

The Relationships Between Milk Consumption Practice with Diarrhea among Hospitalized Children In Surabaya, Indonesia: A Five Years Study

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Abstract. Diarrhea is a major cause of morbidity and mortality and is currently a public health problem. Diarrhea also causes adverse outcomes in hospitalized children. Meanwhile, the protective effects of an exclusive breast milk diet in a population of hospitalized children compared to combined feeding and exclusive breast milk substitute diets, as summarized through disease prevalence, remains undefined. The aim of this study was to uncover the relationship between feeding practice and diarrhea prevalence in hospitalized children. Our study is a retrospective study that includes 1861 patients under 3 years old hospitalized in Dr. Soetomo General Hospital, Indonesia, with varying diagnosis, of which 1304 fulfilled our inclusion criteria. A large proportion (91.5%) has either community-acquired diarrhea and is hospitalized because of the disease or contract nosocomial diarrhea. We hypothesize that an exclusive breast milk diet has a protective effect in reducing the prevalence of diarrhea. This hypothesis is supported by the 2.89 times larger risk of suffering from diarrhea within the exclusively formula-fed population. We conclude that a diet of exclusive breast milk has a beneficial protective effect against diarrhea. This finding again highlights the importance of breast milk in the infant diet plan. Breast milk as the staple of feeding practice must also be strongly recommended to hospitalized children unless medically contraindicated.

Keywords: children; diarrhea; hospitalized; milk; public health.

A. INTRODUCTION

Diarrhea is defined as an increased frequency of defecation with watery stool form. Diarrhea is the second most common cause of death in children under 5 years old. Each year, diarrhea kills approximately 760,000 children under 5th years [1]. In Indonesia, diarrhea is one of the major public health problem causing several outbreaks, high morbidity, and high mortality, especially in infants and toddlers. Based on Riskesdas 2013, the incidence and period prevalence of diarrhea for all age groups in Indonesia is 3.5% and 7.0%, with the number of incidents of diarrhea in 1st-4th years group was 5.1%, 5.5% in the <1th year group, and 6.7% within the under five years group. According to these data, the highest incidence of diarrhea in Indonesia is within the under 5 years group [2]. Diarrhea could cause serious

complications such as shock syndrome, electrolyte imbalance, and malnutrition if it is not handled properly [3].

Nosocomial diarrhea within the pediatric population is a common occurrence and has a large impact on patient health. An Indian study reports that the most common pathogen associated with nosocomial pediatric diarrhea is *Escherichia coli*. Unlike within adult populations, *Clostridium difficile* does not seem to hold a large importance in pediatric diarrhea. Instead, outbreaks of rotavirus, *Salmonella*, *Shigella*, *Yersinia*, and both enteropathogenic *Escherichia coli* (EPEC) and enterotoxigenic *Escherichia coli* (ETEC) has been known to cause diarrhea. The mean duration of diarrhea within case group was 3,2 days given medication. Children with diarrhea lasting longer than 5 days have 1,8 – fold higher mortality risk. Some antibiotics are also

implicated in causing nosocomial diarrhea, such as vancomycin, meropenem, and metronidazole [4].

Breastfeeding is known having many benefits for infants such as growth support and increasing survival rate because of its high nutrient and antibody contents [2]. Indonesian health ministry has recommended breastfeeding exclusively for at least until the 6th months. Although breast milk is the best source of nutrition for infants, not all women can breastfeed their infants exclusively. However, they could give formula or breast milk supplemented with formula as a substitute. Infant formula itself can fulfill infant nutrition needs, but its contents are not as complete as breast milk. In addition, breast milk is also easier to digest than milk formula [5]. The aim of this study was to uncover the relationship between feeding practice and diarrhea prevalence in hospitalized children.

