ORIGINAL ARTICLE

Factors Influencing the Duration of Acute Infantile Diarrhea

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ABSTRACT A retrospective study was conducted on infantile diarrhea treated at the Gunung Wenang General Hospital to evaluate the relationship of age, nutritional status and cause of diarrhea to the duration of episode of infantile diarrhea. From January 1991 up to December 1992, 584 infantile diarrhea cases out of 1109 infants were treated at the Division Gastroenterology Child Health Department, Three hundred and forty-four (58,7%) of them were male, and 56% of patients were less than 12 months of age. The nutritional status was evaluated using NCHS standard; 391 (67,0%) were well-nourished, 49 (8,4%) were moderately undernourished, and 5 (0,8%) were severely malnourished. Duration of diarrhea of 4 days of less was found in 70.8% of patients 13-24 months old, 43.9% in 7-12 months age group, 46.2% of infants 4-6 months age group, and 54.8% of infants 1-3 months age group, 60,6% of wellnourished infants, 56,8% of mildly malnourished infants, and 31,5% of moderate to severely malnourished infants. Chronic diarrhea was found in 5 infants (0,9%), 3 with severe malnourished infants suffered from carbohydrate intolerance with E. histolytica infestation and the other 2 infants due to E. coli. **[Pediatr Indones 1995; 35:141-149]**

Introduction

Based on the Survey on Illness and Management of Diarrhea in 1990, there are eight Provinces in Indonesia with second highest number of population, namely Aceh, Riau, Jambi, Yogyakarta, West Kalimantan, South Kalimantan, North Sulawesi and Bali. The morbidity rate of diarrhea for all age was 20,1°/oo (ranging 10,7 to 35,1°/oo) and for children under five years of age was 103,6 °/oo, (range 62.8-137.1 °/oo). In North Sulawesi, the morbidity rate of diarrhea for all age was 10.7°/oo and for children under five years of age was 62.8°/oo.[1]

For the age group under five years, the highest proportion is in the age group of

Accepted for publication: January 22, 1995. Author's address: Sutomo Rahardjo, MD, Department of Child Health, Medical School, University of Sam Ratulangie, Manado, North Sulawesi.

18-23 months.[1] Most of diarrhea cases occur in the first two years of age (infantile diarrhea), which is associated with bad weaning practice.[2] Generally, the episode of acute infantile diarrhea continues for relatively short period. However, 5-15% of the cases continue for two weeks or more and this prolonged diarrhea causes problems in treatment, nùtritional interference, and increases the diarrheal mortality rate.[2]

The duration of infantile diarrhea is influenced by eexternal factors (i.e. etiology of diarrhea, breast feeding, accompanying disease) and intrinsic factors (i.e. age and nutritional status). The aim of this study is to evaluate some factors which influence the duration of diarrhea in infantile diarrheal group.

Methods

This is a retrospectively analysis of 584 cases of diarrhea out of 1109 diarrheal cases aged 1 to 24 months treated at the Gastroenterology subdivision of Child Health Department, Gunung Wenang General Hospital Manado during the period from January 1991 through December 1992. In this study diarrhea followed the National Seminar on Diarrhea Eradiication, as follows:

1. Diarrhea was liquid / soft stool with the frequency of more than three times within 24 hours.
2. Acute diarrhea was diarrhea which continued for less than 14 days, without being interrupted by a stop for more than two days.
3. Chronic diarrhea was diarrhea which continued for more than 14 days or more than 4 episodes within one month period.

The classification of dehydration was based on WHO criteria:

- no dehydration: fluid loss less than 2.5% of body weight
- mild to moderate dehydration: fluid loss 4%-9% of body weight
- severe dehydration: fluid loss more than 10% of body weight,

while the patient's nutritional status was determined based on WHO/ NCHS (National Center of Health Statistics) Standard:[3]

- severely malnourished: below 60% standard
- moderately malnourished: 60 up to 69.9% standard
- mildly malnourished: 70 up to 79.9% standard
- well-nourished: 80% standard or above.

Routine stool examination was carried out at the laboratory of Gunung Wenang General Hospital. Parasitological examination was done at the Parasitology Department of the Medical Faculty of Sam Ratulangie University, and bacteriological examination of the rectal swab was sent to the Laboratory of Health Department, Manado. Examination of reductor material in stool was conducted by means of clinitest tablets.

Data was analyzed by using chi-square test. For the purpose of statistical test requirements, several cells were combined.

