Factors associated with diarrhoea among infants with low-birth-weight history in Indonesia

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ABSTRACT

Introduction: Diarrhoea is one of the leading causes of infant mortality and morbidity. Infants with low-birth weight (LBW) have a higher risk of diarrhoea due to their low immunity and nutritional status issues.This study aimed to analyze the factors associated with diarrhoea in infants with LBW in Indonesia.

Materials and methods: We used cross-sectional and secondary data from the 2017 Indonesia Demographic and Health Survey (IDHS). A total of 142 infants under 1 year were selected as the respondents. Chi-square test and binary logistic regression were used to examine factors associated with diarrhoea in infants with LBW in Indonesia.

Results: There are several factors more likely to increase the incidence of diarrhoea in infants with LBW, which are living in rural areas [OR = 5.65, 95% CI = 1.08–29.5] and having internet access less than the last 12 months (OR = 13.03, 95% CI = 1.48–114). Meanwhile, factors more likely to decrease the incidence of diarrhoea in infants with LBW, which are maternal age (20–24 years old) [odds ratio (OR) = 0.07, 95% CI = 0.01–0.98], cell phone ownership (OR = 0.08, 95% CI= 0.01–0.45), and the use of feeding bottles (OR = 0.22, 95% CI = 0.05–0.92).

Conclusion: This study highlights that maternal age, cell phone ownership, internet access, area of residence, and use of feeding bottles are significant factors associated with diarrhoea in infants with LBW. Health workers must enhance health education related to those factors through the Community Integrated Child Health Service (Posyandu) programs.

KEYWORDS:
Diarrhoea, infant, low birth weight, Indonesia

INTRODUCTION

More than 98% of neonatal mortality occurs in developing countries, with infections (32%) being one of the leading causes.[1] For example, in one rural area of the Belagavi district in India, the incidence of morbidity during the first year of life for neonates is still high at 14-18 episodes per year. Diarrhoea, among others, is a cause of morbidity, and it was found that the incidence of diarrhoea in the 12th month of infant age is about 0.25/infant/year.[2] In 2017, diarrhoea as an infectious disease was the leading cause of mortality in children. It kills around 480,000 children worldwide.[3] It is also the second leading cause of death in children after pneumonia, which has infected 1.7 billion children and caused the death of 525,000 children worldwide.[4] Children aged three experience about three times more diarrhoeal infections.[5] Morbidity during infancy, caused by diarrhoea, might impact an infant's growth and development.[2] Furthermore, a history of chronic diarrhoea is the most dominant risk factor for childhood stunting.[6]

Neonatal mortality is still a prevalent health issue in Indonesia. The country's infant mortality rate is 32/1000 live births, whereas the neonatal mortality rate is 19/1000.[7] The infant mortality rate in Indonesia in 2015 was 25 per 1000 live births. Although the data saw a decreasing trend compared to the previous years, the infant mortality rate in Indonesia is still relatively high compared to ASEAN member countries, which is 4.6 times, 1.3 times, and 1.8 times higher than Malaysia, the Philippines, and Thailand, respectively.[8] Infant mortality from all causes and hospitalizations were significantly higher among LBW infants compared to normal birth weight, and diarrhoea was the major cause of hospital admission and death.[9,10]

One of the factors associated with infant morbidity is low-birth weight (LBW).[2] Babies with LBW have morbidity and mortality due to infectious diseases caused by immune disorders and are at increased risk of growth failure.[11] Several studies have shown a regular pattern of increasing childhood disease in low-birth-weight children, especially in the first 2 years of life.[12] Infants with LBW experience infectious diseases more often, such as diarrhoea and acute respiratory infection (ARI), which tend to be longer and more serious (and therefore require hospitalization) compared to normal-birth weight infants.[13] Nutritional status was significantly related to the incidence of diarrhoea. The frequency of diarrhoea increased by 15% per standard deviation of the decrease in the height-for-age z-score. Episodes of diarrhoea in children <6 months last significantly longer than the episodes among older children.[14]

Many factors predispose children under five to develop diarrhoea, especially in low- and middle-income countries. A study in Kenya shows that the mother/caregiver's education level and residence area affect the incidence of diarrhoea. The prevalence of diarrhoea is higher in infants living in

