (67)

Laboratory Findings and Interpretation
Various laboratory examinations of the stool samples were performed to determine the cause of diarrhea. Each etiology presented distinct characteristics, which were mentioned in the methodology. One patient might have more than one significant laboratory findings and hence was diagnosed with more than one causes of diarrhea.

Most of the samples demonstrated the presence of leucocytes, erythrocytes, and fat. Positive results with a low number of these components in stool can be considered normal. However, excessive amounts may indicate various conditions such as bacterial infection, dysentery, or fat malabsorption.

Table 3. Stool analysis profile of the study subjects

Laboratory Findings*	n (%)
Mucus	536 (52)
Blood	25 (2.4)
Leucocyte	
+1	273 (26.5)
+2	395 (38.3)
+3	198 (19.2)
Erythrocyte	
+1	471 (45.7)
+2	200 (19.4)
+3	82 (8.0)
Fat	
+1	347 (33.7)
+2	188 (18.2)
+3	63 (6.1)
Amylum	129 (12.5)
Plant fibers	192 (18.6)
Muscle fibers	34 (3.3)
Occult blood	337 (32.7)
pH	
6 or more	951 (92.2)
Less than 6	80 (7.8)
Glucose	
0.25%	22 (2.1)
0.50%	36 (3.5)
0.75%	8 (0.8)
1%	16 (1.6)
2%	3 (0.3)
Parasites	6 (0.6)
Fungi	216 (21)

*One participant might present with more than 1 significant findings

The laboratory findings of each participant were then interpreted to determine the etiology of diarrhea. The most common interpretation indicated that most patients suffered from diarrhea caused by bacterial infection (48%).

Table 4. Interpretation of stool analysis profile in patients aged 0-18 years

Diagnosis*	n (%)
Bacterial infection	503 (48.8)
Fungal infection	80 (7.8)
Carbohydrate maldigestion	130 (12.6)
Food maldigestion	187 (18.1)
Protein maldigestion	29 (2.8)
Fat malabsorption	214 (20.8)
Lactose malabsorption	76 (7.4)
Suspected cow's milk allergy	45 (4.4)
Dysentery/Infective colitis	143 (13.4)

*One participant might have more than 1 interpretation

Table 5. Interpretation of stool analysis profile in patients aged 0-59 months

Diagnosis*	n (%)
Bacterial infection	269 (35.2)
Fungal infection	49 (6.5)
Carbohydrate maldigestion	72 (9.5)
Food maldigestion	81 (10.7)
Protein maldigestion	9 (1.2)
Fat malabsorption	228 (30.2)
Lactose malabsorption	76 (10.1)
Suspected cow's milk allergy	42 (5.6)
Dysentery/Infective colitis	94 (12.4)

*One participant might have more than 1 interpretation

Discussion

The relationship between diarrhea and nutrition has been discussed widely. Many factors contributed in the effect of diarrhea towards nutritional status. Increased

nutrients loss, malabsorption, maldigestion, and the impact of inflammatory responses are some of the factors involved in diarrhea with malnutrition. In this study, diarrhea mainly occurred in children aged 0-24 months (55.6%). This result was similar to other research in Indonesia, which stated that diarrhea mainly occurred in children aged less than 24 months with the prevalence of 56.68%.[8]

This study demonstrated that the prevalence of diarrhea in children, especially boys, was higher than in girls. It is similar to a study done in a hospital located in Yogyakarta, Indonesia.[9] Another study in Munimbili National hospital also revealed that 60% of diarrhea patients were boys aged 7-12 months old.[10]

The characteristics of stool analysis varied among patients. The most prevalent consistency among the samples in our study was liquid / watery stool (67%). Diarrhea can cause malabsorption when the fluid volume in the colon is higher than the absorption capacity. Damage in the intestine due to diarrhea decreases absorption and increases secretion, generating the liquid consistency of the stool.[1]

Leukocytes in stools are produced as a response to the inflammatory process in the mucosa of the colon. The presence of leukocytes in the feces indicates the existence of invasive bacteria or bacteria-produced cytotoxin, which may cause tissue damage. Furthermore, higher numbers of leukocytes increase the likelihood of invasive pathogens infection. Fecal leukocyte stain was considered to have better accuracy and diagnostic value in determining the etiology of diarrhea.[11, 12] In our study, the number of samples with leukocyte counts of +2 was higher than patients with leukocytes count of +3, which accounted for 38.3% and 19.2% respectively.

The erythrocyte counts in our study were accounted for 19.4% (+2) and 8% (+3), respectively. Although there was still no consensus in interpreting the erythrocytes count in stool analysis, a study in Bangladesh had reported the benefit of direct microscopical stool examination to quantify the leukocytes and erythrocytes in making an early diagnosis of Shigella infection.[13]

Diarrhea is commonly related to motility dysfunction. Changes in motility can affect absorption and lead to diarrhea. The reduction in motility promotes faster growth of bacteria, as the pathogen can invade the intestine and disrupt the immunity of the mucosal intestine, leading to the disruption of nutrient absorption.[14]

Based on the interpretation of stool analysis, bacterial infections were the most frequently identified etiology of diarrhea in our study. It contradicts other findings, which stated that viral infection was more likely to cause diarrhea in children.[15] However, our study did not perform any viral examination and stool culture.

Therefore, the presence of viral infection and the type of bacteria causing diarrhea could not be determined.

Diarrhea can cause maldigestion and malabsorption, which decreases nutrient absorption. The main types of maldigestion and malabsorption that frequently occurred in this study were fat malabsorption (20.8%), food maldigestion (18.1%), and carbohydrate maldigestion (12.6%). Despite the lack of information on the prevalence of food maldigestion, a study by Hendrawati et al. stated that the prevalence of fat malabsorption and carbohydrate maldigestion were 51% and 19%, respectively. These findings were higher compared to our study.[3] The lower prevalence in our study could be caused by the absence of data in some medical records. In addition, Hendrawati et al. found that the peak incidence of carbohydrate maldigestion occurred at the age of 12-59 months.[3] Carbohydrate is a component of diet with the highest percentage of consumption in children at this particular age (12-59 months old). Furthermore, diarrhea caused by Enterotoxigenic E.coli (ETEC) was found to occur more frequently in children aged 12-59 months old. Diarrhea caused by ETEC is classified as secretory diarrhea, in which the increase in intestinal motility and decrease in transit time were observed. This will cause rapid contact between digestive enzymes and carbohydrates, leading to inadequate digestion of carbohydrates, which results in the occurrence of carbohydrate maldigestion.[16]

Conclusion
Diarrhea in children mainly occurs before two years old, particularly in boys than girls. Watery diarrhea was the most frequent type of diarrhea, and bacterial was found to be the primary etiology.

Conflict of Interest
None declared.

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