

Correlation between non-exclusive breastfeeding and low birth weight to stunting in children

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Abstract

Background Indonesia is ranked fifth in the world for the problem of stunting. Stunting in children under the age of five requires special attention, due to its inhibiting effect on children's physical and mental development. Stunting has been associated with several factors, one of which is non-exclusive breastfeeding.

Objective To determine the correlations between non-exclusive breastfeeding and low birth weight to stunting in children aged 2-5 years.

Methods This case-control study was conducted in October to November 2016 in multiple integrated health service clinics (posyandu) in Sangkrah, Surakarta, Central Java, Indonesia. Subjects were children aged 24-59 months who visited the posyandu and were included by purposive sampling. Children classified as stunted were allocated to the case group, whereas the children classified with normal nutritional status were allocated to the control group. Parents filled questionnaires on history of exclusive breastfeeding, child's birth weight, maternal education, and family socio-economic status.

Results Of the 60 subjects, the control group had 30 normal children and the case group had 30 stunted children. Multivariate analysis by logistical regression test revealed statistically significant correlations between stunting and non-exclusive breastfeeding (adjusted OR for exclusive breastfeeding 0.234; 95%CI 0.061 to 0.894), as well as low birth weight (adjusted OR 10.510; 95%CI 1.180 to 93.572) This value implies that exclusive breastfeeding is a protecting factor against stunting, which means exclusive breastfeeding is able to decrease the prevalence of stunting in children under the age of five.

Conclusion In children aged 2-5 years, the histories of non-exclusive breastfeeding and low birth weights are significantly correlated with stunting. [Paediatr Indones. 2018;58:123-7; doi: <http://dx.doi.org/10.14238/pi58.3.2018.123-7>].

Keywords: exclusive breastfeeding; stunting; children 24-59 months

Stunting is a chronic nutritional deficiency caused by inadequate nutritional intake for an extended period, due to improper feeding. Chronic nutritional deficiency will influence the body length.^{1,2} Stunting is defined as a Z-score of <-2 SD for body height to age ratio (BH/A) or body length to age ratio (BL/A), according to the World Health Organization (WHO) Child Growth Standard.³ Indonesia is currently one of 117 countries worldwide with three highly prevalent nutritional problems in toddlers: stunting, wasting, and overweight, as reported in the 2014 *Global Nutrition Report of Indonesia*.^{4,5} The Indonesian Ministry of Health 2013 Basic Health Data (*Riskesmas*) reported a 37.2% prevalence of stunting in children under the age of five in Indonesia, which had increased compared to 2007 (36.8%), and 2010 (35.6%).⁴

Stunting in children under the age of five requires special attention due to inhibiting effects on physical and mental development. Stunting at early ages can increase the risk of mortality and morbidity, as well as suboptimal body posture as adults.¹ The WHO/UNICEF global strategy on

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feeding infants and young children recommends four important points to achieve optimal growth and development: early breastfeeding initiation (EBI) in the first 30 minutes of life, exclusive breastfeeding for the first 6 months of life, giving complementary food accompanied by breastfeeding at 6-24 months of age, and continuous breastfeeding for 2 years or more.^{6,7} Growth and development during infancy requires balanced nutrition, as the toddler's intestinal system is still in the process of maturing. Breast milk contains numerous factors that meet the nutritional needs of infants according to their age.⁸ Also, breast milk also contains immunological substances that can prevent infections in infants. Yet, the latest data have shown that exclusive breastfeeding behavior in the first 6 months of life remains inappropriately with the recommendation.⁵⁻⁷ *The 2015 WHO/UNICEF Data on Infant and Young Child Feeding* showed that only 39% of babies in developing countries received exclusive breastfeeding from 0-5 months.⁶ Hence, we aimed to determine the correlation between non-exclusive breastfeeding and the incidence of stunting in children aged 2-5 years.

Methods

This observational analytic study with a case-control approach was done in October – November 2016 to analyze for a relationship between a history of exclusive breastfeeding and stunting in children aged 2-5 years. Subjects were patients aged 24-59 months at multiple integrated health service clinics (posyandu) under the auspices of the primary health care integrated service unit in Sangkrah, Surakarta, Central Java, Indonesia. Children's nutritional status was assessed by way of body height/age (BH/A) index. Stunted children were allocated to the case group and children without stunting were allocated to the control group. Subjects' parents provided written informed consent. Children with infection or other chronic conditions at the time of the study were excluded.

