Journal of Maternal and Child Health 4(3): 158-169
https://doi.org/10.26911/thejmch.2019.04.03.03

Logistic Regression Analysis on the Determinants of Stunting among Children Aged 6-24 Months in Purworejo Regency, Central Java

Atika Rakhmahayu[1)], Yulia Lanti Retno Dewi[2)], Bhisma Murti[1)]

[1)]Masters Program in Public Health, Universitas Sebelas Maret
[2)]Faculty of Medicine, Universitas Sebelas Maret

ABSTRACT

Background: Stunting is a representation of the state of chronic malnutrition in the first 1000 days of life that occurred in the world at an incidence of 22.2% in 2017. Stunting in children has impact on morbidity and mortality, resulting in a long-term decline socio-economic productivity of the community. The purpose of this study was to analyze the determinants of stunting in children aged 6-24 months in Purworejo, Central Java.
Subjects and Method: This was an analytic observational study with a case control design. It was conducted in 25 integrated community health posts (posyandu) in Purworejo, from October to December 2018. A sample 200 children under five was selected using by simple random sampling. The dependent variable was stunting. The independent variables were maternal mid-upper arm circumference (MUAC) at pregnancy, maternal education, paternal education, family income, family food allocation, infant birth weight, exclusive breastfeeding, complementary feeding (CF), posyandu strata, stunting monitoring at posyandu, and posyandu stunting intervention. The data was collected by questionnaire and analyzed by a multiple logistic regression.
Results: Maternal MUAC at pregnancy ≥23.5 cm (b= -1.56; 95% CI= 0.06 to 0.67; p = 0.009), high maternal education (b= -1.70; CI95% = 0.06 to 0.57; p = 0.003), high paternal education (b= -1.90; 95% CI= 0.05 to 0.51; p= 0.002), high family income (b= -1.85; 95% CI= 0.05 to 0.50; p = 0.002), family food allocation (b= -2.26; 95% CI= 0.03 to 0.37; p<0.001), birth weight ≥2,500 g (b= -1.39; 95% CI= 0.08 to 0.83; p= 0.024), exclusive breastfeeding (b = -2.04; 95% CI= 0.04 to 0.48; p= 0.002), and adequate complementary feeding (b= -1.61; 95% CI= 0.06 to 0.65; p= 0.007) reduced the risk of stunting in children aged 6-24 months.
Conclusions: Maternal MUAC at pregnancy ≥23.5 cm, high maternal education, high paternal education, high family income, family food allocation, birth weight ≥2,500 g, exclusive breastfeeding, and adequate complementary feeding reduce the risk of stunting in children aged 6-24 months.

Keywords: stunting, determinants, children aged 6-24 months

Correspondence:
Atika Rakhmahayu. Masters Program in Public Health, Universitas Sebelas Maret. Jl. Ir. Sutami No. 36 A, Surakarta, Indonesia. Email: tikarakhmahayu@gmail.com. Mobile: 083124386960.

BACKGROUND

Child growth is one of the benchmarks in efforts to monitor nutritional status in a population that provides an overview of the state of nutrition and food security in a country (Atsu et al, 2017). One of the factors that play a major role in child growth is nutrition in the first 1000 days of life where the growth of children has the most rapid increase and nutrition at this time will affect development in the future. One of the problems that arise due to chronic malnutrition in the first 1000 days of life is stunting. Stunting is a representation of the state of chronic malnutrition in particular protein energy malnutrition (Hossaine et al, 2017).

Stunting is the most common form of malnutrition in children in the world with a prevalence of 22.2% or 150.8 million children in 2017 (UNICEF, 2018). 90% of the highest prevalence of stunting is in countries in Sub-Saharan Africa and Asia (UNICEF, 2013; WHO, 2014). Indonesia ranks fifth as the highest stunting prevalence in the world with a percentage of 37.2% in 2010. The highest percentage of stunting cases in Indonesia is East Nusa Tenggara Province (51.7%), West Sulawesi (48.0%), and Nusa Tenggara West (45.3%). The high percentage of stunting was also obtained by Central Java Province with 33.9% consisting of 18.1% short and 6.7% very short (RI Ministry of Health, 2015). Purworejo is an area in Central Java with a prevalence of stunting 4,764 cases or 10.57% in 2017. The figure is indeed not the highest in Central Java but the percentage of stunting in Purworejo has always increased in the last three years, namely 9.56% in 2015 and 10.21% in 2016 (Health Office Purworejo, 2017).