Results

The number of children included in this study was 584. The age distribution of the children is shown in Table 1 which shows the following: age 1 to 3 months 31 (5.3%), 4 to 6 months 93 (15.9%), 7 to 12 months 204 (34.9%) and 13 to 24 months 256 (43.9%). Table 2 shows the nutritional status of these children. It appears that 139 (23.8%) of the patients were mildly malnourished, 49 (8.4%) were moderatley malnourished, and 5 (0.8%) were severely malnourished. The hydration status according to age group is displayed in Table 3 which shows that the majority of cases had mild to moderate dehydration (92.5%).

Table 4 shows the results of stool examination for certain bacteria and yeast. There were only 104 microorganisms could be isolated. *E.coli* was the most frequently iisolated bacteria (44.4% of 104). Table 5 shows the association between age and the duration of diarrhea. It appears that longer diarrhea was found in younger age groups. The association between nutritional status and the duration of diiarrhea is depicted in Table 6. The duration of diarrhea tended to increase with poorer nutritional status.

The distribution of duration of diarrhea and the type of microorganism is shown in Table 7. We can see that chronic diarrhea was caused by *E. coli* and *E. histolytica*. Tables 8 and 9 show that there was no association between food consumption or type of accompanying disease with the duration of diarrhea.

Discussion

Age factor has influence on the duration of infantile diarrhea, namely diarrhea which lasts for a relatively short time (1 to 4 days) occurred more often in infants of 13-24 months compared with those of lower age (Table 5). Househam et al. also showed that the duration of diarrhea of less than 4 days was most frequently found in patients older than 6 months, followed by the age group of 4-6 months, and the lowest was in age group of lower than 3 months.[4] Behrman et al indicates that diarrhea tends to become persistently chronic in infants under 3 months with recurrent episod.[5]

Nutritional factor has some influence on duration of infantile diarrhea as well. In our study well-nourished infants, 237 (60.6%) had diarrhea continues for a short time (1-4 days), compared with those with mild malnutrition 78 (56.8%) and those with moderate-severe malnutrition 16 (31.5%). This difference was statistically significant (Table 6). In patients with malnutrition, diarrhea tends to continue for a longer period, because:

1. Histopatological changes of intestinal epithelium and the lowering ability of the intestinal epithelium to replace the damaged cells.[2,6]
2. Occurrence of carbohydrate malabsorption,[5,6] fat malabsorption[5,7] and minimum interference on protein absorption.[5] Mustadjab et al with Sudan III examination and lipiodol absorption test on stool of infants below two years of age with protein energy malnutrition found fat malabsorption in 62.5% kwashiorkor, 50% marasmus and 37.5% marasmic kwashiorkor.[7]
3. Lowering of immunity status brings about the growth of enteropathogenic germs which caused damage to intestine walls by means of toxin or bacterial invasion.[5-7]

Table 1. Age and sex distribution of the patients

Age (Month)	Sex		Total
	Male	Female	
1 - 3	17	14	31 (5.3%)
4 - 6	55	38	93 (15.9%)
7 - 12	115	89	204 (34.9%)
13 - 24	117	99	256 (43.9%)
Total	344 (58.7%)	242 (41.3%)	584 (100%)

Table 2. Distribution of age and nutritional status

Age (Months)	Nutritional Status				
	Normal	Mild malnutrition	Moderate Malnutrition	Severe Malnutrition	Total
1 - 3	25	2	3	1	31 (5.3%)
4 - 6	85	5	3	0	93 (15.9%)
7 - 12	137	53	12	2	204 (34.9%)
13 - 24	144	79	31	2	256 (43.9%)
Total	391 (67.0%)	139 (23.8%)	49 (8.4%)	5 (0.8%)	584 (100 %)

Table 3. Distribution of age and dehydration

Age (Month)	Dehydration			Total
	No dehydration	Mild to moderate	Severe	
1 - 3	0	31	0	31 (5.3%)
4 - 6	5	84	4	93 (15.9%)
7 - 12	5	185	14	204 (34.9%)
13 - 24	11	241	4	256 (43.9%)
Total	21 (3.6%)	541 (92.5%)	22 (3.8%)	584 (100.0%)