Sixty children were included by purposive sampling, to which the rule of thumb was applied, resulting in 30 subjects per group.⁹ Data on exclusive breastfeeding, birth weight, maternal education, and socio-economic status based on Surakarta's minimum wage were collected using questionnaires. Low socio-

economic level was defined as family income of less than the minimum regional wage of Surakarta in 2016, which was rounded up to Rp 1,400,000. Education level was defined as the length of education less than 9 years and higher than 9 years. Body height was measured three times, using a microtoise with 0.1cm accuracy, and mean values were calculated. The measurements were conducted on the same day or within three days at most of the interview.

The dependent variable of this study was stunted nutritional status, while the independent variable was the history of exclusive breastfeeding. External variables were the maternal educational status, socio-economic status, and history of low birth weight.

Chi-square test was used for bivariate analysis and logistical regression test was used for multivariate analysis, using statistical product and service solution (SPSS) 24.0 for Mac, with significance of $P < 0.05$. The Research Ethics Committee of Sebelas Maret University Medical School, Surakarta, approved this case control study.

Results

Table 1 shows that the case group had a rather balanced sex ratio, with 15 children of each sex. The control group consisted of 14 boys (46.7%) and 16 girls (53.7%). The independent variable of exclusive breastfeeding was differentiated into exclusively breastfed or not exclusively breastfed. In the case group, 17 children (56.7%) were exclusively breastfed, while 13 children (43.3%) were not exclusively breastfed in other words, they received infant formula or complementary foods. In the control group, 26 children (86.7%) were exclusively breastfed, and 4 children (13.3%) were not exclusively breastfed. There were 6 children in the case group and one in the control group who did not receive breast milk the first day of life.

Low birth weight was defined as birth weight < 2500 grams. The case group had 9 children (30%) with a history of low birth weight and 21 children (70%) with normal birth weight. In the control group, 1 child (3.3%) had a history of low birth weight, while 29 children (96.7%) had normal birth weight.

Maternal education was classified as either low (less than 9 years) or high (more than 9 years). In the case group, 10 subjects (33.3%) had low, while

20 (66.7%) had high maternal educational status. In the control group, 14 subjects (46.7%) had low and 16 (53.3%) had high maternal educational status.

Socio-economic status was classified as low (< IDR 1400000 monthly income) or high (> IDR 1400000 monthly income). In the case group, 21 children (70.0%) had low and 9 children (30.0%) had high socio-economic status. In the control group, 24 children (83.3%) had low and 6 children (16.6%) had high socio-economic status. Overall, 45 children (75%) had parents with low socio-economic status and 15 children (25.5%) had parents with high socio-economic status (Table 1).

Table 1. Characteristics of subjects

Characteristics	Case group (n=30)	Control group (n=30)
Sex, n (%)		
Male	15 (50.0)	14 (46.7)
Female	15 (50.0)	16 (53.3)
Exclusive breastfeeding, n (%)		
Yes	17 (56.7)	26 (86.7)
No	13 (43.3)	4 (13.3)
Birth weight, n (%)		
Low	9 (30.0)	1 (3.3)
Normal	21 (70.0)	29 (96.7)
Maternal education, n (%)		
Low	10 (33.3)	14 (46.7)
High	20 (66.7)	16 (53.3)
Socio-economic status, n (%)		
Low	21 (70.0)	24 (83.3)
High	9 (30.0)	6 (16.6)

Table 2 shows the bivariate statistical analysis results. Chi-square test revealed that stunting had significant correlations with non-exclusive breastfeeding (OR for exclusive breastfeeding: 0.201; P=0.010) and low birth weight (OR 12.429; P=0.006). There were no significant correlations between stunting and sex (P=0.796), maternal education (P=0.292), or socio-economic status (P=0.371).

Table 2. Bivariate statistical analysis

Variables	OR	95%CI	P value
Sex	0.875	0.318 to 2.410	0.796
Exclusive breastfeeding	0.201	0.056 to 0.721	0.010
Maternal education	1.750	0.616 to 4.97	0.292
Low birth weight	12.429	1.461 to 105.737	0.006
Socio-economic status	1.714	0.371 to 5.621	0.523

Multivariate analysis by logistical regression test similarly revealed statistically significant correlations between stunting and non-exclusive breastfeeding (adjusted OR for exclusive breastfeeding 0.234; P=0.034), as well as low birth weight (adjusted OR 10.510; P=0.035) (Table 3).