This article was accepted: 04 October 2022
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rural areas. The education of mothers/caregivers showed a considerable significance in the prevalence of diarrhoea. It was revealed that mothers/caregivers who cannot read have a higher prevalence of diarrhoea than those who have attained higher education.[15] Meanwhile, a study in Nigeria found that the age and gender of the baby did not show a significant relationship with the incidence of diarrhoea in children. The mother's educational status and occupation, and family income are significantly related to the incidence of diarrhoea in Southwest Nigeria.[16]

However, studies focusing on diarrhoea in infants with a history of LBW in Indonesia are still relatively scarce. Identifying the factors related to the incidence of diarrhoea in infants with a history of LBW is essential to formulate a better intervention strategy so that policymakers can consider them to reduce the prevalence of diarrhoea in Indonesia. With that rationale, this study was conducted to analyze the factors associated with diarrhoea in infants with LBW in Indonesia.

MATERIALS AND METHODS

Data source

This study used data from the 2017 Demographic Health Survey, conducted in Indonesia and employed a cross-sectional design. Interviews during the survey were conducted on all eligible women aged 15–49 years. In this study, the children's dataset was used. This study was conducted from July 24 to September 30, 2017, by a collaboration of the National Population Planning Board (BKKBN), Statistics Indonesia (BPS), and the Indonesia Ministry of Health (Kemenkes) with technical assistance from the Inner City Fund (ICF). Once registration was completed through the website, all datasets were downloaded from www.dhsprogram.com.

Sample size and sampling

The 2017 IDHS covered 1970 census blocks in urban and rural areas in Indonesia. 49,627 women aged 15–49 completed the survey and were interviewed across 34 provinces in Indonesia. The sample designs of this survey were two-stage probability samples drawn from an existing sample frame. The master sample of Census Blocks from the latest population census was used as the sampling frame. The two-stage stratified sampling was utilized to select the participants. The first stage was the selection of several census blocks by systematic sampling proportion size. In the second stage, 25 ordinary households were selected with systematic sampling from the listing. There were 142 children under one year old who met the inclusion criteria and were included as respondents in this study. Inclusion criteria in this study were infants under 1-year-old with a history of low-birth weight.

Instruments and data collection

The questionnaire was administered to females of child-bearing age to obtain information from those between 15 and 49 years of age. Questionnaire items consisted of respondents' background, history of pregnancy, contraception usage and knowledge, childbirth, post-childbirth examination, breastmilk, child feeding, infant mortality, childhood immunizations and diseases, marriage and sexual activities, fertility preference, spouses' background, respondents' occupation, knowledge on HIV/AIDS and other sexually transmitted infections, mother's sibling mortality, and other health issues. The selection of independent variables for the study was based on previous studies examining factors affecting children's diarrhoea. The dependent variable in this study is the incidence of diarrhoea. The data were based on the mother's perception of the baby two weeks before the survey. Meanwhile, there are several independent variables, namely: mother's age; area of residence; mother's education; father's education; television ownership; cell phone ownership; internet access; economic status; the number of children in the family; and the rest of independent variables, which are infants who have received breastfeeding; use of feeding bottles; baby gender; and vitamin A supplements.

Statistical analysis

Statistics analysis in this study is univariate analysis; chi-square tests and logistic regression were performed with a final report of odds ratio (OR) and 95% confidence intervals (CI). Stata version 14 is used in all of the analyses.

Ethics

The 2017 IDHS received ethical approval from the Inner City Fund's Institutional Review Board (ICF IRB). In addition, an ethical license was also obtained from the Indonesian Ministry of Health. Permission to use data was obtained from ICF International as part of the Demographic Health Survey program.

RESULTS

In 26 (18.31%) of the 142 infants who had LBW, diarrhoea had occurred within 2 weeks before the survey was conducted. 48 (33.80%) of the mothers who were interviewed and completed the study were in the 25 to 30 years age range. In more than half, 84 (59.15%) of the mothers interviewed had lived in rural areas, and 83 (58.45%) mothers had completed secondary education. With regards to father's education, 88 (61.97%) of the fathers had completed secondary education. 46 (32.39%) respondents were classified as very poor, and 94 (66.20%) respondents had less than three children. Out of 142 respondents, more than two-thirds, 111 (78.17%) owned a television at home, 100 (70.42%) had a cell phone, and 85 (59.86%) had internet access. Regarding the infants, 74 (52.11%) were female. In the majority of the studied infants, 114 (80.28%) received breast milk, whilst less than half, 65 (45.77%) received vitamin A supplements, and only 55 (38.73%) had used milk bottles. More details about the descriptive characteristics of respondents are presented in Table I.