Table 4. Results of stool examination

Culture / Examination	Age group (months)				Total
	1-3	4-6	7-12	13-24	
Negative culture	27	75	153	225	480 (82.2%)
Positive culture:	**4**	**18**	**51**	**31**	**104 (17.8%)**
o *E. coli*	2	8	24	12	46 (44.4%)
o *Enterobacter spp*	2	2	6	4	14 (13.4%)
o *Streptococcus faecalis*	0	3	3	2	8 (7.7%)
o *Enterobacter aerogenes*	0	1	1	1	3 (2.9%)
o *Proteus spp*	0	0	1	2	3 (2.9%)
o *Coliform*	0	2	0	0	2 (2.0%)
o *Staphylococcus albus*	0	0	2	1	3 (2.9%)
o *Klebsiella aerogenes*	0	1	0	0	1 (1.0%)
o *Cholera (Ogawa)*	0	0	1	0	1 (1.0%)
o *Tricephalo disper*	0	0	1	0	1 (1.0%)
o *Entamoeba histolytica*	0	1	5	5	11 (10.5%)
o *Ascaris*	0	0	6	1	7 (6.7%)
o *Candida*	0	0	1	3	4 (3.8%)
T o t a l	**31**	**93**	**204**	**256**	**584**

Table 5. Age group and duration of diarrhea

Age Months	Duration of diarrhea (Days)			Total
	1 - 4	5 - 14 *	> 14 *	
1 - 3	17	13	1	31 (5.3%)
4 - 6	43	50	0	93 (15.9%)
7 - 12	90	112	2	204 (34.9%)
13 - 24	182	72	2	256 (43.9%)
Total	332 (56,8%)	247 (42,3%)	5 (0,9%)	584 (100%)

$X^2 = 38.98$ df = 3 $p < 0.01$

* these columns were combined in statistic calculation

Table 6. Nutritional status and duration of diarrhea

Nutritional Status	Duration of diarrhea (Days)			Total
	1 - 4	5 - 14 *	> 14 *	
Well-nourished	237	152	2	391 (67.9%)
Mild malnutrition Mod-	78	60	1	139 (23.8%)
erate- malnutrition	16	33	0	49 (8.4%)
Severe- malnutrition	1	2	2	5 (0.8%)
Total	332 (56,8%)	247 (42,3%)	5 (0,9%)	584 (100%)

$X^2 = 16.46$ df = 2 $p < 0.01$

* = these columns were combined in statistic calculation

Table 7. Cause and duration of diarrhea

Cause	Duration of diarrhea (Days)			Total
	1 - 4	5 - 14	> 14	
Negative culture	301	179	0	480 (82.2%)
Positive culture	**16**	**28**	**2**	**46 (44.4%)**
° *E. coli*	3	11	0	14 (13.4%)
° *Enterobacter spp*	3	5	0	8 (7.7%)
° *Streptococcus foecalis*	1	2	0	3 (2.9%)
° *Enterobacter aerogenes*	0	3	0	3 (2.9%)
° *Proteus spp*	1	1	0	2 (2.0%)
° *Coliform*	0	3	0	3 (2.9%)
° *Staphylococcus albus*	0	1	0	1 (1.0%)
° *Klebsiella aerogenes*	1	0	0	1 (1.0%)
° *Cholera (ogawa)*	3	5	3	11 (10.5%)
° *Entamoeba histolytica*	1	0	0	1 (1.0%)
° *Tricephalo disper*	1	6	0	7 (6.7%)
° *Ascaris*	1	3	0	4 (3.8%)
° *Candida*				
Total	332	247	5	584

Table 8. Food consumption and duration of diarrhea

F o o d	Duration of diarrhea (Days)			Total
	1 - 4	5 - 14	> 14	
Breast milk	51	35	2	88 (15.1%)
Formula milk	5	4	0	9 (1.5%)
Breast & formula milk	11	5	0	16 (2.7%)
Breast milk & daily food	149	105	1	255 (43.7%)
Daily food	116	98	2	216 (37.0%)
Total	332 (56,8%)	247 (42,3%)	5 (0,9%)	584 (100%)

$X^2 = 2.105$ df = 4 $p > 0.05$

daily food: porridge, rice, meat, vegetable etc.

Table 9. Accompanying disease / complication and duration of diarrhea

Accompanying disease / complication	Duration of diarrhea (Days)			Total
	1 - 4	5 - 14	> 14	
Tonsillopharyngitis	42	27	0	70 (12.0%)
Bronchopneumonia	27	18	0	46 (7.9%)
Otitis media	10	5	0	15 (2.6%)
Tropical malaria	6	7	0	13 (2.2%)
Bronchitis Asthmatic	2	2	1	5 (0.8%)
Sepsis	2	1	0	3 (0.5%)
Measles	1	1	0	2 (0.3%)
Tertiana malaria	2	0	0	2 (0.3%)
Post colostomy	1	0	0	1 (0.1%)
ASD + Down syndrome	0	1	0	1 (0.1%)
Tuberculosis	0	1	0	1 (0.1%)
Scrofuloderma	1	0	0	1 (0.1%)
Cerebral palsy	1	0	0	1 (0.1%)
Purulent Meningitis	0	1	0	1 (0.1%)
Urinary tract infection	1	0	0	1 (0.1%)

n = 584

Our study shows that the most frequent of enteropathogen causing infantile diarrhea was *E. coli* (Table 4). Alamsyah reported that *E.coli* is the cause of 23.4% bacterial gastroenteritis. [8]

