

The Effects of Exclusive Breastfeeding and Contextual Factor of Village on Stunting in Bontang, East Kalimantan, Indonesia

Joko Sugiyanto¹⁾²⁾, Setyo Sri Raharjo³⁾, Yulia Lanti Retno Dewi³⁾

¹⁾Bontang District Health Office, Kalimantan Timur

²⁾Masters Program in Public Health, Universitas Sebelas Maret

³⁾Faculty of Medicine, Universitas Sebelas Maret

ABSTRACT

Background: Basic Health Research Results of 2018 stated that 30.8% of Indonesian children experienced Stunting. Stunting problems describe the existence of chronic nutritional problems, which can be influenced by a variety of interrelated factors. This study aimed to examine the determinants of stunting Bontang, East Kalimantan, Indonesia.

Subjects and Method: This was an analytic observational study with a case control design. It was conducted at 15 sub-districts in Bontang, East Kalimantan, from February to April 2019. A sample of 225 children was selected by purposive sampling. The dependent variable was stunting. The independent variables were exclusive breastfeeding, history of infection, low birth weight (LBW), economic status, maternal education, maternal height, basic sanitation, and Community Based Total Sanitation (CBTS) urban village status. The data were collected by questionnaire and analyzed by a multilevel multiple logistic regression.

Results: The risk of stunting decreased with maternal height ≥ 150 cm ($b = -1.37$; 95% CI= -2.41 to -0.32; $p = 0.010$), maternal education \geq senior high school ($b = -1.83$; 95 % CI= -2.79 to -0.87; $p < 0.001$), exclusive breastfeeding ($b = -1.67$; 95% CI= -3.28 to -0.06; $p = 0.042$), and high economic status ($b = -1.33$; 95% CI= -2.23 to -0.41; $p = 0.004$). It was increased with number of family members > 4 ($b = 1.32$; 95% CI= 0.41 to 2.22; $p = 0.004$), history of infectious disease ($b = 2.23$; 95% CI= 1.32 to 3.14; $p < 0.001$), poor environmental sanitation ($b = 1.83$; 95% CI= 0.64 to 3.02; $p = 0.003$), and LBW ($b = 1.30$; 95% CI= 0.04 to 2.56; $p = 0.043$). Subdistricts had neglected contextual effect on the incidence of stunting with ICC $< 1\%$.

Conclusion: The risk of stunting decreases with maternal height ≥ 150 cm, maternal education \geq senior high school, exclusive breastfeeding, and high economic status. It is increased with number of family members > 4 , history of infectious disease, poor environmental sanitation, and LBW. Subdistricts has neglected contextual effect on the incidence of stunting.

Keywords: stunting, exclusive breastfeeding, multilevel analysis

Correspondence:

Joko Sugiyanto. Masters Program in Public Health, Universitas Sebelas Maret, Jl. Ir. Sutami No. 36 A, Surakarta, Indonesia. Email: jksgnt@gmail.com. Mobile: 081254261020

BACKGROUND

Indonesia is one of 17 countries with high prevalence of stunting, wasting, and overweight in infants (Achadi, 2018). Baseline Health Study in 2018 reported 30.8% of Indonesian children experienced stunting (BAPPENAS, 2018).

Children under five growing short and very short (stunting) in East Kalimantan each year increased from 26.7% in 2015 to

30.6% in 2017. Bontang City is an area with high stunting cases among 10 regencies/cities in East Kalimantan, recorded in 2017 the number of stunting children under five 32.4% (Health office of Bontang, 2017).

Stunting problems display the existence of chronic nutritional problems, which can be influenced by a variety of interrelated factors. Public health problems are considered severe, if the prevalence is short

by 30% - 39%, and serious if the prevalence is short $\geq 40\%$ (WHO, 2010).

Baseline health study of 2010 shows that under-two-year old children from unprotected water sources have higher risk of stunting compared to children from families who have clean water sources and proper types of toilets (Adiyanti et al., 2014).

A study conducted by Hidayat et al. (2011) states that there is a significant relationship between healthy environmental sanitation and nutritional status of children under five with body weight according to age. Healthy environmental sanitation indirectly affects the health of children under five which ultimately can affect the nutritional status of children under five.

