

## Macronutrient malabsorption in acute diarrhea: Prevalence and affecting factors

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### ABSTRACT

**Introduction** Diarrhea remains a major problem for community health in Indonesia. More than 25% of children with severe diarrhea suffer from malabsorption syndrome.

**Objectives** This study aimed to determine the age range of children with acute diarrhea, the prevalence of macronutrient malabsorption, and the relationship between age and bacterial infection in macronutrient malabsorption.

**Methods** This was a cross-sectional study, subjects were children aged 0-59 months with acute diarrhea whose stools were obtained and examined in the laboratory of Gastrohepatology Division, Department of Child Health, Cipto Mangunkusumo Hospital, Jakarta from January 2002 to December 2003.

**Results** Children with acute diarrhea were mostly in the age range of 0-11 months (61%). The prevalence of lactose malabsorption was 11%, carbohydrate malabsorption was 19%, and fat malabsorption was 51%. Moreover, the age group of 0-11 months had a 1.5 times greater possibility of lactose and fat malabsorption compared to that of 12-59 months. The 12-59 months age group had a greater possibility of suffering carbohydrate maldigestion (70%). The group of children who did not suffer from bacterial infection had a higher prevalence of lactose malabsorption (54%), carbohydrate maldigestion (65%), and fat malabsorption (58%).

**Conclusions** Acute diarrhea occurred more frequently in the age of 0-11 months. There was a significant correlation between the age groups of 0-11 months and 12-59 months in experiencing macronutrient malabsorption. Lactose malabsorption, carbohydrate maldigestion, and fat malabsorption were encountered more frequently in the group that did not have bacterial infection [*Pediatr Indones* 2005;45:207-210].

**Keywords:** Acute diarrhea, malabsorption syndrome, stool analysis

Diarrhea is one of the main problems of community health in Indonesia.<sup>1</sup> Its mortality rate in Indonesia has decreased markedly, from the first rank in 1972 to the fifth in 1996.<sup>2</sup> A study conducted by Ariyani in the Department of Child Health, Medical School, University of Indonesia, Cipto Mangunkusumo Hospital during 1996-1997, showed that acute diarrhea occurred in 85 patients aged 2-24 months with the highest incidence at age 0-11 months (42.4%).<sup>3</sup> In children with severe diarrhea, more than 25% suffered from malabsorption syndromes.<sup>4</sup> Previous studies reported various prevalence of lactose intolerance which were 52.5% (Suharyono),<sup>5</sup> 63.2% (Mustajab),<sup>6</sup> and 23.1% (Hegar).<sup>7</sup> The prevalence of fat malabsorption were 57% (Suharyono),<sup>8</sup> and 43.6% (Hegar).<sup>7</sup>

The purpose of this study was to determine the age range of children with acute diarrhea and the prevalence of macronutrient malabsorption, such as lactose malabsorption, carbohydrate maldigestion, and fat malabsorption. This study also aimed to determine the relationship between age and bacterial infection with macronutrient malabsorption.

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## Methods

This was a cross-sectional study. The specimens were stools collected from children aged 0-59 months with acute diarrhea during the period of January 2002 - December 2003. Specimens were examined in the Laboratory of Gastrohepatology Division, Department of Child Health, Medical School, University of Indonesia, Cipto Mangunkusumo Hospital, Jakarta.

Based on the formula for proportion estimation, the minimum sample size was 272 subjects, whereas based on the formula for hypothesis testing of a proportion, it was 261 subjects. The analyzed variables were age, bacterial infection, lactose malabsorption, carbohydrate maldigestion, and fat malabsorption. Bacterial infection was considered positive if the amount of leucocyte in the stool was  $\geq +2$  or 10-20 leucocytes per high magnification field. Lactose malabsorption was positive if the stool pH was  $< 5.5$  or the level of glucose in the stool was  $\geq +1$  (0.5%). Maldigestion of carbohydrate was considered positive if amylum was microscopically present in the stool. Fat malabsorption was positive if fat was present with the size of 1-8  $\mu$  in high magnification fields.

Data was processed using SPSS 11.0 and chi square tests were done to assess the relationship between the variables. The level of significance was  $p < 0.05$ . Odds ratio was also determined with a confidence interval of 95%.

## Results

There were 3485 specimens obtained, 5 of which were excluded from the study since stool pH was not stated.

Acute diarrhea occurred more frequently in the age of 0-11 months (61%) compared to that of 12-59 months (39%).

There were 2840 specimens that showed macronutrient malabsorption, which consisted of lactose, carbohydrate, and fat malabsorption. The prevalence of lactose malabsorption was 393 out of 3480 specimens (11%), mostly from infants in the age group of 6-11 months (41%). The prevalence of carbohydrate maldigestion was 674 out of 3480 specimens (19%), mostly from toddlers in the age group of 12-59 months (70%). The prevalence of fat malabsorption was 1773 out of 3480 specimens (51%), mostly from infants aged 6-11 months (41%).

