JMCH Journal of Maternal and Child Health (2020), 5(1): 35-48
Masters Program in Public Health, Universitas Sebelas Maret
Research

The Association between Exclusive Breastfeeding, Maternal Nutritional Status, Maternal Zinc Intake, and Stunting in Infants Aged 6 Months

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ABSTRACT

Background: Stunting is a form of malnutrition that has an impact on decreased learning achievement, motor and mental development and intellectual. Exclusive breastfeeding is a perfect nutrition for the First 1,000 Days of Life for normal growth. Maternal nutritional status also plays an important role for the success of breastfeeding whose indicators are measured by the duration of exclusive breastfeeding and the nutritional status of children. Adequacy of zinc is an important micronutrient during the child's growth period to prevent growth failure. This study aimed to analyze the association between exclusive breastfeeding, maternal nutritional status, maternal zinc intake, and stunting in infants aged 6 months.

Subjects and Method: This was cross sectional study conducted in the 3 areas of community Health Center, Jember Regency. The subjects of the study were infants aged 6 month and 115 mothers. Infants were selected by cluster sampling and simple random sampling for each area. The zinc intake data was obtained by the 24 hours Recall. Body Mass Index was used to obtain maternal nutritional status data. The stunting data measured by microtoise. The other data were collected by questionnaire. The data were analyzed by path analysis.

Results: Exclusive breastfeeding (b = - 0.61; 95% CI = -1.42 to 0.21; p = 0.143) and maternal zinc intake (b = -0.04; 95% CI = 1.35 to 0.58; p = 0.436) directly decreased the risk of stunting in infants. Maternal BMI indirectly affected the risk of stunting in infants through exclusive breastfeeding

Conclusion: Exclusive breastfeeding and maternal zinc intake directly decrease the risk of stunting in infants. Maternal BMI (Body Mass Index) indirectly affect to the risk of stunting in infants through exclusive breastfeeding.

Keywords: Exclusive breastfeeding, nutritional status, zinc intake, stunting

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Cite this as:
Anindya IG, Salimo H, Dewi YLR (2020). The Association between Exclusive Breastfeeding, Maternal Nutritional Status, Maternal Zinc Intake, and Stunting in Infants Aged 6 Months. J Matern Child Health. 5(1): 35-48. https://doi.org/10.26911/thejmch.2020.05.01.05

BACKGROUND

According to UNICEF (2013), stunting is a nutritional problem in the world, especially in poor and developing countries. According to Banerjee and Chattopadhyay (2019), malnutrition is still the highest health problem in developing countries. There is 22.2% of stunting in the world. In 2017, more than a half of stunting children came from Asia (56%). The highest percentage was in South Asia by

58.7% (UNICEF et al., 2018). Indonesia is one of the states of Southeast Asia with a stunting prevalence by 29.6% (9.8% of infants was very short and 19.8% of infants was short) (Ministry of Health, 2018).

Besides, the stunting prevalence in East Java was 26.7% (7.9% was very short and 18.8% was short). In Jember Regency, the stunting prevalence in 2017 has reached 17.73% (Primary Data, 2018).

WHO 2010 has a limit for the stunting problems with no more than 20% (Izwardy, 2018). It has been achieved by Jember Regency. However, the preventive actions are still being carried out to prevent an increase of stunting in the next year. It aims to reduce the effect of stunting that is directly related to an increase in morbidity and mortality, stunted mental growth (UNICEF, 2013), inappropriate motor development (Septiawahyuni and Suminar, 2019), decreased learning achievement of children (Picauly and Toy, 2013), risk of being susceptible to non-communicable diseases (Souganidis, 2012), and decreased intellectual ability and risk of degenerative diseases (Kusuma and Nuryanto, 2013). In addition, it inhibits economic growth and decreases the work productivity; as a result, it causes in intergenerational poverty (TNP2K, 2017).

Stunting largely occurs due to inadequate nutrition during the first 1,000 days of life (WHO, 2014). Therefore, it is important to pay attention to the patterns of infant feeding during the period of 1000 days of life starting from conception to the second year which has a significant effect on infant growth (Uwaezuoke et al., 2017). Breast milk is an ideal and balanced nutrition according to the infant needs during the first 6 months of life (Ferreira et al., 2013).

Exclusive breastfeeding can reduce stunting (Kumar and Singh, 2015; Lestari et al., 2018). According to Muldiasman et al. (2018), late initiation of early breastfeeding will increase the risk of stunting by 1.3 times higher.

WHO recommends exclusive breastfeeding for 6 months. Breast milk is the perfect nutrient for linear growth. Based on the global level, the coverage of exclusive breastfeeding is still 30%, while the WHO target in 2025 related to the level of exclusive breastfeeding in the first 6 months of life is 50% (WHO, 2018). At the national level through the Health Profile in 2016, the exclusive breastfeeding coverage was still below the target by 29.5% (Ministry of Health, 2017).