Exclusive breastfeeding should be followed by supplementary feeding when the baby reaches the age of 6 months, children under five who get exclusive breastfeeding for more than 1 year are likely to have the risk of stunting 2.77 times higher than children under five who are exclusively breastfed and get food supplementation aged 6 months and above (Nsereko et al., 2018).

Stunting can be prevented by optimizing the growth of infants / children under five in the first 1000 days of life by optimizing the need for all micro and macro nutrients in a balanced manner that can be obtained by giving exclusive breastfeeding for 6 months and followed by supplementary breastfeeding food after 6 months.

The benefits of exclusive breastfeeding include protecting babies from bacterial infections such as bacteria, viruses, and parasites. Breast milk contains special proteins that can boost your child's immune system. The provision of exclusive breastfeeding to babies is good, to protect the baby's body from various diseases. Nutritional intake in infants is very im-

portant in supporting growth in accordance with the graph of growth so as not to occur growth failure which can cause stunting.

This study aimed to determine the determinants of stunting in children under five in Bontang, East Kalimantan.

SUBJECTS AND METHOD

1. Study Design

This was a case-control study conducted in Bontang, East Kalimantan, Indonesia, from February to April 2019.

2. Population and Samples

The study population was children aged 6-59 months in Bontang, East Kalimantan, Indonesia. A sample of 225 children was selected by fixed disease sampling.

3. Study Variables

The dependent variable was stunting. Independent variables were exclusive breastfeeding, history of infection, history of low birth weight, economic status, number of household members, mother's education, maternal height, basic sanitation, and CBTS urban village status.

4. Operational Definition of Variables

Stunting was a condition of failure to thrive in children under five due to chronic malnutrition so children are too short for their age with a Z-score of < -2 SD/ standard deviation (stunted) and < -3 SD (severely stunted).

Exclusive breastfeeding was defined as infants who received breastmilk without any additional food (other than medicine from a doctor / midwife) at the age of 0-6 months. It was measured by questionnaire.

A history of infectious diseases was a history of children under five suffering from infectious diseases in the past six months. It was measured by questionnaire.

Low birthweight was a history of infants birth weight $< 2,500$ g. It was measured by questionnaire.

Economic status was a description of family income each month compared to the minimum wage of the city of Bontang in 2018 which is equal to Rp. 2,715,078. It was measured by questionnaire.

Number of family member was the number of family members who live and live in homes with children under five. It was measured by questionnaire.

Maternal education was the highest maternal education. It was measured using a questionnaire and produced categorical data, and for analysis purposes, the data was converted into dichotomous data.

Maternal height was the height of the mother at the time of the study which was measured using a microtoxic measurement device expressed in units of centimeters. It was measured by questionnaire.

Basic sanitation was the minimum standard requirement in the CBTS program. This was measured using a questionnaire and produced categorical data, and for analysis purposes, the data was converted into dichotomous data.

5. Study Instruments

The data were collected by questionnaire. It

has been tested for content validity, face validity, and reliability testing.

6. Data Analysis

Univariate analysis was conducted to describe sample characteristics. Categorical data were describe in frequency and percents. Continuous data were described in n (frequency), Mean, SD, Min, and Max. Bivariate analysis was carried out using Chi-square test and Odds Ratio. Multivariate analysis was performed using multi-level multiple logistic regression.

7. Research Ethics

Research ethics include informed consent, anonymity, confidentiality, and ethical clearance. The ethical feasibility in this study came from the Health Research Ethics Committee of Dr. Moewardi, Surakarta with number: 128 / I / HERC / 2019.

RESULTS

1. Sample Characteristics

Sample characteristics were described in Table 1 for frequency distribution and Table 2 to see N, Mean, Minimum, and Maximum on continuous data.

