

## Risk of nutritional status on diarrhea among under five children

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### Abstract

**Background** Diarrhea is still the leading cause of children's mortality worldwide and the main cause of malnutrition. Meanwhile, malnourished children are proven to have more severe, prolonged, and frequent episodes of diarrhea, making them a vicious circle.

**Objective** To investigate the risk of nutritional status on diarrheal severity and duration as well as length of hospital stay.

**Methods** We conducted a cross sectional study involving 176 under five children who admitted to Mataram Province Hospital with acute diarrhea since January until December 2013. We analyzed data using logistic regression model.

**Results** Most subjects were infants (median 12 months, range 1-53), male (56.8%), well-nourished (85.8%), admitted with acute watery diarrhea (97.2%), mild-to-moderate dehydration (71.6%), diarrhea severity score  $\geq 11$  (74.4%), duration of diarrhea  $\leq 7$  days (96.6%), and length of stay  $< 5$  days (73.3%). Logistic regression model indicated significant risk of nutritional status on length of hospital stay (adjusted OR 2.09, 95% CI 1.06 to 6.38), but neither diarrheal severity (adjusted OR 1.03, 95% CI 0.38 to 2.80) nor duration of diarrhea (adjusted OR = 1.17, 95% CI = 0.13 to 10.89) indicated significant risks. However, malnourished children had more severe (76% versus 74.2%) and longer duration (4% versus 3.3%) of diarrhea than well-nourished children.

**Conclusion** Nutritional status is the risk for length of hospital stay in under-five children admitted with acute diarrhea. [Paediatr Indones. 2015;55:235-8].

**Keywords:** nutritional status, diarrhea, under-five children

**W**orld Health Organization defines diarrhea as frequent passage of watery or liquid stools, usually more than 3 times/day.<sup>1</sup> Diarrhea is still the leading cause of death in under-five children worldwide including Indonesia. *Riset Kesehatan Dasar 2010* (National Basic Health Research) revealed that the prevalence of diarrhea in Indonesia ranged from 4-19% and mostly caused by infection with peak incidence in 6-24 months of age.<sup>2</sup>

Diarrhea is the main cause of malnutrition.<sup>1</sup> Each episode of diarrhea deprives nutrients for normal growth, especially in under-five children due to the decrease of food intake and the absorption of nutrients as well as higher nutritional requirements during diarrhea.<sup>1,3</sup> Meanwhile, the malnourished children are said to have more severe, prolonged, and frequent episodes of diarrhea, making diarrhea and malnutrition a vicious circle.<sup>1</sup> A previous study stated that there were no correlation between nutritional status and length of hospital stay.<sup>4</sup>

The aim of this study was to investigate the risk

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of nutritional status on diarrheal severity and duration as well as length of hospital stay.

## Methods

This study was part of a larger multi-center study of hospital-based diarrhea surveillance of *Asian Rotavirus Surveillance Network* (ARSN). The details of the study are available elsewhere.<sup>5</sup> Ethical approval for the surveillance was issued by the Ethics Review Committee, Medical School of Universitas Gadjah Mada (UGM), Yogyakarta, Indonesia.

The subjects for this study were included from all under-five children admitted to the Mataram Province Hospital in 2013 with acute diarrhea (diarrhea occurring less than 14 days). They were excluded if the cause of acute diarrhea was proven to be extra-intestinal. Trained doctors and residents collected data of demographic, clinical, and laboratory characteristics. Parents who were agree to enroll their children in this study signed informed consents. Each patient was treated as standard protocol according to WHO and Mataram Province Hospital guidelines.

Diarrhea severity was defined using modified 20-point Vesikari score,<sup>6</sup> classified as severe ( $\geq 11$ ) and non-severe ( $< 11$ ). Length of diarrhea was defined as the duration in days since the beginning of diarrhea until its stool become formed, classified as 7 days or less (acute) and more than 7 days (prolonged). Length of hospital stay was defined as the duration in days since the admission to the hospital until the patient was discharged, classified as less than 5 days and 5

days or more. Nutrition status was classified using WHO z score of weight for height/length, defined as well-nourished (z score  $\geq -2$ ) and malnourished (z score  $< -2$ ).

Statistical analysis was carried out in *STATA for Windows version 12.0* using simple logistic regression. Significant P value was defined as less than 0.05. We adjusted plausibly possible confounders such as age and sex using multiple logistic regression models. The minimum sample size was calculated in condition of alpha 0.05 and power 0.9, resulting in minimum sample size of 97.

## Results

A number of 184 (19.74%) patients with acute diarrhea were admitted to the Mataram Province Hospital in 2013. After managing missing data by simple deletion method, we analyzed 176 subjects (**Table 1**). Most subjects were infants, male (56.8%), well-nourished (85.8%), admitted with acute watery diarrhea (97.2%), diarrhea severity score  $\geq 11$  (74.4%), duration of diarrhea  $\leq 7$  days (96.6%), and length of stay  $< 5$  days (73.3%).