Table 3. Multivariate analysis

Variables	Adj OR	P value	95%CI
Exclusive breastfeeding	0.234	0.034	0.061 to 0.894
Low birth weight	10.510	0.035	1.180 to 93.572

Discussion

There was a significant relationship between non-exclusive breastfeeding and stunting in children aged 24-59 months. More children with normal nutritional status received exclusive breastfeeding (86.7%) than stunted children (56.7%). Bivariate analysis showed that exclusive breastfeeding was a protective factor against stunting, with OR 0.201. Furthermore, multivariate analysis revealed that exclusive breastfeeding was still a protective factor, with OR 0.234 (95%CI 0.061 to 0.894). A 2010 study in Banda Aceh similarly reported that stunting in children under the age of five was associated with non-exclusive breastfeeding, with a 5 times higher risk of stunting than children under five who had received exclusive breastfeeding.¹⁰

According to interviews, most mothers gave their children formula in addition to breast milk. Their reasons variations in breast milk production, infant lack of appetite for breast milk, and maternal work outside the home. Feeding of formula and breast milk can satisfy the nutritional requirements of the child, but formula lacks antibodies. As such, the child would be prone to diseases.¹¹ Breast milk contains numerous immunological substances not found in formula, such as immunoglobins that can prevent disease, secretory substances that can

neutralize pathogenic *E. coli* and multiple viruses of the digestive track, as well as lactoferrin, an immunological substance that binds iron from the digestive track and has bactericidal properties.¹² Breast milk also contains a 65:35 ratio of whey to casein, while formula has a ratio of 20:80. As such, proteins and other substances in breast milk tend to be more easily absorbed compared to formula milk.¹²

More children with history of low birth weight were in the case group than in the control group. We found that history of low birth weight increased the risk of stunting more than 12 times compared to those with normal birth weight. A Zimbabwe study also found that more infants with history of low birth weight (41.4%) experienced stunting.¹³ The effect of birth weight on stunting happens in the first 6 months of life, then decreases until the age of 24 months. As such, if infants can catch up in their growth in the first 6 months of life, there is a higher chance for them to achieve normal body height.¹⁴ Infants with history of low birth weight have been shown to have growth retardation in utero, both acutely and chronically. Hence, these children are prone to infections such as diarrhea and lower respiratory tract infections, as well as increased probability of icterus, anemia, chronic lung problems, exhaustion, and loss of appetite compared to children with normal birth weight.¹⁵ In our study, 70% of those in the case group had a history of normal birth weight. This may have been due to inadequate nutrition in these otherwise normal infants, which caused growth faltering (failure to thrive).¹⁶

We found no significant relationship between socio-economic status and stunting ($P=0.371$). Low socio-economic status was noted in 70% of the case group, and 83.3% of the control group. In contrast, a study in the North Moluccas reported a significant relationship between stunting/severe stunting and low socio-economic status in children aged 0-59 months.¹⁷ The food consumed by low income families is less varied and lower in quantity, particularly in terms of nutrition required for childhood growth, such as sources of protein, minerals, and vitamins. As such, there is a higher risk of malnutrition in these children.¹⁸ The contrasting results in our study may have been due to different socio-economic measurements.

Low parental education level, of both fathers and mothers, may increase the risk of stunting, but we did not find this to be the case in our study. We found no

significant relationship between stunting and maternal educational level ($P=0.292$). Similarly, Nasikhah (2012) in East Semarang reported that bivariate and multivariate analyses revealed no statistical significance between stunting and maternal educational level.¹⁹ This finding may have been due to the mothers with high educational status giving their infants formula, because they work outside home and cannot breastfeed their children. Working mothers have less time for their children, perhaps leading to malnutrition in a later stage and influencing growth and development.²⁰

In conclusion, there is a significant relationship between non-exclusive breastfeeding and stunting. Breastfeeding may be a protective factor against stunting in children under the age of five. Low birth weight infant also have a significant relationship with stunting. Further study should include not yet investigated variables, a larger sample size, and larger population coverage.

In light of our findings, we suggest that health workers, promote breastfeeding to mothers during pregnancy and after delivery. Mothers should be informed of the recommended practice of breastfeeding from childbirth to the age of 6 months, and about factors affecting the nutritional status of children aged 24-59 months, specifically to prevent stunting. In addition, expecting and new mothers should educate themselves on the nutritional requirements of infants, and early detection of stunting, so that they can lower the risk in their toddlers.