Table 1. The sample characteristics (categorical data)

Characteristics	n	Percentage
Children Age		
< 2 years	85	37.8
≥ 2 years	140	62.2
Gender		
Male	111	49.3
Female	114	50.7
Nutritional Status		
Normal	153	68.0
Stunting	72	32.0
Exclusive Breastfeedingg		
Yes	210	93.3
No	15	6.7
History of Infectious Disease		
No	139	61.8
Yes	86	38.2
Birth weight		
Normal (≥2500 gram)	197	87.6

Low (<2500 gram)	28	12.4
Maternal Education		
High (≥SHS)	165	73.3
Low (<SHS)	60	26.7
Maternal height		
Normal (≥ 150 cm)	171	76.0
Normal (< 150 cm)	54	24.0
Income		
High (≥Minimum Wage)	147	65.3
Low (<Minimum Wage)	78	34.7
Basic Sanitation/Environment		
Good	186	82.7
Poor	39	17.3

Table 2. Sample characteristics (continuous data)

Variable	N	Mean	SD	Minimum	Maximum
Maternal height	225	153.4	5.7	140	170.0
Family members	225	4.7	1.4	3.0	10.0
Children under five birth weight	225	2.9	0.5	1.0	4.7
Births length	225	48.1	4.9	54.0	54.0
Economical Status Income (Rp)	225	3,041,573	960,554	1,000,000	7,500,000

Table 3. Bivariate analysis

Independent Variables	Nutritional Status				Total		OR	p
	Normal		Stunting		n	%		
	n	%	N	%				
Exclusive Breastfeeding								
Yes	149	71.0	61	29.0	210	100	6.71	<0.001
No	4	26.7	11	73.3	15	100		
Infectious Disease History								
No	119	85.6	20	14.4	139	100	9.10	<0.001
Yes	34	39.5	52	60.5	86	100		
Birth Weight								
Normal(≥2500 gram)	141	71.6	56	28.4	197	100	3.36	<0.001
Low (<2500 gram)	12	42.9	16	57.1	28	100		
Maternal Education								
High (≥ SHS)	134	81.2	31	18.8	165	100	9.33	<0.001
Low (< SHS)	19	31.7	41	68.3	60	100		
Maternal Height								
Normal (≥ 150 cm)	132	77.2	39	22.8	171	100	105.32	<0.001
Normal (< 150 cm)	21	38.9	33	61.1	54	100		
Income								
Sufficient (≥ Minimum Wage)	120	81.6	27	18.4	147		0.16	<0.001
Low (<Minimum Wage)	33	42.3	45	57.7	78			
Total of family member								
Small (< 4 people)	98	77.2	29	22.8	127		2.64	0.001

Big (≥ 4 people)	55	56.1	43	43.9	98		
Basic Sanitation							
Good	143	76.9	43	23.1	186	9.64	<0.001
Poor	10	25.6	29	74.4	39		
Village Status							
Complete	83	69.2	37	30.8	120	0.890	0.688
Incomplete	70	66.7	35	33.3	105		

2. Bivariate Analysis

Table 3 showed the Chi-square test results of the influence between exclusive breastfeeding, history of infection, history of low birth weight, maternal height, maternal education, economic status, number of family members, environmental sanitation on the incidence of stunting in infants. The status of the CBTS village had no effect on the incidence of stunting.

3. Multilevel Logistic Regression

Multilevel multiple logistic regression results are shown in Table 4. Factors of maternal height, maternal education, exclusive breastfeeding, and economic status reduced the risk of stunting. The number of family members, history of infection, low birth history, and poor environmental sanitation

increased the risk of stunting. Table 4 showed the normal maternal height (≥ 150 cm) influencing the risk of stunting ($b = -1.37$; CI 95% = -2.41 to -0.32; $p = 0.010$).

There was an influence of maternal education level on the incidence of stunting. Children under five with high maternal education had logod to reduce the risk of stunting by 1.83 units compared to children with low maternal education ($b = -1.83$; 95% CI = -2.79 to -0.87; $p < 0.001$).

There was an influence of exclusive breastfeeding on the incidence of stunting. Children under five who get exclusive breastfeeding had logod to reduce the risk of stunting 1.67 units compared to children who don't get exclusive breastfeeding ($b = -1.67$; CI 95% = -3.28 to -0.06; $p = 0.042$).

