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Original Article

Association between the absence of colostrum feeding and symptoms of intestinal obstruction or neonatal necrotizing enterocolitis

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ABSTRACT

Objective To assess the relationship between withholding colostrum and symptoms of intestinal obstruction (SIO) or neonatal necrotizing enterocolitis (NNEC).

Methods This was a longitudinal cohort study in four subdistricts in West Lombok involving mothers and live newborns. Mothers were interviewed about prenatal care, delivery process, and practice of colostrum feedings. Neonates were followed everyday for 28 days by field assistants for signs of intestinal obstruction or NNEC. We used X^2 test to analyze the association between the absence of colostrum feeding and the occurence of SIO and student t test to compare the average of colostrum feeding between the SIO and the non-SIO group.

Results 3420 live newborns between 1993-1994 were observed. 1900 mothers gave colostrum while 1520 did not. The incidence of SIO was 1.8%. There was a significant association between the absence of colostrum feeding and the occurence of the SIO (RR 1.816; 95%CI 1.08-3.06; p=0.028). No infants with NNEC were given colostrum.

Conclusion The absence of colostrum feeding is an important risk factor for the occurence of SIO and NNEC in neonates **[Paediatr Indones 2004;44:7-11].**

Keywords: *absence of colostrum, symptoms of intestinal obstruction, neonatal necrotizing enterocolitis.*

Colostrum, the yellowish breast milk on the first to third day,[1] contains immunological substances, both cellular (lymphocytes, neutrophils, macrophages, and epithelial cells), humoral (immunoglobulin, especially IgA, lactoferrin, lysozyme and bifido factor),[2-4] and hormones responsible for growth and development of the intestine i.e., epidermal growth factor and prostaglandin.[5] At birth, the intestinal mucosa is immature, although morphologically complete[6] and factors like colostrum and bacterial flora influence the growth and kinetic of intestinal epithelial cells.[7]

The Weaning Project sponsored by the United States Agency for International Development (USAID) between 1985-1989 in West Nusa Tenggara Province (WNTP) revealed that 64% of mothers did not give colostrum to their babies and also in East Java Province, 76% of mothers disposed their colostrum.[8] A study in Labuapi WNTP in 1991 showed that 93% of mothers disposed their colostrum.[9]

In a verbal autopsy by interviewing mothers whose neonates had just died in Kediri subdistrict in 1986, WNTP found 414 neonatal deaths, of which 124 (30%) were due to acute respiratory tract infections, 101 (24.4%) to diarrhea, 35 (8.4%) to neonatal tetanus, and 42 (10.1%) were associated with the

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primary symptoms of vomiting and SIO.[10] Interestingly, all neonates dying with SIO were not given colostrum prior to breastfeeding. Some reports state that breast milk protects the intestinal mucosa and prevents neonatal necrotizing enterocolitis (NNEC).[11-13]

This study aimed to look for probable association between withholding colostrum and the occurrence of SIO or NNEC and to understand the role of colostrum feeding in neonatal morbidity/mortality.

Methods

We performed a cohort study on a large number of neonates West Lombok District (WLD). Four subdistricts were chosen randomly depending on the total population of that area, i.e., Gerung (4 villages), Kediri, (5 villages), Labuapi (6 villages), and Gunung Sari (5 villages). All live-born infants in the study area were included in the study.

The core of our study was home visits by field assistants. Newborns reported within 24 hours after birth by midwives or traditional birth attendants were visited by the field assistants to record the delivery procedure, prenatal care, mother condition during pregnancy, and weight of the infant. Then, the field assistants carried out daily visits until 28 days to observe and record colostrum feeding habits and any symptoms of distress or poor health. If vomiting and abdominal distention appeared, they reported to the principal researcher who immediately visited the baby. If the clinical picture suggested SIO, the neonate was referred to Neonatal Intensive Care unit at Mataram General Hospital. Physical, laboratory, and x-ray examinations were performed. Diagnosis of NNEC was based on the presence of intestinal pneumatosis in plain abdominal x-ray. Upper/lower barium examination was done if intestinal obstruction was suspected. Stool was cultured at the Department of Microbiology, Medical School, Airlangga University, Surabaya. The patients were hospitalized and treated accordingly.