Based on the bivariate analysis results, three independent variables, television ownership, breastfeeding, use of feeding bottles, and father's education, were identified as having a significant relationship with the prevalence of diarrhoea in LBW infants in Indonesia. Details about the bivariate analysis are shown in Table II. In the multivariate analysis, binary logistic regression was used to analyze the dependent and independent variables (Table III). The results of the multivariate analysis showed that the mother's age, area of residence, cell phone ownership, internet access, and use of feeding bottles were significantly associated with the

Table I: Socio-demographic characteristics of participants

Characteristics	Frequency	Percentage
Mother's age		
15–19	13	9.15
20–24	31	21.83
25–30	48	33.80
31–35	29	20.42
36–39	11	7.75
40–45	10	7.04
Area of residence		
Urban	58	40.85
Rural	84	59.15
Mother's education		
Primary	38	26.76
Secondary	83	58.45
Higher	21	14.79
Father's education		
No education	3	2.11
Primary	36	25.35
Secondary	88	61.97
Higher	15	10.56
Television ownership		
Yes	111	78.17
No	31	21.83
Cell phone ownership		
Yes	100	70.42
No	42	29.58
Internet access		
Yes, before last 12 months	4	2.82
Yes, last 12 months	53	37.32
No	85	59.86
Economic status		
Very poor	46	32.39
Poorer	41	28.87
Middle	23	16.20
Richer	32	22.54
Number of children in the family		
≥3 children	48	33.80
<3 children	94	66.20
Breastfeeding		
Yes	114	80.28
No	28	19.72
Use of feeding bottles		
Yes	55	38.73
No	87	61.27
Sex of the baby		
Male	68	47.89
Female	74	52.11
Vitamin A		
Yes	65	45.77
No	77	54.23
Diarrhoea		
Yes	26	18.31
No	116	81.69

prevalence of diarrhoea in infants in Indonesia. According to the results of this study, infants of mothers aged 20-24 are 0.07 times less likely to develop diarrhoea than other ages [Odds Ratio (OR) = 0.07, 95% CI = 0.01–0.98]. Infants living in rural areas are 5.65 times more likely to develop diarrhoea than those in urban areas [OR = 5.65, 95% CI = 1.08–29.5]. Infants whose mothers had cell phones are 0.08 times less likely to develop diarrhoea (OR = 0.08, 95% CI= 0.01–0.45). Interestingly, infants whose mothers have internet access for less than 12 months are 13.03 times more likely to develop diarrhoea (OR = 13.03, 95% CI = 1.48–114). Lastly, the use of feeding bottles in infants is 0.22 times less likely to develop diarrhoea (OR = 0.22, 95% CI = 0.05-0.92). Details of the results of the multivariate analysis are shown in Table III.

DISCUSSION

Diarrhoea is the second morbidity after ARI for LBW in the first 6 months of life.[13] The survey results in India support that the history of LBW births is associated with an increased incidence of diarrhoea by 19%.[17] This result supports our finding that by 26 of 142 (18.31%), we found LBW infants suffered from diarrhoea. Gedefaw and Berhe explained that low-birth weight is one of the determining factors of diarrhoea, partly because babies with low-birth weight have an immunocompromised immune system that makes them susceptible to various infections, including diarrhoea and pneumonia.[18] This is because premature infants with LBW have lower immunoglobulin G (IgG) levels than term infants. IgG begins to be transferred from the mother to the fetus at

Table II: Bivariate analysis of factors associated with diarrhea among infants with LBW history