The provincial level in East Java, coverage of exclusive breastfeeding has almost reached the target by 74% (target 77%). In 2016, the coverage of exclusive breastfeeding in Jember region has reached the target (80%) by 83.37% (DHO, 2016). However, in 2017, the prevalence of coverage decreased by 69.43% (Primary Data, 2018). There was a decrease in exclusive breastfeeding coverage from the previous year by 13.97%. Therefore, there are still problems with exclusive breastfeeding in Jember Regency. It can increase the incidence of stunting. Besides, it indirectly affect children's development.

The nutritional status of breastfeeding mothers plays an important role for the success of breastfeeding. The indicators are measured by the duration of exclusive breastfeeding and infant growth (Syafiq et al., 2015).

Adequacy of zinc is one of the important things during the infant growth period. If there is zinc deficiency, the growth failure will occur (Roohani et al., 2013). Besides, infant development is also affected by higher mineral intake in the composition of breast milk (Huang et al., 2016). Zinc is a mineral that is very important for the linear growth of infants. It is because there is an association between the increase of IGF-1 and zinc mineral (El-Farghali et al., 2015).
According to De Onis (2011), early detection

on stunted linear growth is very important to provide more timely and effective intervenetions in preventing malnutrition. In order to prevent further severity, the researcher wanted to analyze the association between exclusive breastfeeding, maternal nutritional status, and maternal zinc intake and stunting in infants aged 6 months. It is expected that this study can produce data in order to improve the quality of human resources.

SUBJECTS AND METHOD

1. Study Design

This study used a cross sectional design in the 3 areas. There were Sumbersari, Kaliwates, and Patrang Community Health Centers. This study was conducted in February to March 2019.

2. Population and Sample

The subjects of the study were infants aged 6 months and 115 mothers. The population of the study was 127 infants using Finite Population. A sample of 96 infants was selected for this study. The estimated dropout was 20%, so that the sample was 115 infants. The sample was collected by cluster sampling technique. In addition, simple random sampling was used to collect the sample in each region.

3. Study Variables

The dependent variable was stunting. The independent were exclusive breastfeeding, maternal nutritional status, and maternal zinc intake.

4. Operational Definition of Variables

Exclusive breastfeeding was breast milk that was given to babies from birth until aged 6 months without adding and/or replacing with other food or drinks. Measuring instruments using questionnaires and Card toward Health (Kartu Menuju Sehat) book. Data of exclusive breastfeeding were obtained by interview method. The measurement scale was a dichotomy. Code 0 was for exclusive breastfeeding and 1 was for non-exclusive breastfeeding.

Maternal nutritional status was a physiological condition of the body which was a result of food consumption and nutrients in the body. It was measured by anthropometry of body weight and height. In addition, it was interpreted based on BMI. It used weight scale and microtoise. Data of maternal nutritional status were obtained by direct measurement. The measurement scale was continuous, but it was changed to dichotomy to analyze the data. Code 0 was for normal nutrition (BMI 18.5 to 25 kg weight /m2 height and 1 was for abnormal nutrition (BMI <18.5 kg weight/m2 height).

Maternal zinc intake was the amount of zinc-containing food in each menu consumed using Estimated Food Record procedure. It was converted in grams through the Nutri survey application. Measuring instruments using a questionnaire. Zinc intake data obtained by 24-hour recall method. The measurement scale was continuous, but it was changed to dichotomy. Code 0 was for adequate nutritional intake if ≥ 77% of RDA (15 grams/day), and 1 for inadequate zinc intake if < 77% of Recommended Dietary Allowances (RDA) (15 grams/day).

Stunting was a measure of body length with a unit of cm. It was interpreted using a graph of body length growth according to age and sex of the infants. The measuring instrument was meter in cm. Data of zinc intake status were obtained by direct measurement method with supine infants. The measurement scale was continuous, but it was changed to dichotomy. Code 0 was for non-stunting (> -2SD) and 1 was for stunting (<-2SD).

5. Data Analysis

The characteristics of continuous data were described in n, mean, SD, min, and max. The characteristics of categorical data were described in n and percentage. The association of the variables were analyzed by path analysis.

6. Research Ethic

This study has been approved by Health Research Ethics Committee Universitas Sebelas Maret No.410/UN27.6/KEPK/2019 on 9th January 2019.

RESULT

1. Sample Characteristics

Table 1 showed the average of maternal age was 27 years. The youngest age was 19 years and the oldest age was 39 years. The average of maternal nutritional status was 20.20 kg weight/m2 height with a minimum BMI by 15.56 kg weight/m2 height and a maximum BMI by 25.00 kg weight/ m2 height. The average of maternal zinc intake was 7.66 grams/day with a minimum intake by 4.52 grams/day and a maximum intake by 17.22 grams/day. The average of the infants' body length was 62.39 cm with a minimum length by 55 cm and a maximum length by 72.5 cm. The number of baby girls was more (62%) than baby boys (53%).