Questions for interview were pretested to ensure that appropriate responses were obtained. Data quality were assessed by checking reports and random crosschecking of approximately 10% of all household visits. Three categories of data were collected: parent attributes, pregnancy, and delivery histories, with specific focus on key indicators of neonatal health, i.e., asphyxia, low birth weight, and congenital cyanotic heart disease. Data about disposing colostrum prior to breastfeeding and any symptoms of SIO were also collected.

Variables

The exposure variable was the absence of colostrum feeding, meaning that no colostrum was given by disposing the colostrum prior to breastfeeding. The average of colostrum feeding was the number of colostrum feeding in the morning, afternoon and evening divided by days of observation. Colostrum consumption was considered high if the number of colostrum feeding exceeded the average of colostrum feeding in infants with SIO. The main outcome variable was SIO, defined as vomiting and abdominal distention. Specifically, SIO diagnoses included abdominal tenderness and distention, apparent distress of the infant, increased intestinal peristaltic movements, metallic sounds, and vomiting. The confounding variables were mother's fever after premature rupture of the membrane, asphyxia, low birth weight (<2500 g), congenital heart disease, and delivery procedure. The exposure, outcome, and confounding variables were classified as dichotomous or discrete.

Sample size

Sample size was determined by an unequal sample size method according to Fleiss and Schlessel-man.[14,15] Assuming the incidence of SIO in the exposure group was 0.012, while in the unexposed group was 0.0012, $\alpha=0.05$, and $\beta=0.20$ (power= 80%), then the subjects needed was 3460.

Statistical analysis

Data were processed using dSurvey software program.[16] We used X^2 analysis for categorical variables and student's t-test for comparing means. Statistical significance was defined by a p value of <0.05. Mantel-Haenszel stratified analysis and logistic regression analysis were used to adjust for confounding variables. Odds ratio and 95% CI were supplied where appropriate. Statistical analysis was performed with EpiInfo version 5,[17] the Systat software program,[18] and BMDP software package.[19]

Informed Consent

Community agreement was given by the leaders of WLD, which was regarded sufficient as a substitute for informed consent in a population based study.[20,21]

Results

There were 3440 live births eligible during the study. At the end of the study, 20 subjects had migrated, leaving 3420 subjects comprising 1520 with absence of colostrum feeding and 1900 with colostrum feeding. **Table 1** shows significant association between the absence of colostrum feeding and the occurrence of SIO.

TABLE 1. ASSOCIATION BETWEEN THE ABSENCE OF COLOSTRUM FEEDING AND THE OCCURENCE OF SIO

	SIO (+)		SIO (-)	
	n	(%)	n	(%)
Absence of colostrum	37	(2.5)	1483	(97.5)
Colostrum given	25	(1.3)	1875	(98.7)
Total	62		3358	

RR=1.85 (95% CI 1.12;3.06); X^2 =5.32; p=0.0210

In neonates with SIO, the average of colostrum feeding was 2.81 (SD 2.10) and in neonates without SIO the average was 3.31 (SD 2.32) times, this difference was not significant (p=0.08) The association between low and high consumption of colostrum and SIO is shown in **Table 2**.

TABLE 2. ASSOCIATION BETWEEN LOW (<2.81 TIMES) AND HIGH (> 2.81 TIMES) CONSUMPTION OF COLOSTRUM AND OCCURRENCE OF SIO

Colostrum given	SIO (+) n	(%)	SIO (-) n	(%)	Total	p
Low consumption	14	(1.8)	748	(98.2)	762	0.1536
High consumption	11	(1.0)	1.127	(99.0)	1.138	
Total	**25**		**1.875**		**1.900**	

There was no significant association (p= 0.1536) between low and high consumption of colostrum feeding to the occurrence of SIO.