There was significant correlation between age and lactose malabsorption ( $P = 0.0005$ , OR = 1.5; CI 95%: 1.19; 1.87), age and carbohydrate maldigestion ( $P = 0.0005$ , OR = 0.19; CI 95%: 0.16; 0.23), age and fat malabsorption ( $P = 0.0005$ , OR = 2.28; CI 95%: 1.98; 2.62). The age group of 0-11 months had a greater possibility of experiencing lactose and fat malabsorption compared to that of 12-59 months. On the other hand, the age group of 12-59 months had a greater possibility of experiencing carbohydrate maldigestion (Figure 1).

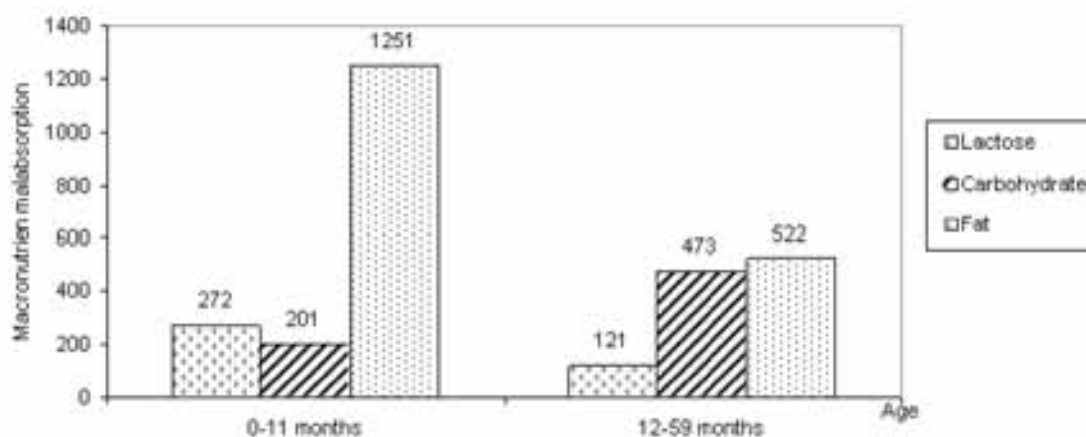
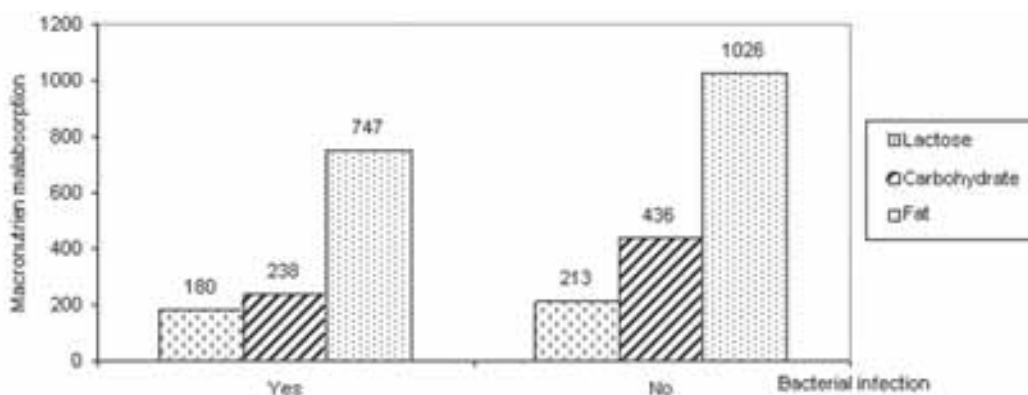


FIGURE 1. DISTRIBUTION OF MACRONUTRIENT MALABSORPTION ACCORDING TO AGE



**FIGURE 2.** DISTRIBUTION OF MACRONUTRIENT MALABSORPTION ACCORDING TO BACTERIAL INFECTION

There was significant correlation between bacterial infection and lactose malabsorption ( $P = 0.027$ ,  $OR = 0.79$ ;  $CI\ 95\%: 0.64; 0.97$ ), carbohydrate maldigestion ( $P = 0.0005$ ,  $OR = 0.45$ ;  $CI\ 95\%: 0.38; 0.54$ ), and fat malabsorption ( $P = 0.0005$ ,  $OR = 0.48$ ;  $CI\ 95\%: 0.42; 0.55$ ) (**Figure 2**). Children who did not suffer from bacterial infection experienced more lactose, carbohydrate, and fat malabsorption.

## Discussion

This study had limitations in concluding the cause-effect relationship of the variables studied, since the exact times of each variable were not determined. Furthermore, stool culture and viral examination were not performed, therefore the exact type of bacteria and the presence of viral infection could not be determined.

Acute diarrhea, in this study, mostly occurred in children 0-11 months of age (61%). This result was in accordance with a study by Suharyono (61.9%),<sup>9</sup> which stated that diarrhea generally occurred during the weaning period (the administration of solid foods), around the age of 6-11 months.