The number of babies who were given exclusive breastfeeding was more (73%) than babies who were not given exclusive breast feeding (42%). The result can be seen in Tables 1 and 2.

Table 1. Sample characteristics (continuous data)

Variable	N	Mean	SD	Min	Max
Maternal age (year)	115	27.43	3.95	19.00	39.00
Maternal nutritional status (kg BW/m2)	115	20.20	2.46	15.56	25.00
Maternal zinc intake (gram)	115	7.66	2.46	4.52	17.22
Body length (cm)	115	62.39	3.04	55.00	72.50

Table 2. Sample characteristics (categorical data)

Variable	Category	n	%
Sex	Male	62	53.9
	Female	53	46.1
Exclusive breastfeeding	Non-exclusive breastfeeding	42	36.5
	Exclusive breastfeeding	73	63.5

2. The result of bivariate analysis

The distribution of the association between exclusive breastfeeding, maternal nutritional status, maternal zinc intake and stunting in infants aged 6 months can be seen in Table 3.

The result of bivariate analysis explained that infants with exclusive breastfeeding had stunting by 5/100 times compared to infants with non-exclusively breast feeding (OR=0.45; p=0.045). Breastfeeding mothers with abnormal nutritional status had stunting by 3.27/100 imes compared to mothers with normal nutritional status (OR=3.27; p=0.002). Inadequate zinc intake in breastfeeding mothers was 7/100 times compared to adequate zinc intake (OR=0.70; p=0.612), but it was statistically no significant.

Table 3. The results of bivariate analysis

Variable	Stunting				Total		OR	p
	Non-stunting		Stunting					
	n	%	n	%	n	%		
Exclusive breastfeeding								
Non-exclusive breastfeeding	16	38.1	26	61.9	42	100	0.45	0.045
Exclusive breastfeeding	42	57.4	31	42.5	73	100		
Maternal nutritional status (kg weight/m² height)								
Normal	36	65.5	19	34.5	55	100	3.27	0.002
Not normal	22	36.7	38	63.3	60	100		
Maternal zinc intake (gram)								
Sufficient	11	45.8	13	54.2	24	100	0.70	0.612
Insufficient	47	51.7	44	48.4	91	100		

3. Path Analysis

The process of data used STATA. Based on path analysis on the result of the study, the following results are obtained. Model specification described the association between variables in detail. There were four measurement variables, namely exclusive breastfeeding, maternal nutritional status, maternal zinc intake, and stunting.

The result of Path Analysis showed that exclusive breastfeeding reduced the risk of stunting, but it was statistically non-significant. Infants aged 6 months who got exclusive breastfeeding had logodd ("risk") of stunting by 0.6 lower than non-exclusive breastfeeding, but it was statistically non-significant (b=-0.6; 95% CI -1.42 to 0.21; p=0.143).

BMI of breastfeeding mothers <18.5 kg/m2 height increased the risk of stunting. Infants aged 6 months with breast feeding mothers with abnormal nutritional status (BMI <18.5 kg weight / m2 height) had log odd ("risk") of stunting by 1.14 units higher than good nutritional status (b=1.14; CI95 0.35 to 1.93; p=0.005).

Maternal zinc intake was directly associated with the decrease of the risk of stunting, but it was statistically non-significant. Zinc intake that was fulfilled in mothers had log odd ("risk") of stunting by 0.4 lower than non-exclusive breastfeeding, but it was statistically non-significant. There was an indirect association between maternal BMI through exclusive breastfeeding, but it was statistically significant

Table 4. The results of path analysis

Dependent Variable	Independent Variable	b	95% CI		p
			Lower Limit	Upper Limit	
Direct Association					
Stunting	Exclusive Breastfeeding	-.06	-1.42	0.21	0.143
	Maternal Body Mass Index	1.14	0.35	1.93	0.005
	Zinc intake	-.04	-1.35	0.58	0.436
Indirect Association					
Exclusive Breastfeeding	Maternal Body Mass Index	-.08	-1.56	0.00	0.050

N observation= 115
Log likelihood= -146.92761

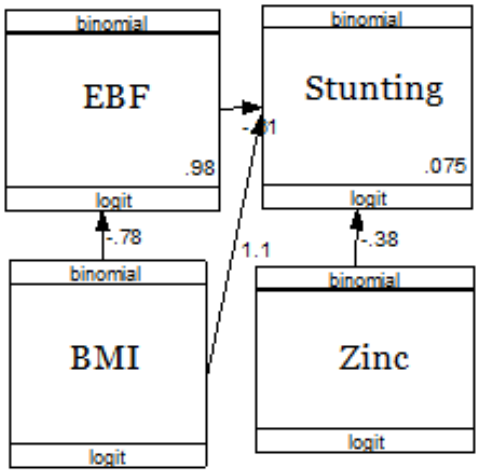

Figure 1. Path analysis model on stunting as the dependent variable

Description:
EBF: Exclusive Breastfeeding
BMI: Body Mass Index

DISCUSSION

1. The association between exclusive breastfeeding and stunting in infants aged 6 months

Breast milk is the ideal nutrition to support the health, growth and infant development optimally; as a result, it is important to give exclusive breastfeeding for the first 6 months of life (IDAI, 2010; Sulistyoningsih, 2010; Ferreira et al., 2013).