Table 4. Multilevel multiple logistic regression analysis on the determinants of stunting

Independent Variables	b	CI 95%		P
		Lower Limit	Upper Limit	
Fixed Effect				
Maternal height (≥ 150 cm)	-1.37	-2.41	-0.32	0.010
Maternal education (\geq senior high school)	-1.83	-2.79	-0.87	<0.001
Exclusive breastfeeding (yes)	-1.67	-3.28	-0.06	0.042
Income (<Minimum Wage)	-1.33	-2.23	-0.42	0.004
Famsize (≥ 4 persons)	1.32	0.41	2.22	0.004
Infectious illness (yes)	2.22	1.32	3.14	<0.001
Environment (poor)	1.83	0.64	3.02	0.003
Low birth weight (yes)	1.30	0.04	2.46	0.043
Constant	1.55	-0.37	3.46	0.114
Random Effect				
Variation (constant)	<0.01	-	-	-
N Observation = 225				
N Village = 15				

Average n per village =15
 Likelihood Random= - 67.43
 LR test vs. Logistic regression, $p \sim 1.0$
 ICC= < 1%

There was a negative effect of economic status on the incidence of stunting. Children with high family income had logodds to reduce the risk of stunting 1.33 units compared to children with low family income ($b = -1.33$; 95% CI = -2.23 to -0.41; $p = 0.004$).

There was a positive effect of the number of family members on the incidence of stunting. Children who lived with large family member (>4) had logodds to experience a risk of stunting 1.32 units compared to children who lived in small family member ≤ 4 ($b = 1.32$; 95% CI= 0.41 to 2.22; $p = 0.004$).

There was an influence of the history of infectious diseases of infants on the incidence of stunting. Children under five who had a history of infectious diseases had logodds to experience a stunting risk of 2.23 units compared to children under five who had no history of infectious diseases ($b = 2.23$; 95% CI = 1.32 to 3.14; $p = <0.001$).

There was an influence of environmental sanitation on the incidence of stunting in infants. Children under five who live in environments with poor sanitation had logodds to experience stunting risk of 1.83 units compared to children under five living in environments with good sanitation ($b = 1.83$; 95% CI = 0.64 to 3.02; $p = 0.003$).

There was an influence of LBW birth history on the incidence of stunting. Children under five who have low birth weight (2500g) had logodds to experience a stunting risk of 1.30 units compared to children under five who had a history of normal birth weight (≥ 2500 g) ($b = 1.30$; 95% CI = 0.04 to 2.56; $p = 0.043$).

There was no random effect of urban

contextual factors on variations in multiple logistic regression constants ($b = <0.01$).

LR test vs. logistic regression produced $p \sim 1$. This means that the multilevel multiple logistic regression analysis model shows no statistical difference with the usual logistic regression model. ICC = <1% means that there was no variation in stunting at the village contextual level.

DISCUSSION

1. The effect of exclusive breastfeeding on the incidence of stunting

Children under five who received exclusive breastfeeding had logodds to reduce the risk of stunting 1.67 units compared to children under five who did not get exclusive breastfeeding ($b = -1.67$; CI 95% = -3.28 to -0.06; $p = 0.042$). The results of this study were in line with the study by Ayuningrum et al. (2017) and Rakhmahayu et al. (2019) stated that exclusive breastfeeding can reduce the risk of stunting.

WHO recommends exclusive breastfeeding without any additional food / drink other than breast milk to infants up to the age of 6 months, followed by children aged 2 years by getting additional food besides breast milk according to their age (Mensah et al., 2017).

According to Fauziyah et al. (2018), exclusive breastfeeding through complementary feeding had an effect on the incidence of stunting ($b = 1.94$; 95% CI = 1.27 to 2.61; $p <0.001$). It was shown that children who received exclusive breastfeeding were 1.94 times more likely to get complementary food than children under five who did not receive exclusive breastfeeding, so in theory the risk for stunting

would be lower than for children under five who did not get exclusive breastfeeding. A study by Lestari et al. (2018) stated that exclusive breastfeeding was a protective factor against stunting (AOR= 0.23; 95% CI = 0.06 to 0.89).