B. SUBJECTS AND METHODS

1. Population

A total of 1861 pediatric patients aged less than 3 years who were having bed rest with varying diagnoses in the pediatric department at RSUD Dr. Soetomo hospital, Surabaya from January 2009 to December 2013 were studied retrospectively. The data were obtained from patient's medical record which have been processed by the pediatric department into their electronic medical record database. The records we obtained includes the patient's history, diagnosis, nutrient status, and type of milk consumed. Patients with missing data, malnutrition or dehydration were excluded from the analysis to minimize the probability of false negatives, due to the absence of diarrheal manifestation in a large population of malnourished or dehydrated patients. Diagnosis of diarrhea relied on the clinical diagnosis or laboratory confirmation of diarrhea. It is finally concluded that 1304 patients fulfilled the criteria.

2. Statistical Analysis

A test of independence of type of milk consumed and diarrhea data were made using Pearson Chi-Square χ^2 statistic. First, a univariate analysis was carried out from all variables from the patient's gastrointestinal data. Variable which had p value less than 0.05 included in multivariate regression analysis to estimate the relationship among variables. Level of significance was set at 0.05. All statistical analysis were conducted using SPSS 20.0 statistical software.

3. Ethical Considerations

This research study has been approved by the ethical review board of RSUD Dr. Soetomo, Surabaya, according to ethical clearance decree code 07/Panke.KKE/I/2015.

C. RESULTS

Of the 1304 patients studied, 1194 patients were diagnosed with diarrhea and 110 patients were not diagnosed with diarrhea. The findings mentioned above are presented in Table 1. Most

patients in RSUD Dr. Soetomo were given both breast milk and substitute. A larger proportion of children with breast milk do not suffer from diarrhea. The results of the univariate analysis is presented in Table 2. There exists a significant relationship between the milk type and diarrhea incidence.

The results of the multivariate regression analysis are presented in Table 3. Significantly more patients who consumed breast milk substitute (OR = 2.89; 95% CI = 1.87-4.48; p-value: 0.00) are more likely to have diarrhea compared to patients consuming breast milk. Our findings for patients who consume both breast milk and substitute is statistically non-significant (OR = 1.04; 95% CI = 0.60-1.82; p-value: 0.88). According to the Table 3, we can conclude that children consuming breast milk substitute have a 2,89 times larger chance to suffer diarrhea compared to children consuming exclusive breast milk.

Table 1. Cross tabulation between type of milk consumed and diarrhea incidence

	Milk Consumed N (%)			Total N (%)
	Breast milk	Breast milk substitute	Breast milk & substitute	
Diarrhea				
Yes	212 (83.5)	252 (93.3)	730 (93.6)	1194 (91.5)
No	42 (16.5)	18 (6.6)	50 (6.4)	110 (8.5)
Total N (%)	254 (19.4)	270 (20.6)	780 (60)	1304 (100)

Table 2. Chi Square test results

Pearson Chi-Square (χ^2 value)	df	P-value
26.811	2	.000

Table 3. Association between milk consumption practice and diarrhea incidence

Variable	Case (%)	OR	95% CI	P Value
Milk Consumed				
Breast milk	17.8			
Breast milk substitute	21.1	2.89	1.87-4.48	0.00
Breast milk & substitute	61.1	1.04	0.60-1.82	0.88

D. DISCUSSION

We hypothesized that breast milk, especially exclusive feeding of breast milk, has a protective effect on children with diarrhea. Breastfeeding has previously been shown to have a protective effect against diarrhea, although the results are mixed.

The study conducted in Bangladesh [6] noted a lower incidence of rotavirus, ETEC, and cholera mediated diarrhea within the population of breast-fed infants. Meanwhile a study conducted in Uganda [7] instead found that breast feeding duration is correlated with the incidence of infectious diarrhea: children breast-fed for less than four months has a statistically significant increase of incidence in diarrheal disease compared to those with more than four months of exclusive breastfeeding. Quigley, Kelly and Sacker concluded that breast milk provides no protective effect towards rotavirus-mediated diarrhea. [8] Another study found that the incidence of diarrhea and associated illnesses in formula-fed infants are twice those of breast-fed infants during the first year of life [9].

Meanwhile, breast milk is also found to have a protective effect against secondary diarrhea where infants with exclusive breast milk consumption were infected by rotavirus 3.2 times less often, and all displayed asymptomatic disease [10]. A study comparing breastmilk and probiotics concluded that breast milk was effective in preventing rotavirus-caused diarrhea contracted nosocomially, whilst probiotics were ineffective [11]. In a study by Sachdev *et al.* [12], breast feeding is found to have significant protective effect against diarrhea in hospitalized children.