There is a significant difference between exclusive and non-exclusive breastfeeding with the linear growth of children (Chika et al., 2014). Breastfeeding is stated to be exclusive if children under five only get breast milk without any additional food or drink from birth to aged 6 months (Zogara et al., 2016). Infants who get exclusive breastfeeding have 1.62 times greater chance of getting normal growth (Fitri et al., 2014).

The result of path analysis showed that the association between exclusive breastfeeding and stunting was statistically non-significant. However, there was a direct association between exclusive breastfeeding and stunting. Infants with exclusive breastfeeding would have the risk of stunting by 0.6 lower than non-exclusive breastfeeding. This is in line with a study conducted by Rakhmahayu et al. (2019) that infants who get exclusive breastfeeding have the risk of stunting by 2.04 lower than infants who do not get exclusive breastfeeding. It is supported by Fitri et al. (2014); Kuchenbecker et al. (2015) and Uwiringiyimana et al. (2019) that exclusive breastfeeding in the first 6 months can reduce the risk of stunting. Infants with exclusive breastfeeding have the lower risk of stunting by 3.27 times (Abubakar et al., 2010). It is because breast milk contains antibodies and calcium content. In addition, breast milk also has high bioavailability, so that it can be optimally absorbed, especially in bone formation (Almatsier, 2009).

Besides, there is growth hormone which can increase the growth process of the baby's digestive system and protect the baby against bacteria and viruses (Kismul et al., 2017). Infants who do not exclusively breastfed will have a risk of stunting by 4.9 to 6.54 times. It is associated with the incidence of infectious diseases such as diarrhea that is more commonly occur in infants under 6 months who are given other food besides

breast milk. Infectious diseases cause decreased appetite, decreased absorption of nutrients and increased catabolism, so that the nutrients are insufficient to support growth (AL-Rahmad et al., 2013; Lestari et al., 2018).

Breast milk has a better availability of nutrients in the process of digestion, absorption, and metabolism of body cells. Poly Unsaturated Fatty Acid (PUFA), especially AA and DHA are the structural components of cell membranes and the precursors of thromboxane, prostaglandin, and leukotriene (Ambartsumyan and Clark, 2008).

An adequate supply of PUFA ensures optimal growth and development (Keim et al., 2012); (Glaser et al., 2011). Besides, oligosaccharides in breast milk also play a role in infant growth (Alderete et al., 2015; Charbonneau et al., 2016). Glutamine content also positively affects the length of the baby's body (Larnkjaer et al., 2016).

A balanced diet for breastfeeding mothers is important to do; it aims to take care the infants' health through the ideal breast milk content (Erick, 2012; Selimouglu, 2013).

The statistically non-significant association in exclusive breastfeeding and stunting could be caused by the small number of subjects in the study. As a result, the p value was non-significant. There might be a significant association between exclusive breastfeeding and stunting, but it was not identified.

2. The association between breastfeeding mother nutritional status and stunting in infants aged 6 months

Based on the result of the study, there was a direct association between nutritional status of breastfeeding mothers and stunting. Infants aged 6 months with breastfeeding mothers with abnormal nutritional status had a risk of stunting by 1.14 units higher than normal nutritional status. It is in line with Kaur and Sen (2017) and Ayuningrum et al. (2017) that maternal nutritional status will affect the nutritional status of the child; therefore, it significantly affects the infant growth (Soi et al., 2006).

It is supported by Rahayu et al. (2018) that infants with mothers who are malnourished have a risk of stunting by 8.87 times higher than mothers with good nutrition.Maternal nutritional status will determine the quantity and quality of dairy products that indirectly play a role in determining the nutritional status of children (Nadimin et al., 2010; Syafiq et al., 2015).

The lower the nutritional status of breastfeeding mothers, the lower the lactation performance. As a result, it increases the risk of child morbidity (Demissie et al., 2003). According to Irawati et al. (2003), mothers with underweight nutritional status have a risk of unsuccessful breastfeeding by 2.26-2.56 times compared to breastfeeding mothers with normal nutritional status. Therefore, the unsuccessful exclusive breastfeeding will affect their child's nutritional status.

3. The association between maternal zinc intake and stunting in infants aged 6

Zinc is one of the minerals that is very needed by breastfeeding mothers. Breast milk has a very good zinc bioavailability. However, the zinc content decreases after breastfeeding for the first 6 months (Hardinsyah and Supariasa, 2016).