Breast milk contains special proteins that can improve the children under five immune system. Nutritional intake in infants is very important in supporting growth in accordance with the graph of growth so as not to occur growth faltering which can cause stunting (Pusdatin Ministry of Health, 2018).

2. The effect of history of infectious diseases on the incidence of stunting

The results of the analysis showed that children under five who had a history of infectious diseases had logodds to experience a stunting risk of 2.23 units compared to children under five who had no history of infectious disease (b = 2.23; 95% CI = 1.32 to 3.14; p = <0.001). Namangboling et al. (2017) stated that infectious disease history is the dominant factor determining the nutritional status of children aged 7-12 months (OR= 2.38; 95% CI= 1.11 to 5.08; p= 0.025) indicating that children under five having a history of infectious disease has a greater risk of stunting compared to children under five who have no history of infectious diseases.

A study conducted by Danaei et al. (2016) states that 5.8 million children who have had infections such as diarrhea have a higher risk of stunting compared with children who have never had diarrhea (95% CI = 2.4 to 9.2).

Recurrent infectious diseases suffered by a child will cause impaired absorption of nutrients and subclinical infections that result in nutrient intakes that should be absorbed by the body to be not optimal resulting in chronic malnutrition, one of

which is shown to be stunting (Freeman et al., 2017).

3. The effect of LBW on the incidence of stunting

Children under five who had a normal birth weight (≥ 2500 g) had logodds to reduce the risk of stunting 1.30 units compared to children under five who had a history of low birth weight (<2500g) (b = 1.30; 95% CI = 0.04 to 2.56; p= 0.043).

Cruz et al. (2017) which states that there is a significant influence between birth weight and stunting (AOR = 19.99; 95% CI = 5.8 to 68.85; p <0.001).

Infant birth weight affected the growth of children, low birth babies began with a mother's food intake when pregnant. If the growth has been hampered since the womb, when it is born it also has the possibility to stunt growth. The study conducted by Manggala et al. (2018) states that infants with low weight have a risk of stunting 5.09 times higher than babies born with normal weight (AOR 5.09; 95% CI = 1.03 to 25.31; p = 0.047).

4. The effect of economic status on the incidence of stunting in infants

Economic status affected the incidence of stunting in children under five. Children with high family income had logodds to reduce the risk of stunting 1.33 units compared to children with low family income (b = -1.33; 95% CI = -2.23 to -0.41; p = 0.004).

Rakhmahayu et al. (2019) stated that children aged 6-24 months with low family income were more likely to experience stunting (b = -1.85; 95% CI = 0.05 to 0.50; p = 0.002).

Family with low economic levels tend to allocate income for other needs besides food, so that family nutrition is not met (Custodio et al., 2010).

Utami et al. (2017) reported the same results that family income influences the

incidence of stunting in children under five ($r = 0.23$; $p = 0.005$) has a positive effect on the incidence of stunting, children who have high income families will have an opportunity to reduce the risk of stunting. There was an indirect effect of family income on the incidence of stunting through children's energy intake and protein intake. The risk of stunting depends on socioeconomic, demographic and environmental factors. Family income is related to providing family food, access to food in the family and adequate food distribution for families. The quality and quantity of nutritional intake for all family members is affected by income. Families with high income will be able to buy food with good quality and nutrition for family nutrition (Omondi and Kirabira, 2016).

5. The effect of maternal education on the incidence of stunting

Children with high maternal education had logodds to reduce the risk of stunting by 1.83 units compared to children with low education ($b = -1.83$; $CI_{95\%} = -2.79$ to -0.87 ; $p < 0.001$).

Shamah et al. (2017) mentioning that there was an interaction between the socioeconomic level and education of mothers with having a marginal effect ($p = 0.09$). In contrast to the study of Utami et al. (2017) it was stated that maternal education had no effect on the incidence of stunting ($b = 0.23$; $p = 0.18$).