It has been found that breast milk contains non-inflammatory secretory immunoglobulin antibodies (sIgA). This antibody protects the intestinal mucosa from pathogens such as *Vibrio cholerae*, ETEC, *Campylobacter* and *Shigella*. Secretory IgA found in breast milk seem to have a protective effect against *Campylobacter jejuni*; children with breastfeeding suffer from diarrhea 2.3 times less likely than their non-breastfed counterpart [13]. It appears that the protection of breast milk does not protect children from infection, but instead protects against disease in those who are infected.

Diarrhea among hospitalized children is an important niche that needs to be researched further, since it poses a risk for high morbidity among already compromised patients. It is found that hospital-acquired rotavirus infection may infect up to 55% of children, as checked by fecal samples [14]. Dr. Soetomo General Hospital's site in a very large urban area in a developing, tropical country, may also contribute to the finding of a very high incidence of diarrhea among hospitalized children. Our study even found that more or less 90% hospitalized children that fulfilled our inclusion criteria had diarrhea, both as a primary and secondary diagnosis. However, divided according to the infants' feeding practice, children consuming exclusive breast milk has a lower incidence (86.5%) of diarrhea compared to the other two groups (93.3% and 93.6%) When existing together with other diseases, diarrhea may pose significant risk to patients. Uncontrolled diarrhea may cause dehydration, malnutrition, and impair the child's immune system and homeostasis.

Our results show that children with breast milk consumption have a lower prevalence of diarrhea, compared to those consuming formula milk exclusively. Although comparisons between exclusive breast milk consumption, and exclusive

formula consumption, are often made, some confusion still exist on the effects between exclusive and combined breast milk feeding. Sullivan *et al.* [15] concluded that an exclusively human-based milk diet is associated with a lower rate of necrotizing enterocolitis, compared to combined feeding. The odds ratio for contracting diarrhea for patients consuming breast milk substitute is 2.89 times larger compared to patients consuming only breast milk.

Despite refinements and attempts to create formula-feeding milk more similar in nutritional content to breast milk, many natural qualities of breast milk can not be replicated by formula preparations. Feeding of breast milk, compared to formula milk, creates a more acidic environment within the intestines that can promote the growth of several bacteria that has a probiotic effect. The same acidic environment also suppresses the growth of potential pathogens [16]. *Enterobacter* predominates the intestinal flora in formula fed newborns, outnumbering *bifidobacteria* 10:1; the reverse is true for milk-fed infants, with a ratio of 1000:1. Attempts to mix probiotics with formula milk are now made, aiming to replicate this effect.

It can be concluded that breast-feeding is a practice that must be avidly campaigned for several reasons. The American Academy of Pediatrics [17] recommends that each hospital adopt the principles of the 1991 WHO/UNICEF Publication "Ten Steps to Successful Breastfeeding" and develop a hospital policy for breastfeeding support according to the template. Hospitals are recommended to encourage early skin-to-skin contact, and discontinue practices that can interfere with breastfeeding or provide additional commercial formula, glucose, or other substitutes without a medical indication.

Albeit being more practical and hassle-free, the consumption of formula milk for daily use also costs more money and time spent for healthcare in the long run. Infants who are not breastfed, in average, scored more than 2000 excess office visits, 200 days of hospitalization, and 600 excess prescriptions per 1000 infants, compared to infants exclusively breastfed at least for three months [18].

Pediatricians have a very important role in the community and society to serve as advocate and supporter of exclusive breastfeeding. All medical personnels, in addition to non-medical volunteers, must serve as breastfeeding advocates and supporters.

E. CONCLUSION

Data from the study indicate a statistically significant difference in the prevalence of diarrhea for the different consumed milk type. This study concludes that consuming breast milk exclusively, at least for the first 2 years of life has an epidemiologically beneficial effect on diarrhea. This may be mediated by breast milk's protective effect on the gastrointestinal system.

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