Therefore, the need for zinc increases during breastfeeding compared to during pregnancy. According to Huang et al. (2016), higher mineral intake in the composition of breast milk can affect the infants' growth and development. It is because according to Tanumihardjo et al. (2016), zinc intake has an association with the increase of growth hormone (IGF-1) or cell replication and the development of immune responses. As a result, if zinc intake is inadequate, there will

be growth disturbance and an increase of the risk of child morbidity.

Zinc (trace element) is the second element that play the most important role for humans. However, it cannot be stored in the body, so it is necessary to do regular intake in its fulfillment (Fallah et al., 2018). Based on the result of the study, there was a direct association between zinc intake and the risk of stunting for infants aged 6 months, but it was statistically non-significant. It is in line with Sundari and Nuryanto (2016), that there is no significant association between zinc intake and stunting. According to the result of a 24-hour recall, mothers rarely consume foods high in zinc such as fish, shellfish or animal protein. They more often consume plant-based protein every day.

According to Gropper et al. (2009), vegetable zinc sources such as grains, vegetables and fruits contain a small amount of zinc, so that they are less absorbed by the body. However, according to Sandberg, (2002), these food ingredients contains high phytic acid which can inhibit the absorption of zinc. As a result, zinc absorbed from nuts is not absorbed as well as zinc from animal protein sources.

According to Andriani and Wirjatmadi (2012), some zinc uses transferrin, which is also an iron transport. The normal condition of iron transferrin saturation is usually less than 50%. If the ratio between iron and zinc is more than 2:1, the transferrin for zinc is reduced, thereby inhibiting zinc absorption. Conversely, high doses of zinc also inhibit iron absorption. It can affect the effect of zinc on stunting. The amount consumed is high, but the amount absorbed is low, so the possible result is not significantly associated.

Another factor that was not statistically associated with zinc intake and stunting in this study was the small number of subjects. As a result, the p value was non-significant. There might be a significant association between maternal zinc intake and stunting, but it was not identified.

4. The association between breastfeeding mother nutritional status and exclusive breastfeeding

The result of the study showed that there was an indirect association between BMI of breastfeeding mothers and exclusive breastfeeding, but it was statistically significant. It is supported by Bobrow et al. (2013), that nutritional problems in breastfeeding mothers are health problems caused by various interrelated factors. One of the factors is the pattern of breastfeeding. Breastfeeding can reduce maternal weight after giving birth.

Weight loss occurs due to increased energy expenditure by 595 to 670 kcal during the first 6 months after giving birth and due to the mobilization of body fluids and protein needed to produce breast milk (Soetjiningsih, 2012). Breastfeeding can accelerate weight loss after giving birth, but in the ideal limits. Breastfeeding also affects the reduction in body fat percent. Breastfeeding exclusively decreases body fat percent by 2.7 times greater than non-exclusive breastfeeding (Harsanti and Kusumastuti, 2013).

Mothers who breastfeed their babies have changes in body composition due to changes in body fat mass. Mothers who breastfeed exclusively have a reduction in body fat percent in the arms. Meanwhile, mothers who do not breastfeed exclusively have a reduction in body fat percent that is only found in the legs (Wosje and Kalkwarf, 2004).

According to Harsanti and Kusumastuti (2013), changes in maternal nutritional status as an effect of the pattern of breastfeeding can be seen after giving breast milk for 6 months. It is supported by Okechukwu et al. (2009), that maternal nutrition has a significant association on exclusive breastfeeding and non-exclusive breastfeeding. There was a weight loss that was significantly

higher between the exclusive breastfeeding group (4.13 kg) and non-exclusive breastfeeding group (1.06kg) in the first 6 months. They lost weight, but still in the normal limits. According to Bobrow et al. (2013), the maternal average BMI is 1% lower for every 6 months after breastfeeding, thus reducing the risk of obesity with age.

AUTHOR CONTRIBUTION

Ivanda Glanny Anindya responsible for all scientific content of the article, conducting analysis, data interpretation and discussion, preparing manuscript drafts and making revisions. Harsono Salimo providing guidance starting from the concept study to data analysis, doing corrections starting from data, results and discussion, as well as providing advice and motivation. Yulia Lanti Retno Dewi providing guidance starting from the concept of the study to data analysis, doing corrections starting from data, results, discussion and writing, as well as providing advice and motivation.

CONFLICT OF INTEREST

There was no conflict of interest.

FUNDING AND SPONSORSHIP

There was no fund and sponsor support.

ACKNOWLEDGEMENT

The researcher give the best gratitude to the parties in the Health Office, Sumbersari, Kaliwater, and Patrang Community Health Centers, Jember Regency who given permission for the study.

REFERENCE

Abubakar A, Holding P, de Vijver FJR, Newton C, Van Baar A (2010). Children at risk for developmental delay can be recognized by stunting, being underweight, ill health, little maternal schooling or high gravidity. Journal of Child Psychology and Psychiatry, 51(6): 652–659. Retrieved from https://doi.org-/10.1111/j.1469-7610.2009.02193.x.