Mothers who are highly educated are expected to have good nutrition knowledge. With good knowledge, a mother will be better able to prioritize providing nutritious food for family members, especially her children. Ignorance of information about nutrition can cause intake of poor quality food consumed by children. The higher the mother's education, the higher the mother's knowledge about good nutrition for their children, thus reducing the risk of having a

child with stunting (Ni'mah and Nadhiroh, 2010).

Maternal education affected children under five care, family food allocation, especially for children under five, and mother's knowledge about the health of her baby. Mothers with higher education understood better about healthy living behaviors, so that they would make their children under five more secure in their health, avoid infectious diseases, and so on.

6. The effect of maternal height on the incidence of stunting in infants

Children under five who had biological mothers with normal height (≥ 150 cm) had logodds and reduced the risk of stunting 1.37 units compared to children under five who have biological mothers with short stature (< 150 cm). ($b = -1.37$; $95\% CI = -2.41$ to -0.32 ; $p = 0.010$). This study is in line with the study of Ali et al. (2017) showing that, the possibility of stunting was higher in children of mothers with a height of less than 150 cm ($AOR = 3.87$; $95\% CI = 1.34$ to 11.20); $p = 0.01$).

A study by Indriani et al. (2018) stated that there is a relationship between maternal height and stunting. Maternal height < 150 cm is more likely to have stunting than normal height mothers (≥ 150 cm) ($b = 2.59$; $95\% CI = -0.75$ to 4.42 ; $p = 0.006$). Heredity really plays a role in one's height. This is slightly different from the results of Dubois et al. (2012). The study shows that heredity affects a person's height at birth in low numbers (only around 4.8-7.9% in women). One or both parents who have short bodies due to pathological conditions (such as growth hormone deficiency) have genes in the chromosome that carry short traits that increase the chances of the child inheriting the gene and growing into stunting.

7. The effect of number of family members on the incidence of stunting

ing

Children under five with family members > 4 people had logodds to experience the risk of stunting 1.32 units compared to children under five who live with family members ≤ 4 people. (b = 1.32; 95% CI = 0.41 to 2.22; p = 0.004).

Indriani et al. (2018) which states that the number of family members ≥ 5 people increases the risk of stunting by logically 2.31 times compared to children under five who live with a family member < 5 people. (b = 2.31; CI95% = 0.34 to 4.29; p = 0.022).

Wolde et al. (2015) reported that the number of families affected the incidence of stunting in infants. Children under five with large numbers of families have a 3.3 higher risk of stunting than children under five with small families (AOR = 3.3; CI95% = 1.4 to 7.9).

The large number of families determines the fulfillment of food needs, quantities, and types of food available in the family, resulting in increasingly insufficient quality and quantity of food for family members.

8. The effect of basic sanitation on the incidence of stunting in infants

Children with good sanitation had logodds to reduce the risk of stunting 1.83 units compared to children who live in environments with poor sanitation (b = 1.83; 95% CI = 0.64 to 3.02; p = 0.003).

This study is in line with study conducted by Danaei et al. (2016), poor sanitation is a major risk for stunting with 7.2 million children stunting (95% CI = 6.3 to 8.2). Environmental risk had the second largest estimated impact on stunting globally, especially in southern Asia, Sub-Saharan Africa, and the East Asia and Pacific region.

9. The effect of village level on the incidence of stunting

The results of the analysis showed that

there were no random effects of urban contextual factors on variations in the multiple logistic regression constants (b = <0.01). LR test vs. logistic regression produces $p \sim 1$. This means that the multi-level multiple logistic regression analysis model showed no statistical differences with the usual logistic regression model. ICC = <1% means that there was no variation in stunting at the Kelurahan contextual level. The village contextual level was based on the strata of the implementation of the CBTS program through community empowerment using the triggering method.

The implementation of the CBTS program was focused on community empowerment. In Bontang, the village that implemented the CBTS program with 5 pillar categories, especially the pillar of stopping open defecation, amounted to 7 families from 15 villages. In its implementation, the side of community empowerment was still weak because the community still relied on the government and private assistance, the independence has not yet grown. This could be seen from the influence of environmental sanitation factors at the individual level statistically significant for the incidence of stunting in infants.