Characteristics	No		Yes		X^2
	N (116)	%	N (26)	%	
Mother's age					0.126
15-19	8	6.90	5	19.23	
20-24	26	22.41	5	19.23	
25-30	43	37.07	5	19.23	
31-35	23	19.83	6	23.08	
36-39	7	6.03	4	15.38	
40-45	9	7.76	1	3.85	
Area of residence					0.110
Urban	51	43.97	7	26.92	
Rural	65	56.03	19	73.08	
Mother's education					0.584
Primary	29	25.00	9	34.62	
Secondary	69	59.48	14	53.85	
Higher	18	15.52	3	11.54	
Father's education					0.008
No education	2	1.72	1	3.85	
Primary	23	19.83	13	50.00	
Secondary	79	68.10	9	34.62	
Higher	12	10.34	3	11.54	
Television ownership					0.005
Yes	96	82.76	15	57.69	
No	20	17.24	11	42.31	
Cell phone ownership					0.116
Yes	85	73.28	15	57.69	
No	31	26.72	11	42.31	
Internet access					0.723
Yes, before last 12 months	3	2.59	1	3.85	
Yes, last 12 months	45	38.79	8	30.77	
Never	68	58.62	17	65.38	
Economic status					0.199
Very poor	33	28.45	13	50.00	
Poorer	36	31.03	5	19.23	
Middle	20	17.24	3	11.54	
Richer	27	23.28	5	19.23	
Number of Children in the Family					0.718
≥3 children	40	34.48	8	30.77	
<3 children	76	65.52	18	69.23	
Breastfeeding					0.024
Yes	89	76.72	25	96.15	
No	27	23.28	1	3.85	
Use of Feeding Bottles					0.07
Yes	49	42.24	6	23.08	
No	67	57.76	20	76.92	
Sex of the baby					0.529
Male	57	49.14	11	42.31	
Female	59	50.86	15	57.69	
Vitamin A					0.966
Yes	53	45.69	12	46.15	
No	63	54.31	14	53.85	

the 17th week of gestation, and at the 33rd week, fetal IgG levels are similar to maternal and will increase up to two times at term.[19]

The Indonesian government's program to address the health of children under five is the Community Integrated Child Health Service for Children under Five (also known as Posyandu Balita). The Community Integrated Child Health Service (Posyandu) is very integral in the promotive and preventive efforts for the community, especially in improving the nutritional status and maternal and child health issues.[20] At the Posyandu, there is already a preventive program to improve children's health. However, it is still necessary to increase health monitoring in infants with a history of LBW. This study may provide essential new information to mothers so that their babies can be healthy and, in the worst-case scenario, only suffer from mild diarrhoea.

According to the results of this study, infants with a history of LBW from mothers aged 20–24 years are 0.07 times less likely to develop diarrhoea. Based on the results of a study conducted in Nepal, it was found that maternal age is associated with the incidence of diarrhoea in infants.[15] In Indonesia, most women marry for the first time at 19–24. This marriage age has a strong relationship with fertility, so usually, most women give birth at this age.[21] The age of 19–20 years is considered an adult age who already has maturity in terms of physical and psychological growth, meaning they

Table III: Multivariate analysis of factors associated with diarrhoea among infants with LBW history

Characteristics	Adjusted odds ratio	95% Conf. interval	
Mother's age		Lower	Upper
15-19	1		
20-24	0.07*	0.01	0.98
25-30	0.02	0.00	0.28
31-35	0.23	0.03	2.23
36-39	0.63	0.05	7.93
40-45	0.03	0.00	1.90
Area of residence			
Urban	1		
Rural	5.65*	1.08	29.5
Mother's education			
Primary	1		
Secondary	2.88	0.62	13.3
Higher	5.36	0.30	95.6
Television ownership			
Yes	0.29	0.05	1.67
No	1		
Cell phone ownership			
Yes	0.08**	0.01	0.45
No	1		
Internet access			
Yes, before last 12 months	0.05	0.00	2.70
Yes, last 12 months	13.03*	1.48	114
No	1		
Economic status			
Very poor	1		
Poorer	1.12	0.17	7.45
Middle	0.95	0.09	9.85
Richer	1.72	0.21	14.1
Number of children in the family			
≥3 children	1		
<3 children	1.39	0.27	7.12
Breastfeeding			
Yes	3.28	0.24	44.8
No	1		
Use of feeding bottles			
Yes	0.22*	0.05	0.92
No	1		
Father's education			
No education	1		
Primary	12.84	0.16	1058
Secondary	0.52	0.01	35.6
Higher	1.08	0.01	128.9
Sex of the baby			
Male	1		
Female	2.08	0.54	7.99
Vitamin A			
Yes	1.49	0.45	4.93
No	1		

* p value < 0.05.
** p value < 0.01.