AL-Rahmad AH, Miko A, Hadi A (2013). Kajian stunting pada anak balita ditinjau dari pemberian ASI eksklusif, MP-ASI, status imunisasi dan karakteristik keluarga di Kota Banda Aceh. J Kesehatan Ilmiah Nasuwakes, 6(2): 169–184.

Alderete TL, Autran C, Brekke BE, Knight R, Bode L, Goran MI, Fields DA (2015). Associations between human milk oligosaccharides and infant body composition in the first 6 months of life. The American Journal of Clinical Nutrition, 102(6): 1381–1388. Retrieved from https://doi.org/10.3945/ajcn.115-.115451.

Almatsier S (2009). Prinsip dasar ilmu gizi. Jakarta: Gramedia Pustaka Utama.

Ambartsumyan G, Clark AT (2008). Aneuploidy and early human embryo development. Human Molecular Genetics, 17(R1): R10-R15.

Andriani M, Wirjatmadi B (2012). Peran gizi dalam siklus kehidupan. In Kencana Prenada Media Group. Jakarta.

Ayuningrum IY, Salimo H, Dewi YLR (2017). Path analysis on gestational socio-economic determinants of nutritional status in children under five in Purworejo Regency, Central Java. Journal of Maternal and Child Health, 2(1): 30–41. Retrieved from https://doi.org/10.-26911/thejmch.2017.02.01.04.

Banerjee A, Chattopadhyay N (2019). Impact of malnutrition on neuro-development in children from a marginalized rural community in India. International Journal of Scientific Research, 8(2).

Bobrow KL, Quigley MA, Green J, Reeves GK, Beral V. (2013). Persistent effects of women's parity and breastfeeding patterns on their body mass index: results from the Million Women Study.

International Journal of Obesity, 37(5): 712. Retrieved from https://doi.org/-10.1038/ijo.2012.76.

Charbonneau MR, O'Donnell D, Blanton LV, Totten SM, Davis JCC, Barratt M J, et al. (2016). Sialylated milk oligosaccharides promote microbiota-dependent growth in models of infant under nutrition. Cell, 164(5): 859–871. Retrieved from https://doi.org/10.1016/j.cell.20-16.01.024.

Chika N, Odinakachukwu N, Eucharia U, Aloysius M (2014). Nutritional assessment of exclusively breastfed and non-exclusively breastfed infants aged (0-6 months) at mother of Christ Specialist Hospital, Enugu, Nigeria. Int J Nutr Food Sci, 3(5): 462–470. Retrieved from https://doi.org/10.11648/j.ijnfs.-20140305.25.

de Onis M (2011). Timing of growth faltering: a critical window for healthy growth. Indian Pediatrics, 48(11): 851–852.

Demissie T, Mekonen Y, Jemal H (2003). Agro ecological comparison of levels and correlates of nutritional status of women. Ethiopian Journal of Health Development, 17: 189–196. Retrieved from https://doi.org/10.4314/ejhd.v-17i3.9839.

El-Farghali O, El-Wahed MA, Hassan NE, Imam S, Alian K (2015). Early zinc supplementation and enhanced growth of the low birth weight neonate. OAMJMS,3(1),63. Retrieved from http://dx.-doi.org/10.3889/oamjms.2015.007.

Erick M (2012). Nutrition in pregnancy and lactation, in krause'e food and the nutrition care process. (13th). Elsevier.

Fallah A, Mohammad-Hasani A, Colagar AH (2018). Zinc is an essential element for male fertility: A review of zn roles in men's health, germination, sperm quality, and fertilization. Journal of Reproduction & Infertility, 19(2): 69.

Ferreira HS, Xavier Junior AFS, de Assuncao ML, dos Santos EA, Horta BL (2013). Effect of breastfeeding on head circumference of children from impoverished communities. Breastfeeding Medicine, 8(3):294–301. Retrieved from https://-doi.org/10.1089/bfm.2012.0105.

Fitri DI, Chundrayetti E, Semiarty R (2014). Hubungan pemberian ASI dengan tumbuh kembang bayi umur 6 bulan di Puskesmas Nanggalo. Jurnal Kesehatan Andalas, 3(2).

Glaser C, Lattka E, Rzehak P, Steer C, Koletzko B (2011). Genetic variation in polyunsaturated fatty acid metabolism and its potential relevance for human development and health. Maternal and Child Nutrition, 7(2): 27–40. Retrieved from https://doi.org/10.1111/j.1740-87-09.2011.00319.x

Gropper SS, Smith JL, Groff JL (2009). Micro minerals: advanced nutrition and human metabolism. 5th Ed. Belmont (CA): Wadsworth/ Cengage Learning, 469–525.

Hardinsyah, Supariasa IDN (2016). Ilmu gizi teori dan aplikasi. Jakarta: EGC.