Stunting has a long-term impact on individuals to society. Children with stunting have a greater risk of infection. The most common infection in children with stunting is respiratory and digestive infections. Stunting also results in a decrease in cognitive and behavioral abilities in children (Prendergast and Humphrey, 2014). Low cognitive ability due to stunted growth causes a sustained impact on socio-economic conditions, such as low levels of education, productivity, and income. Stunting children also have a 2.54 times greater risk of being overweight compared to children of normal height (Utami and Sisca, 2015). The long-term impact of stunting in women is the increased risk of giving birth to infants with low birth weight (LBW) specifically due to IUGR (Intra Uterine Growth Retardation). The high morbidity to maternal mortality also affects the increase in perinatal morbidity and mortality (Dhungana et al., 2017).

Stunting in children is multifactorial (Nkurunziza, 2017). One of the predictors of stunting is maternal factors. Pregnant women with MUAC <23.5 cm indicate a protein energy deficiency at risk of giving birth to LBW infants who if not treated properly have a greater potential for stunting. Mothers with low education risk 5.1 times more likely to have stunting children (Rahayu and Khairiyati, 2014). The level of maternal knowledge is known to have a significant relationship with the incidence of stunting (Rosha et al., 2012).

Child factors also become one of the main predictors of stunting. Children with a history of LBW have a risk of 5.87 times greater stunting (Rahayu et al., 2015). Male infants and infants who have a history of neonatal disease have a greater risk of stunting (Aryastami et al., 2017). Exclusive breastfeeding also has a significant effect on stunting. Children with exclusive breastfeeding have a higher body length/age or height/age Z-score higher than children with non-exclusive breastfeeding (Kuchenbecker et al., 2015). Complementary feeding has a significant relationship to the incidence of stunting, especially the history of starting complementary feeding. Children with early complementary feeding are at risk 2.8 times more likely to experience stunting. Proper administration of complementary feeding has an impact on low energy and nutrient intake which has an effect on increasing the incidence of stunting (Khasanah et al., 2016).

Family economic status has an influence on the incidence of stunting in children. The risk of stunting is 4.13 times greater in children from families with low economic status. Policies to reduce the prevalence of stunting in Indonesia must also consider the cleanliness of water, latrines and sanitation through a multisectoral approach. Government programs that support the target of reducing stunting prevalence are also needed to accelerate the achievement of these targets (Torlesse et al., 2016).

SUBJECTS AND METHOD

1. Study Design

This was an analytic observational study with a case control design. The study was conducted in 25 integrated health posts in Purworejo, Central Java, from October to December 2018.

2. Population and Samples

The target population of this study was children aged 6-24 months. A sample of 200 children aged 6-24 months was selected by simple random sampling.

3. Study Variables

The dependent variable was stunting. The independent variables were maternal MUAC at pregnancy, maternal education, paternal occupation, family income, family food allocation, infant birth weight, exclusive breastfeeding, and complementary.

4. Operational Definition of Variables

Stunting was defined as children nutritional status assessed based on the Z-score calculation which refers to the body length anthropometric data according to the age of children aged 0-24 months. The measuring instrument used is the length board or infantometer. The measurement scale was continous and transformed into dichotomous coded 0 for normal (z-score ≥-2 SD) and 1 for stunting (z-score <-2 SD).

Maternal MUAC at pregnancy was defined as size of maternal MUAC taken during the first examination of pregnancy. The data were measured by MUAC tape. The measurement scale was continous and transformed into dichotomous coded 0 for <23.5 cm and 1 for ≥23.5 cm.

Maternal education and paternal education were the last level of education attained by mother and father. The data were collected by questionnaire. The measurement scale was categorical, coded 0 for low <senior high school and 1 for ≥senior high school.

Family income was defined as the average of family income as an economic source received within the last six months. The data were collected by questionnaire. The measurement scale was continous and transformed into dichotomous coded 0 for <minimum regional wage and 1 for ≥minimum regional wage).

Family food allocation was defined as percentage of family expenditure used for food needs compared to total expenditure. The data were collected by questionnaire. The measurement scale was continous and transformed into dichotomous coded 0 for low (<60%) and 1 for high (≥60%).