Results of Mantel Haenszel stratification analysis method revealed that the association between the absence of colostrum feeding and the occurrence of SIO was not influenced by confounding variables. Logistic regression analysis was performed by the adjustment of all possible confounding variables: banana, breast-feeding, asphyxia, LBW, and mother's fever after PROM (and congenital heart disease?). The odds ratio for the absence of colostrum feeding to the occurrence of SIO is 1.816; 95% CI 1.08;3.06; and p=0.028.

TABLE 3. THE COMPARISON BETWEEN THE ABSENCE OF COLOSTRUM FEEDING, COLOSTRUM GIVEN, AND THE OCCURRENCE OF THE NNEC AND SIO

Colostrum	NNEC		SIO	
	Freq	(%)	Freq.	(%)
Colostrum given	0	0.00	25	40.3
Absence of colostrum	10	100.00	37	59.7
Total	**10**	**100.00**	**62**	**100.00**

For NNEC: p=0.003; for SIO p=0.025

Table 3 shows significant association between the absence of colostrum feeding and NNEC (p=0.003) or SIO (p=0.025).

From 62 neonates hospitalized with SIO, 9 died. Of the 62 neonates, 10 were diagnosed as NNEC, 6 of which died.

The stool cultures of neonates with SIO were *Escherichia coli* (58%), *Klebsiella pneumoniae* (13%), *Enterobacter Sp*. (11%), and *Proteus mirabilis* (4). In neonates with NNEC the organisms were *Escherichia coli* in 3 patients and *Entero invasive escherichia coli* (EIEC), *Enterobacter sp*. and *Klebsiella pneumoniae* in each of the remaining patients.

Discussion

Our study shows a significant association between the absence of colostrum feeding and SIO (RR 1.82; 95%CI 1.10;3.01, p=0.025); this indicates that the possibility of developing SIO in infants who do not receive colostrum is almost twice when compared with those who receive colostrum. However no difference was found between the average of colostrum feeding in neonates with or without SIO. The association of low and high consumption colostrum feeding with the occurrence of SIO was also not significant (p=0.1536). The data indicate that there was no dose

response relation between colostrum consumption and SIO.

The results of Mantel Haenszel stratification analysis and logistic regression revealed that the association between the absence of colostrum feeding and SIO was not influenced by confounding variables. Using logistic regression analysis, the odds ratio between the absence of colostrum feeding and the occurrence of SIO was 1.81 (95%CI 1.08;3.06, p=0.028).

Some reports reveal that breast milk protects the intestinal mucosa and prevents NNEC.[11-13] In our study, colostrum also significantly protected neonates from the development of NNEC (p=0.003). Not a single case of NNEC developed in the colostrum feeding group.

Theoretically, in the absence of colostrum feeding, the intestine might become easily infected, may develop paralytic ileus, or disturbance of the integrity of mucosal membranes and abdominal distention.[22] The slow passage of food and decreased ability to digest may cause flocculation of casein by gastric acid to form curd casein, a mass that can obstruct the intestinal tract leading to intestinal obstruction.[23]

Neonates have some limitations i.e., the inability to swallow solid food,[24] slow regeneration of intestinal mucosa,[25] undeveloped pancreatic alpha amylase,[26] small quantity of gastric acid secretion,[27] and immature immune system.[28] Those limitations cause disturbances of peristalsis and flow of intestinal content, which further can easily cause SIO.

The neonatal mortality in this study area was 30.14/1000 live births, lower than statistical prediction of neonatal mortality (46/1000 live birth).[29]

To sum up, the authors suggested that the absence of colostrum feeding in neonates could be the cause of SIO although future studies are needed. To improve the quality of community health, it is necessary to discourage the custom of disposing of the colostrum.

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