Harsanti Y, Kusumastuti AC (2013). Hubungan pemberian ASI Eksklusif dengan Penurunan Persen Lemak Tubuh Ibu Menyusui. Diponegoro University.

Huang LL, Xiong F, Yang F (2016). Relationship between breast milk composition and weight growth velocity of infants fed with exclusive breast milk. Zhongguo Dang Dai Er Ke Za Zhi. Chinese Journal of Contemporary Pediatrics, 18(10): 943–946.

IDAI (2010). Indonesia menyusui. Jakarta: Badan Penerbit IDAI.

Irawati A, Triwinarto A, Salimar S, Raswanti I (2003). Pengaruh status gizi ibu selama kehamilan dan menyusui terhadap keberhasilan pemberian air susu ibu. The Journal of Nutrition and Food

Research, 26(2).
Izwardy D (2018). Program gizi masyarakat untuk perbaikan gizi keluarga dalam rangka mensukseskan SDGs. Bogor: Pertemuan Nasional Asosiasi Institusi Pendidikan Tinggi Gizi Indonesia (AIPGI).
Kaur D, Sen M (2017). Study on the incidence of malnutrition in children (1-5 years) of low income group. International Journal of Engineering Technology Science and Research, 4(7), 2394-3386.
Keim SA, Daniels JL, Siega-Riz AM, Herring AH, Dole N, Scheidt PC. (2012). Breastfeeding and long-chain polyunsaturated fatty acid intake in the first 4 post-natal months and infant cognitive development: an observational study. Maternal & Child Nutrition, 8(4): 471–482. Retrieved from https://doi.org/10.1111/j.-1740-8709.2011.00326.
Ministry of Health (2017). Profil kesehatan Indonesia tahun 2016. Jakarta.
Ministry of Health (2018). Profil kesehatan Indonesia tahun 2017. Jakarta.
Kismul H, Acharya P, Mapatano MA, Hatloy A (2017). Determinants of childhood stunting in the Democratic Republic of Congo: further analysis of demographic and health survey 2013-14. BMC Public Health, 18(1): 1–14. Retrieved from https://doi.org/10.1186/s12889-01746-21-0.
Kuchenbecker J, Jordan I, Reinbott A, Herrmann J, Jeremias T, Kennedy G, Krawinkel MB (2015). Exclusive breastfeeding and its effect on growth of Malawian infants: results from a cross-sectional study. Paediatrics and International Child Health, 35(1): 14–23. Retrieved from https://doi.org/10.11-79/2046905514Y.0000000134.
Kumar A, Singh VK (2015). A Study of exclusive breastfeeding and its impact on nutritional status of child in EAG states. Journal of Statistics Applications & Probability, 4(3): 435. Retrieved from http://dx.doi.org/10.12-785/jsap/040311.
Kusuma KE, Nuryanto N (2013). Faktor risiko kejadian stunting pada anak usia 2-3 tahun (studi di Kecamatan Semarang Timur). Diponegoro University.
Larnkjaer A, Bruun S, Pedersen D, Zachariassen G, Barkholt V, Agostoni C, et al. (2016). Free amino acids in human milk and associations with maternal anthropometry and infant growth. Journal of Pediatric Gastroenterology and Nutrition, 63(3): 374–378. Retrieved from https://doi.org/10.1097/MP-G.0000000000001195.
Lestari DAA, Martianto D, Tanziha I (2018). Pengembangan indeks ketahanan pangan dan gizi tingkat kabupaten di Kabupaten Bandung Barat. Jurnal Ekonomi Pertanian Dan Agribisnis, 2(1): 62–76. Retrieved from https://doi.-org/10.21776/ub.jepa.2018.002.01.7.
Nadimin, Baharudin A, Zakaria A (2010). Faktor-faktor yang berhubungan dengan status gizi ibu menyusui wilayah kerja puskesmas moncobalang Kabupaten Gowa. Media Gizi Pangan, 9(1): 52–57.
Okechukwu AA, Okpe EC, Okolo AA (2009). Exclusive breastfeeding and postnatal changes in maternal anthropometry. Nigerian Journal of Clinical Practice, 12(4).
Picauly I, Toy SM. (2013). Analisis determinan dan pengaruh stunting terhadap prestasi belajar anak sekolah di Kupang dan Sumba Timur, NTT. Jurnal Gizi dan Pangan, 8(1), 55–62. Retrieved from https://doi.org/10.25182/jgp.20-13.8.1.55-62.
Rahayu RM, Pamungkasari EP, Wekadigunawan C (2018). The biopsychosocial de-

terminants of stunting and wasting in children aged 12-48 months. Journal of Maternal and Child Health, 03(02): 105–118. Retrieved from https://doi.org/10.26911/thejmch.2018.03.02.03

Rakhmahay A, Dewi YLR, Murti B (2019). Logistic regression analysis on the determinants of stunting among children aged 6-24 months in Purworejo Regency, Central Java. Journal of Maternal and Child Health, 4(3): 158–169. Retrieved from https://doi.org/10.26911/thejmch.2019.04.03.03

Roohani N, Hurrell R, Kelishadi R, Schulin R (2013). Zinc and its importance for human health: An integrative review. Journal of Research in Medical Sciences: The Official Journal of Isfahan University of Medical Sciences, 18(2): 144.