Birth weight was defined as infants body weight measured within 24 hours after birth. The data were collected by maternal and child health book record. The measurement scale was continous and transformed into dichotomous coded 0 for <2,500 g and 1 for ≥2,500 g.

Exclusive breastfeeding was defined as the infant only received breast milk, no other liquids or solids are given (not even water) with the exception of oral rehydration solution, drops/syrups of vitamins, minerals or medicines from birth to six years old. The data were measured by questionnaire. The measurement scale was categorical coded 0 for non-exclusive breastfeeding and 1 for exclusive breastfeeding.

Complementary feeding was defined as the provision of food provided in addition to breast milk until a 2 year old child. The data were collected by questionnaire. The measurement scale was continous and transformed into dichotomous coded 0 for inadequate (score <mean) and 1 for adequate (≥mean).

5. Data Analysis

Sample characteristics were described by univariate analysis. Bivariate analysis used Chi square. Multivariate analysis used a multiple logistic regression.

6. Research Ethics

The research ethical clearance was obtained from the Research Ethics Committee at Faculty of Medicine, Universitas Sebelas Maret, Surakarta, Central Java, Indonesia, with number 359/UN.27.6/KEPK/2018. Research ethics included issues such as informed consent, anonymity, confidentiality, and ethical clearance.

RESULTS

1. Sample characteristics

Table 1 showed sample characteristics. Table 1 showed that mostly the children were male (56.5%). Most of the mother was working at home (87.0%). As many as 32.5% fathers were self-employed. As many as 72 children (36.0%) living in urban area.

2. Univariate Analysis

Table 2 showed that maternal MUAC at pregnancy ≥23.5 cm were 102 (51.0%). Mothers with high education level were 106 (53.0%). Fathers with low education level were 105 (52.5%). As many as 110 children (52.5%) were born from family with low income. As many as 102 families (51.0%) had low family food allocation. As many as 101 children (50.5%) had normal birth weigt. As many as 101 children (50.5%) received exclusive breastfeeding and 102 chidlren (51.0%) received adequate complementary feeding.

3. Bivariate analysis

Table 3 showed the results of bivariate analysis. Table 3 showed that Maternal MUAC ≥23.5 cm (OR= 0.18; 95% CI= 0.09 to 0.36; p<0.001), maternal education ≥senior high school (OR= 0.16; 95% CI= 0.08 to 0.32; p<0.001), paternal education ≥senior high school (OR= 0.12; 95% CI= 0.06 to 0.27; p<0.001), high family income (OR= 0.25; 95% CI= 0.13 to 0.51; p<0.001), normal birth weight (OR= 0.14; 95% CI= 0.07 to 0.30; p<0.001), exclusive breastfeeding (OR= 0.15; 95% CI= 0.07 to 0.31; p<0.001), and appropriate complementary feeding (OR= 0.16; 95% CI= 0.08 to 0.32; p<0.001) reduced the risk of stunting in children aged 6-24 months.

Table 1. Sample characteristics

Characteristics	n	%
Children Age		
6-12 month	76	38.0
13-18 month	62	31.0
19-24 month	62	31.0
Gender		
Female	86	43.0
Male	113	56.5
Maternal Occupation		
Housewife	174	87.0
Private Employee	10	5.0
Entrepreneur	11	5.5
Employee/labor	3	1.5
Etc	2	1.0
Paternal Occupation		
Private Employee	46	23.0
Civil Servant	10	5.0
Entrepreneur	65	32.5
Employee/Labor	55	27.5
Farmer	24	12.0
Residence		
Highlands	64	32.0
Urban	72	36.0
The coast	63	31.5

4. Multivariate Analysis

Table 4 showed the results of multiple logistic regression analysis. Table 4 showed that there was a significant effect of birth weight, exclusive breastfeeding, complementary feeding, maternal MUAC at pregnancy, maternal education, paternal occupation, family income, and family food allocation on the incidence of stunting in children aged 6-24 months.