AUTHOR CONTRIBUTION

Joko Sugiyanto, the main author, played a role in collecting and processing the data. Setyo Sri Rahardjo examined the conceptual framework and study methodology. Yulia Lanti Retno Dewi reviewed the study paper.

FUNDING AND SPONSORSHIP

This study was funded by PPSDM Health, Ministry of Health of the Republic of Indonesia.

CONFLICT OF INTEREST

The authors do not have any conflict of interest.

ACKNOWLEDGEMENT

Author gratitude goes to the Bontang City Government that has given the permission to conduct the study, and the Indonesian Ministry of Health's Human Resources Development and Empowerment Management Agency which has provided costs in this study.

REFERENCE

- Achadi EL (2018). Stunting: Permasalahan dan potensi dampaknya terhadap kualitas SDM di Indonesia. Disampaikan pada rembug stunting Kementerian Perencanaan Pembangunan Nasional RI (Stunting: Problems and potential impacts on quality of human resources in Indonesia. Presented at the stunting meeting of the Indonesian Ministry of National Development Planning). www.depkes.go.id/resources/download/infoterkini/.. /Pakar%20Stuning.pdf
- Adiyanti M (2014). Pola asuh gizi, sanitasi lingkungan dan pemanfaatan posyandu dengan kejadian stunting pada baduta di Indonesia (Nutrition, environmental sanitation parenting and utilization of Posyandu with stunting occurrences in over two million in Indonesia). <http://lib.ui.ac.id/naskahringkas201604S55589>.
- Ali Z, Saaka M, Adams AG, Kamwininaang SK, Abizari AR (2017). The effect of maternal and child factors on stunting, wasting and underweight among preschool children in Northern Ghana. *BMC Nutrition*, 3(1):1–13. <https://doi.org/10.1186/s40795-017-01542>.
- 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. <https://doi.org/10.26911/thejmch.2017.02.01.04>
- Bontang Health Office (2017). *Laporan Pemantauan Status Gizi di Kota Bontang 2017*.
- Cruz GLM, Azpeitia G, Suárez RD, Rodríguez SA, Ferrer LJF, Majem SL (2017). Factors associated with stunting among children aged 0 to 59 months from the central region of Mozambique. *Nutrients*, 9(5): 1–16. <https://doi.org/10.3390/nu9050491>
- Custodio E, Descalzo MA, Roche J, Molina L, Sanchez I, Lwanga M, Torres AM (2010). The economic and nutrition transition in equatorial guinea coincided with a double burden of over- and under nutrition. *Economics and Human Biology*, 8(1): 807. <https://doi.org/10.1016/j.ehb.2009.10.001>.
- Danaei G, Andrews KG, Sudfeld CR, Fink G, McCoy DC, Peet E, Fawzi WW (2016). Risk factors for childhood stunting in 137 developing countries: a comparative risk assessment analysis at global, regional, and country levels. *PLoS Medicine*, 13(11): 1–18. <https://doi.org/10.1371/journal.pmed.1002164>.
- Davik FI (2018). Evaluasi program sanitasi total berbasis masyarakat pilar stop BABS di Puskesmas Kabupaten Probolinggo (Evaluation of the Stop BABS pillar community-based total sanitation program in Probolinggo district community service). *Jurnal Administrasi Kesehatan Indonesia*, 4(2):107. <https://doi.org/10.20473/jaki.v4i2.2016.107-116>