The prevalence of lactose malabsorption in this study was 11%, with a peak incidence occurring at the age of 6-11 months (41%). This result was similar to Ariyani's study.<sup>3</sup> Lactose malabsorption occurs most frequently at the age of 6-11 months, when consumption of milk or milk-containing foods are of large amounts. Rotavirus diarrhea is of the highest

incidence in this age group, and may damage the intestinal epithelial cells, leading to disaccharidase enzyme deficiency.<sup>10</sup>

The prevalence of carbohydrate maldigestion was 19%, with the peak incidence at age 12-59 months (70%). At this period of age, diet is composed of variable components with carbohydrate being the largest percentage (50%). In addition, diarrhea due to ETEC (*Enterotoxigenic E.coli*) occurs more frequently at this age group compared to that of 0-11 months. Diarrhea due to ETEC is a secretory diarrhea where intestinal motility increases and transit time decreases causing rapid contact between carbohydrate and digestive enzymes, which results in maldigestion as carbohydrate is improperly digested.<sup>11</sup>

Our study found that the prevalence of fat malabsorption was 51%, with the peak incidence at age 6-11 months (41%). This was similar to that obtained by Ariyani.<sup>3</sup>

The 0-11 months age group had a greater possibility of experiencing lactose and fat malabsorption compared to that of 12-59 months. On the other hand, the 12-59 months age group had a greater possibility of experiencing carbohydrate maldigestion.

The group that did not suffer from bacterial infection experienced more lactose malabsorption (54%), carbohydrate maldigestion (65%), and fat malabsorption (58%). However, this seems contrary to logic and existing theory. In the group of non-bacterial infection, viral infection was more likely to have caused the diarrhea. Viral infection damages intestinal mucosa and lactase deficiency may

take place. In the group that had bacterial infection, the causing agents were non-invasive bacteria which do not damage intestinal mucosa.

### Conclusions

Acute diarrhea occurred more frequently in infants (0-11 months) compared to toddlers (12-59 months). The prevalence of lactose malabsorption was 11%, carbohydrate maldigestion was 19%, and fat malabsorption was 51%. The age group of 0-11 months had a greater possibility of experiencing lactose and fat malabsorption, while the age group of 12-59 months had a greater possibility of experiencing carbohydrate maldigestion.

Lactose malabsorption, carbohydrate maldigestion, and fat malabsorption were encountered more frequently in the group without bacterial infection.

### Recommendations

A further study with nutritional status as an additional variable is necessary to be conducted, in order to determine the relationship between nutritional status and macronutrient malabsorption.

To determine one of the predisposing factors of macronutrient malabsorption, a stool culture and viral examination is required.

### References

1. Noerasid H, Suraatmadja S, Asril PO. Gastroenteritis (diare) akut. In: Suharyono, Boediarso A, Halimun EM, editors. *Gastroenterologi anak praktis*. 2nd ed. Jakarta: Gaya Baru; 1994. p. 51-83.
2. Firmansyah A. Pemahaman atas konsep perkembangan saluran cerna dalam upaya menurunkan morbiditas diare pada anak [dissertation]. Jakarta (Indonesia): Medical School, Univ. Indonesia; 1997.
3. Ariyani A. Gambaran diare akut serta hubungannya dengan gejala yang ditemukan pada anak 0-2 tahun yang dirawat di SMF Anak RSUPN CM periode September 1996 – Januari 1997 [thesis]. Jakarta (Indonesia): Clinical Pathology Department, Medical School, Univ. Indonesia; 1998.
4. Suharyono. Literature review: Maldigesti dan malabsorpsi. In: *Diare akut*. Jakarta: Lembaga Penerbit Fakultas Ekonomi Universitas Indonesia; 1986. p.23-9.
5. Suharyono, Sunoto, Sutedjo. Lactose intolerance in Indonesian children. *Ann Inst Child Health* 1971;1:7.
6. Mustadjab L, Munir M. Lactose intolerance in patients with gastroenteritis between 0-2 years of age. *Paediatr Indones* 1976;16:415-20.
7. Hegar B, Firmansyah A. Evaluasi penderita diare yang dirawat di bangsal anak RSCM 1994. *Maj Kes Masy Indones* 1995;8:563-5.
8. Suharyono. Literature review: Penelitian gangguan fungsi saluran pencernaan makanan. In: *Diare akut*. Jakarta: Lembaga Penerbit Fakultas Ekonomi Universitas Indonesia; 1986. p. 23-9.
9. Suharyono. Penanggulangan diare akut pada bayi dan anak di Jakarta dan masalahnya [doctoral thesis]. Jakarta (Indonesia): Medical School, Univ. Indonesia; 1985.
10. Bass DM. Rotavirus and other agents of viral gastroenteritis. In: Nelson WE, Berhman RE, Kliegman RM, Arvin AM, editors. *Nelson's textbook of pediatrics*. 17th ed. Philadelphia: WB Saunders; 2000. p. 765 – 8.
11. Webberley. Travellers' diarrhea. In: Bouchier IA, Allan RN, editors. *Gastroenterology clinical science and practice*. 2nd ed. Philadelphia: WB Saunders; 1993. p. 1425-8.