Conflict of Interest

None declared.

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References

1. Millenium Challenge Account-Indonesia. Stunting dan masa depan Indonesia. [Internet]. 2015; [cited 2016 May 18]. Available from: www.mca-indonesia.go.id.
2. Kikafunda JK, Walker AF, Collett D, Tumwine JK. Risk

- factors for early childhood malnutrition in Uganda. *Pediatrics*. 1998;102:e45.
3. Lestari ED. Diagnosis and nutrition management on children with stunting. In Lestari ED, Wulandari A, Editor. *Pediatric Clinical Updates in daily Practices*. CME Dept of Child Health, UNS-Moewardi Hospital. 2018. p.18-34.
 4. Badan Penelitian dan Pengembangan Kesehatan Kementerian-an Indonesia. *Riset Kesehatan Dasar*. Jakarta: Kementerian Kesehatan RI; 2003. p. 212-213
 5. International Food Policy Research Institute. *Global Nutrition Report 2014 : Actions and Accountability to Accelerate the World's Progress on Nutrition*. Washington DC: International Food Policy Research Institute; 2014. p.9.
 6. WHO. *Global Strategy on Infant and Young Child Feeding*. Switzerland: World Health Organization; 2013. p.15-24.
 7. Cai X, Wardlaw T, Brown DW. Global trends in exclusive breastfeeding. *Int Breastfeed J*. 2012;7:12.
 8. Ballard O, Morrow AL. Human milk composition: Nutrients and bioactive factors. *Pediatrics Clinics of North America*. 2013;60:49-74.
 9. Murti B. *Desain dan Ukuran Sampel untuk Penelitian Kuantitatif dan Kualitatif di Bidang Kesehatan*. Yogyakarta: UGM Press; 2010. p.119.
 10. Hendra A, Miko A, Hadi A. Kajian stunting pada anak balita ditinjau dari pemberian ASI eksklusif, MP-ASI, status imunisasi dan karakteristik keluarga di Kota Banda Aceh. *JKIN*. 2010;6:169-184.
 11. Aldy OS, Lubis BM, Sianturi P, Azlin E, Tjipta GD. Dampak proteksi air susu ibu terhadap infeksi. *Sari Pediatri*. 2009;11:167-73.
 12. Nirwana, A. *Kandungan dan manfaat ASI dan susu formula*. Yogyakarta: Nuha Medika; 2014. p. 125-6.
 13. Mbuya MNN, Chidem M, Chasekwa B, Mishra V. Biological, social, and environmental determinant of low birth weight and stunting among infants and young children in Zimbabwe. Zimbabwe: Zimbabwe Working Papers; 2010. p.11
 14. Adair LS, Guilkey DK. Age-specific determinants of stunting in Filipino children. *The Journal of Nutrition*. 1997;127.
 15. Rahman MS, Howlader T, Masud MS, Rahman ML. Association of low-birth weight with malnutrition in children under five years in Bangladesh: do mother's education, socio-economic status, and birth interval matter? *PLoS One*. 2016;11:0157814.
 16. Kusharisupeni. Peran status kelahiran terhadap stunting pada bayi: sebuah studi prospektif. *Jurnal Kedokteran Trisakti*. 2022;23:73-80.
 17. Ramli, Agho KE, Inder KJ, Bowe SJ, Jacobs J, Dibley MJ. Prevalence and risk factors for stunting and severe stunting among under-fives in North Maluku province of Indonesia. *BMC Pediatrics*. 2009;9:64.
 18. Chaudhury RH. Determinants of dietary intake and dietary adequacy for pre-school children in Bangladesh. *Bangladesh Institute of 23 Development Studies*. [Internet]. 1984; [cited 2016 May 26]. Available from: <http://archive.unu.edu/unupress/food/8F064e/8F064E04.htm>
 19. Nasikhah R, Margawati A. Faktor Risiko Kejadian Stunting pada Balita Usia 24-36 Bulan di Kecamatan Semarang Timur. *Journal of Nutrition College*. 2012;1:176-184.
 20. Girma W, Genebo T. *Determinants of The Nutritional Status of Mothers and Children in Ethiopia*. Calverton:ORC;2002. [Internet]. 1984; [cited 2016 May 26]. Available from: <https://dhsprogram.com/pubs/pdf/fa39/02-nutrition.pdf>.