Sandberg AS (2002). Bioavailability of minerals in legumes. British Journal of Nutrition, 88(S3): 281–285. Retrieved from https://doi.org/10.1079/BJN/2002718.

Selimouglu MA (2013). Importance of nutrition in lactating mothers in terms of both the mother's and the infant's health. Turk Arch Ped, 48: 183–187. Retrieved from https://doi.org/10.4274/tpa.698.

Septiawahyuni HD, Suminar DR (2019). Kecukupan asupan zinc berhubungan dengan perkembangan motorik pada balita stunting dan non-stunting. Amerta Nutrition, 3(1): 1–6. Retrieved from https://doi.org/10.2473/amnt.v3i1.2019.1-6.

Soetjiningsih (2012). Seri gizi klinik ASI: petunjuk untuk tenaga kesehatan. Jakarta: EGC.

Soi B, Julia M, Budiningsari RD (2006). Pengaruh status gizi ibu menyusui terhadap eksklusivitas pemberian ASI dan pertumbuhan bayi di RSUD Prof. Dr. WZ. Johannes Kupang. Jurnal Gizi Klinik Indonesia, 2(3): 101–107. Retrieved from https://doi.org/10.22146-/ijcn.17431.

Souganidis E (2012). The relevance of micronutrients to the prevention of stunting. Sight and Life, 26(2): 10–18.

Sulistyoningsih H. (2010). Gizi untuk kesehatan ibu dan anak. Yogyakarta: Graha Ilmu.

Sundari E, Nuryanto N (2016). Hubungan asupan protein, seng, zat besi, dan riwayat penyakit infeksi dengan Z-Score TB/U pada balita. Journal of Nutrition College, 5(4): 520–529. Retrieved from https://doi.org/10. 14710/jnc.v5i4.16468.

Syafiq A, Fikawati S, Karima K (2015). Gizi ibu dan bayi. Jakarta: PT. Grafindo Indonesia.

Tanumihardjo SA, Russell RM, Stephensen CB, Gannon BM, Craft NE, Haskell MJ, Raiten DJ. (2016). Biomarkers of nutrition for development (BOND)-vitamin A review. The Journal of Nutrition, 146(9): 1816S--1848S. Retrieved from https://doi.org/10.3945/jn.115.229708.

TNP2K (2017). 100 Kabupaten/kota prioritas untuk penanganan anak kerdil (stunting). Sekretariat Wakil Presiden Republik Indonesia, 2.

UNICEF (2013). Improving child nutrition the achievable imperative for global progress. Retrieved from www.unicef.org/media/files/nutrition_report-_2013.pdf.

UNICEF, WHO, WB (2018). Levels and trends in child malnutrition, UNICEF /WHO/World Bank Group joint child malnutrition estimates. Midwifery, 12-(3): 154–155. Retrieved from https://doi.org/10.1016/S02666138(96)900674

Uwaezuoke SN, Eneh CI, Ndu IK (2017). Relationship between exclusive breast-

feeding and lower risk of childhood obesity: a narrative review of published evidence. Clinical Medicine Insights: Pediatrics, 11, 1179556517690196. Retrieved from https://doi.org/.1177/1179-556517690196.

Uwiringiyimana V, Ocke MC, Amer S, Veldkamp A (2019). Predictors of stunting with particular focus on complementary feeding practices: a cross-sectional study in the northern province of Rwanda. Nutrition, 60, 11–18. Retrieved from https://doi.org/10.1016/j.-nut.2018.07.016.

WHO (2014). Global nutrition target 2025 stunting policy brief, 9. Retrieved from https://www.who.int/nutrition/publications/globaltargets2025policybriefstunting/en.

WHO (2018). Global target 2025: breastfeeding. Retrieved from http://www.-who.int.

Wosje KS, Kalkwarf HJ. (2004). Lactation, weaning, and calcium supplementation: effects on body composition in postpartum women. The American Journal of Clinical Nutrition, 80(2): 423–429. Retrieved from https:// doi.-org/10.1093/ajcn/80.2.423.

Zogara AU, Hadi H, Arjuna T (2016). Riwayat pemberian ASI eksklusif dan MPASI dini sebagai prediktor terjadinya stunting pada baduta di Kabupaten Timor Tengah Selatan, Nusa Tenggara Timur. Indonesian Journal of Nutrition and Dietetics, 2(1): 41–50. Retrieved from https://doi.org/10. 20-960/nh.1352.