As described in **Table 2**, malnourished children had more severe (76% vs 74.2%), longer duration of diarrhea (4% vs 3.3%), and longer stay in hospital (44% vs 23.8%) than well-nourished children. In other words, there was higher proportion in malnourished children in terms of diarrhea severity (1.8%), duration of diarrhea (0.7%), and length of stay (20.2%). We also found significant association of nutritional status and

**Table 1.** Subjects profiles

Characteristics		N = 176
Median age (range)		12 (1-53)
Gender, n (%)	Male	100 (56.8)
	Female	76 (43.2)
Nutritional status, n (%)	Well-nourished	151 (85.8)
	Malnourished	25 (14.2)
Diarrhea type, n (%)	Acute watery diarrhea	171 (97.2)
	Dysentery	5 (2.8)
Diarrhea severity score, n (%)	$< 11$	45 (25.6)
	$\geq 11$	131 (74.4)
Diarrhea duration, n (%)	$\leq 7$ days	170 (96.6)
	$> 7$ days	6 (3.4)
Length of stay in hospital, n (%)	$< 5$ days	129 (73.3)
	$\geq 5$ days	47 (26.7)

**Table 2.** Association of nutrition status and diarrhea

Variables	Well-nourished n (%)	Malnourished n (%)	Unadjusted OR (95% CI)	Adjusted OR <sup>+</sup> (95% CI)
Severity of diarrhea				
<11	39 (25.8)	6 (24)	1.10 (0.41 to 2.96)	1.03 (0.38 to 2.80)
≥11	112 (74.2)	19 (76)		
Duration of diarrhea				
≤7 days	146 (96.7)	24 (96)	1.22 (0.14 to 10.87)	1.17 (0.13 to 10.89)
> 7 days	5 (3.3)	1 (4)		
Length of stay				
<5 days	115 (76.2)	14 (56)	2.51 (1.05 to 6.01)*	2.09 (1.06 to 6.38)*
≥5 days	36 (23.8)	11 (44)		

\*adjusted for age and gender

\*significant P value

diarrhea in term of length of stay (OR = 2.51, 95% CI = 1.05 to 6.01), but no association with diarrhea severity and duration of diarrhea.

## Discussion

Malnutrition and diarrhea create a vicious cycle and have bidirectional relationship. Previous studies have attempted to study the link of child nutrition and infection such as diarrhea. Direct evidence of those relationships is still unclear, but improved nutritional intervention during sickness may reduce the effect of infection on child's growth.<sup>3</sup> Infection affects nutrition status by lowering appetite and food absorption, and also increasing catabolism and nutritional sequestration during sickness and recovery. Meanwhile, malnutrition contributes to weaker immune system, making mucosal defense more prone to infection.<sup>4,7</sup>

Around half of our subjects were infants (age 12 months or less). That is in accordance to previous studies stating that diarrhea mostly affects children age 6-24 months, without significant differences in gender.<sup>1,2,4,7,8</sup> Acute watery diarrhea and mild-to-moderate dehydration dominates the type of diarrhea and dehydration in this study. Those conditions suggest Rotavirus as the most probable cause since it is the main cause of acute watery diarrhea and mortality in under-five children suffering from acute diarrhea.<sup>8</sup>

Most of our subjects were well nourished (85.8%), and diarrhea could also affect all children irrespective of their nutrition status. There was more severe

diarrhea (74.4%) as determined by modified Vesikari score, shorter duration of diarrhea ≤7 days (96.6%), and shorter stay in hospital <5 days (73.3%).

We observed significant association between nutrition status and length of stay. That finding could be reasonably explained that malnourished children admitted to the hospital usually had more complex medical problems, such as pneumonia or other infection. However, malnourished children had more severe (1.8%) and longer duration of diarrhea (0.7%) than well-nourished children. The smaller proportion difference and sample size between malnourished and well-nourished children could probably make insignificant association in our study.

There are several limitations of this study. First, we used cross-sectional design due to limited time, staff, and finance. This study would be better if conducted in cohort or follow-up design and with larger sample size to see the causal or etiological relationship between diarrhea and malnutrition more clearly. Second, we measured the variables in categorical type as they were more useful in clinical setting, but the association may be clearer if carried out in numerical or continuous variables, such as weight-for-height z score, diarrhea severity score, duration in days, and length of stay in days. Third, it would be more interesting if we could see the etiological pathogens of diarrhea, which may have different impact on diarrhea or nutrition status.

In conclusion, nutritional status could be the risk for length of hospital stay in under-five children admitted with acute diarrhea. Malnourished children have longer duration of hospital stay than well-nourished children.

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### Conflict of interest

None declared.

### References

1. WHO. The treatment of diarrhea. A manual for physicians and other senior health workers Diarrhoeal disease. 4<sup>th</sup> revision. Geneva: WHO; 2005. p.3.
2. Badan Penelitian dan Pengembangan Kesehatan Departemen Kesehatan RI. Laporan nasional riset kesehatan dasar tahun 2010. Jakarta: Depkes; 2010.
3. Dewey KG, Mayers DR. Early child growth: how do nutrition and infection interact? *Matern Child Nutr.* 2011;7:129-42.
4. Primayani D. Status gizi pada pasien diare akut di ruang rawat inap anak RSUD Soe, Kabupaten Timor Tengah Selatan, NTT. *Sari Pediatri.* 2009;11:90-3.
5. Soenarto Y, Aman AT, Bakrie A. Burden of severe rotavirus diarrhea in Indonesia. *J Infect Dis.* 2009;200:188-94.
6. Lewis K. Vesikari clinical severity scoring system manual. Seattle: PATH; 2011. p.9.
7. Yusuf S. Profil diare di ruang rawat inap anak. *Sari Pediatri.* 2011;13:265-70.
8. Lanata CF, Fischer-Walker CL, Olascoaga AC, Torres CX, Aryee MJ, Black RE. Global causes of diarrheal disease mortality in children <5 years of age: A systematic review. *PLoS ONE.* 2013;8:e72788.