already have the maturity and mental strength, thinking ability, and ability to understand so that they can provide adequate care for their baby. This is supported by research stating that delaying the age at first birth for women in their early 20s might reduce infant mortality and improves child health. Overall, the risk of a poor health outcome dissipates by age 21.[22]

Infants with LBW who live in rural areas have a 5.65 times greater risk of suffering from diarrhoea than infants in urban areas. This result is supported by previous studies, in which the incidence of diarrhoea is also higher in infants living in rural areas than those in urban areas.[15,23,24] Many factors can cause babies living in rural areas to have a higher incidence of diarrhoea-environmental and individual factors play an essential role in it. Wambui explained that these conditions are associated with several factors: lack of safety access, inadequate water consumption, household water supplies, water storage methods, knowledge about hygienic activities and infectious disease prevention and control practices, and poor use of restrooms. For example, in rural areas, it was reported that the people do not have handwashing facilities in their baths, which contributes to diarrhoea.[15] The quality of environmental health is one of the factors that gives the most significant role to public health. Aspects of environmental health include access to clean water, access to

proper basic sanitation, waste management, and disease vectors. In Indonesia, environmental problems are still a problem. According to the research results, environmental factors significantly affect diarrhoea incidence. The majority of diarrhoea events by 77.8% occur in houses whose floors are not waterproof, by 73.9% occur in houses with family latrines that do not meet health requirements, by 47.1% occur in houses without sewerage meet the requirements, by 83.3% occur in improper household waste processing, and by 68.8% occurs in inadequate clean water availability.[25]

Infants with LBW from mothers who have cell phones are less likely to develop diarrhoea; meanwhile, infants with LBW whose mothers have had internet access for less than the last 12 months are more likely to have diarrhoea. As we all know that cell phones and internet access are essential needs for society. The Indonesian Ministry of Communication and Informatics stated that Indonesia's internet users had reached 82 million people, making Indonesia rank 8th globally.[26] Cell phones and internet access make it easier for a mother to quickly and accurately look up information through materials and articles on various subjects.[27] The study results showed that parents' benefits are getting parenting support (e.g., accessing information on parenting via the internet or social media) and connecting with their children.[28]

Infants with LBW fed using feeding bottles are 0.22 times less likely to develop diarrhoea than those without. This result might be that mothers with low birth weight babies are more exposed to health services from the beginning. This happens because the LBW baby will usually be hospitalized in the perinatology room for the stability of his condition. Mothers will receive health education about the baby's condition and care for babies with LBW. In Indonesia, this health education is packaged as discharge planning, carried out from admission until the patient leaves. The health education contains kangaroo mother care, nutrition for LBW infants (including preparation and use of feeding aids such as feeding bottles), and infection prevention. With this program, mothers have adequate knowledge and skills in providing nutrition for premature babies. This is supported by research on health education in discharge planning that can increase mothers' knowledge and skills in caring for premature babies at home.[29] It is also supported that education programs that are carried out regularly and continuously can provide information according to the needs of parents so that they can help parents to understand the information conveyed.[30] The information is about breastfeeding benefits, techniques, kangaroo mother care, infection prevention, and infant danger signs.[31]

CONCLUSION

Mother's age between 20–25, rural area of residence, cell phone ownership and internet access for less than the last 12 months, and the use of feeding bottles were found to have a significant relationship with the incidence of diarrhoea in infants with a history of LBW. The practical implications of our findings support increasing the awareness of LBW infants' families through adequate health education and promotion. Therefore, enhancing health information and services adequacy, accessibility, and affordability across all Indonesian regions is essential. Moreover, health workers also need to improve the administration of health education to the mothers of babies with LBW, who are at risk of developing diarrhoea, through Posyandu programs.

FUNDING

We received funding from the Directorate of Research and Community Service, Ministry of Education, Culture, Research, and Technology with grant number 0267/E5/AK.04/2022 dated April 28, 2022.

ACKNOWLEDGEMENTS

We are grateful for the availability of data provided by the Indonesian Demographic and Health Survey, which has enabled us to understand the crucial issues around factors associated with diarrhoea among infants with low birth weight history. And we also thank the Directorate of Research and Community Service, the Ministry of Education, Culture, Research, and Technology for giving us the funding. We deeply appreciate everyone for helping us in this study.

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