Enteropathogens tend to cause infantile diarrhea continues for a longer time.[2,9] In our study, 28 (60.9%) infantile diarrhea caused by *E.coli* continues 5 to 14 days (Table 7). Two cases with good nutrition has diarrhea for more than 14 days and *E.coli* was found in their stool culture. There were 3 cases (27.3%) of chronic diarrhea caused by *E. histolytica* in malnourished infants (Table 7).

Carbohydrate malabsorption were observed in 103 (17.6%), which could be congenital due to primary deficiency lactose enzyme or secondary due to infection which is reversible.[5,6,10-12] Suharjono et al. recommended the use of low lactose milk for infantile gastroenteritis. [13] In our study, infantile diarrhea with carbohydrate malabsorption continued for a short time in 64 (62.1%), except two cases with malnutrition, the duration of diarrhea became more than 14 days (persistent diarrhea) (Table 9).

There were 58.8% infants who got breastfeeding or combination with duration of diarrhea 1-4 days, compared with 53.7% who only got solid food and 44.4% got only formula milk, but the difference was not significant (Table 8). Formula milk can prolong the duration of diarrhea if there is protein intolerance. [14]

Conclusions

Factor which influence duration of infantile diarrhea which we observed in our study are:

1. Age factor. Infantile diarrhea in infants of 13-24 months old continue within a shorter time.
2. Nutritional factor. Infantile diarrhe continues within a shorter time in pa tients with good nutrition.
3. Causative factors. Infantile diarrhe caused by *E.coli* and *Entamoeba hist lytica* tend to continue for a longe time especially in malnourished in fants.

References

1. Hernani, Widodo, Sutoto. Angka kesa kitan/angka kematian diare saat ini d Indonesia. Seminar Nasional Pemberan tasan Diare di Yogyakarta. Dep Kes RI 1992.
2. Sunoto, Sutoto, Soeparto, Soenarto Y, Is mail R. Buku Ajar Diare, Dep Kes RI 1990.
3. Biro Pusat Statistik Indonesia. Statu Balita menurut buku Harvard dan WHO NCHS 1986, 1987 dan 1989.
4. Househam KC, Bowie DC, Mann MD Bowi MD. Factors influencing the dura tion of acute diarrheal disease in Infancy J Pediatr Gastroenterol Nutr 1990; 10 37-40.
5. Behrman RE, Kliegman RM, Nelson WE Vaughan VC. Nelson Textbook of Pediat rics; 14th ed Philadelphia: WB Saunders Company, 1992: 979-80.
6. Gracey M. Gastroentestinal disease in malnourished children. Paediatr Indones 1975; 15: 25-33.
7. Mustadjab I, Indrawati R, Soegianto S, Isa S, Makmuri, Zulkarnaen I. The inci dence of fat malabsorption in severe PEM. Paediatr Indones 1979; 19: 123-8.
8. Alamsjah E, Asnil PO, Budiarso A Sunoto, Suhardjono. Pathogenic Entero bacterial in infantile gastroenteritis. Pae diatr Indones 1977; 17: 18-22.

9. Neto UF, Farreira VC, Patricio FRS, Mostaco VL, Trabulsi LR. Protracted diarrhea; The importance of the Enteropathogenic E.coli (EPEC) Strain and Salmonella in its genesis. J Pediatr Gastroenterol Nutr 1989; 8: 207-11.
10. Mustadjab I, Munir M. Lactose intolerance in patient with gastroenteritis between 0-2 years of age. Paediatr Indones 1976; 16: 415-29.
11. Soeparto P, Noerasid H, Satjadibrata K. Carbohydrate intolerance in infants with chronic recurrent diarrhea. Paediatr Indones 1977; 17: 153-60.
12. Soeparto P, Noerasid H, Subianto MS, Ismudijanto, Noer S, Soetjipto P. Disaccharide intolerance in infants during the diarrheal stage of acute gastroenteritis. Paediatr Indones 1977; 17: 161-7.
13. Suharjono, Sunoto, Boediarso A, Sutoto, Dadi EM. Low Lactose Milk (LLM) on refeeding of infantile diarrhoea. Paediatr Indones 1975; 15: 247-54.
14. Munir M. Infantile diarrhoea: breast and bottle feeding compared with special reference to their clinical role. Paediatr Indones 1985; 25: 100-6.