- Dubois L, Ohm Kyvik K, Girard M, Tatone-Tokuda F, Pérusse D, Hjelmborg J, Martin NG (2012). Genetic and environmental contributions to weight, height, and bmi from birth to 19 years of age: An international study of over 12,000 twin pairs. *PLoS ONE*, 7(2). <https://doi.org/10.1371/journal.pone.0030153>.
- Fauziyyah RL, Dewi YLR, Wekadigunawan C, Adriani RB (2018). Path analysis on the life-course biopsychosocial determinants of stunting in children under five years of age in Karawang, West Java. *Journal of Maternal and Child Health*, 04(01): 25–35. <https://doi.org/10.26911/thejmch.2019.04.01.04>
- Hidayat TS, Fuada N (2011). Hubungan sanitasi lingkungan, morbiditas, dan status gizi balita di Indonesia (Relationship between environmental sanitation, morbidity and nutritional status of children in Indonesia). *The Journal of Nutrition and Food Research*, 34(2): 104-105. <http://download.portalgaruda.org/article.php?article=71914&val=4888>
- Indriani D, Dewi YLR, Murti B, Qadrijati I (2018). Prenatal factors associated with the risk of stunting: A Multilevel Analysis Evidence from Nganjuk, East Java. *Journal of Maternal and Child Health*, 03(04): 294–300. <https://doi.org/10.26911/thejmch.2018.03.04.07>.
- Lestari ED, Hasanah F, Nugroho NA (2018). Correlation between non-exclusive breastfeeding and low birth weight to stunting in children. *Paediatrica Indonesiana*, 58(3): 123–127. <https://doi.org/10.14238/pi58.3.2018.123-7>
- Manggala AK, Wiswa K, Kenwa MM, Kenwa L, Agung A, Sawitri S (2018). Risk factors of stunting in children aged 24-59 months. *Paediatrica Indonesiana*, 58(5):205–212.
- Mensah KA, Acheampong E, Anokye FO, Okyere P, Brempong EA, Adjei RO. (2017). Factors influencing the practice of exclusive breastfeeding among nursing mothers in a periurban district of Ghana. *BMC Research Notes*, 1–7. <https://doi.org/10.1186/s1310401727>
- Murti B (2018). Prinsip dan metode riset epidemiologi edisi keempat (The fourth edition of the principles and methods of epidemiology research). Surakarta: Pascasarjana Ilmu Kesehatan Masyarakat Universitas Sebelas Maret.
- Namangboling AD, Murti B, Sulaeman ES (2017). Hubungan riwayat penyakit infeksi dan pemberian ASI eksklusif dengan status gizi anak usia 7-12 bulan di Kecamatan Kelapa Lima Kota Kupang (The relationship between infectious disease history and exclusive breastfeeding with nutritional status of children aged 7-12 months in Kupang's Kelapa Lima District). *Sari Pediatri*, 19(2): 91. <https://doi.org/10.14238/sp19.2.2017.91-6>.
- National Development Planning Board (2018). Pedoman pelaksanaan intervensi penurunan stunting terintegrasi di kabupaten/ kota (Guidelines for implementing integrated stunting reduction interventions in districts / cities). November 2018 edition.
- Ni'mah K, Nadhiroh SR (2010). Faktor yang berhubungan dengan kejadian stunting pada balita (Factors associated with the incidence of stunting in infants). *Media Gizi Indonesia*, 10(1): 13–19.

- Nsereko E, Mukabutera A, Iyakaremye D, Umwungerimwiza YD, Mbarushimana V, Nzayirambaho M (2018). Early feeding practices and stunting in Rwandan children: A cross-sectional study from the 2010 Rwanda demographic and health survey. *Pan African Medical Journal*, 29: 1–7. <https://doi.org/10.11604/pamj.2018-29.157.10151>
- Rakhmahayu 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. <https://doi.org/10.26911/thejmc.2019.04.03.03>
- Shamah LT, Nasu LC, Moreno MH, Monterrubio FE, Avila AMA (2017). Maternal characteristics determine stunting in children of less than five years of age results from a National Probabilistic Survey. *Clinical Medicine: Pediatrics*. 43-52. <https://doi.org/10.4137%2FCMPed.S1019>.
- Utami AD, Indarto D, Dewi YLR (2017). The effect of nutrient intake and socioeconomic factor toward stunting incidence among primary school students in Surakarta. 2(1): 1–10.
- WHO (2013). Childhood stunting: Context, causes and consequences contextualising. *Complementary Feeding in a Broader Framework For Stunting Prevention*. *Maternal and Child Nutrition*, 9(2):27-45.
- Wolde M, Berhan Y, Chala A (2015). Determinants of underweight, stunting and wasting among schoolchildren. *BMC Public Health*, 15(1):1–9. <https://doi.org/10.1186/s12889-014-13372>.