Table 2. The results of univariate analysis

Variables		n	%
Stunting Status	Yes	57	28.5
	No	143	71.5
Maternal MUAC	<23.5 cm	98	49.0
	≥23.5 cm	102	51.0
Maternal Education	Low	94	47.0
	High	106	53.0
Paternal Education	Low	105	52.5
	High	95	47.5
Family Income	Low	110	55.0
	High	90	45.0
Family Food Allocation	Low	102	51.0
	High	98	49.0
Birth Weight	Low	99	49.5
	Normal	101	50.5
Exclusive Breastfeeding	No	101	50.5
	Yes	99	49.5
Complementary Feeding	Inadequate	98	49.0
	Adequate	102	51.0

Table 3. The results of bivariate analysis

Independent Variables	Not Stunting		Stunting		OR	CI 95%		p
	n	%	n	%		Lower Limit	Upper Limit	
Maternal MUAC								
<23.5 cm	54	55.1	44	16.5	0.18	0.09	0.36	<0.001
≥23.5 cm	89	87.3	13	12.7				
Maternal Education								
<Senior high school	50	53.2	44	46.8	0.16	0.08	0.32	<0.001
≥ Senior high school	93	87.7	13	12.3				
Paternal Education								
<Senior high school	57	54.3	48	45.7	0.12	0.06	0.27	<0.001
≥ Senior high school	86	90.5	9	9.5				
Family Income								
Low	66	60.0	44	40.0	0.25	0.13	0.51	<0.001
High	77	85.6	13	14.4				
Family Food Allocation								
Low	52	51.0	50	49.0	0.08	0.34	0.19	<0.001
High	91	92.9	7	7.1				
Birth Weight								
<2,500 g	53	53.5	46	46.5	0.14	0.07	0.30	<0.001
≥2,500 g	90	89.1	11	10.9				
Exclusive Breastfeeding	55	54.5	46	45.5	0.15	0.07	0.31	<0.001
No	88	88.9	11	11.1				
Yes								
Complementary Feeding								
Inadequate	53	54.1	45	45.9	0.16	0.08	0.32	<0.001
Adequate	90	88.2	12	11.8				

The risk of stunting was decreased by maternal MUAC at pregnancy ≥23.5 cm (b= -1.56; 95% CI= 0.06 to 0.67; p= 0.009), maternal education ≥senior high school (b= -1.70; 95% CI= 0.06 to 0.57; p= 0.003), paternal education ≥senior high school (b= -1.90; 95% CI= 0.05 to 0.51; p= 0.002), high family income (b= -1.85; 95% CI= 0.05 to 0.50; p= 0.002), high family food allocation (b=-2.26; 95% CI= 0.03 to 0.37; p <0.001), normal birth weight (b= -1.39; 95% CI= 0.08 to 0.83; p= 0.024), exclusive breastfeeding (b= -2.04; 95% CI= 0.04 to 0.48; p= 0.002), and adequate complementary feeding (b= -1.61; 95% CI= 0.06 to 0.65; p= 0.007).

Table 4. Multiple logistic regression analysis

Stunting	OR	95% CI		p
		Lower Limit	Upper Limit	
Maternal MUAC	-1.56	0.06	0.67	0.009
Maternal education	-1.70	0.06	0.57	0.003
Paternal education	-1.90	0.05	0.51	0.002
Family income	-1.85	0.05	0.50	0.002
Family food allocation	-2.26	0.03	0.37	<0.001
Birth weight (≥2,500 g)	-1.39	0.08	0.83	0.024
Exclusive breastfeeding	-2.04	0.04	0.48	0.002
Complementary feeding	-1.61	0.06	0.65	0.007
N observed = 200				
-2 Log likelihood = 90.55				
Nagelkerke R square = 0.75				

DISCUSSION

1. The effect of maternal MUAC on the incidence of stunting

The results of this study showed that there was an effect of maternal MUAC at pregnancy on the incidence of stunting among children aged 6-24 months. This study showed that children aged 6-24 months old who had mothers with MUAC <23.5 cm were more likely to experience stunting. This result was in line with a study by Sukmawati et al. (2018) which showed that there was a significant effect of maternal MUAC in early pregnancy on the incidence of stunting among children aged 6-24 months old.

Maternal MUAC at the beginning of pregnancy of <23.5 cm represented chronic energy deficiency (CED). It occurred due to an imbalance between the energy obtained with the energy released in the period of time. CED that occurs in pregnant women have an impact on inter-generation malnutrition in children so that fetal growth was not optimal (Sumarmi, 2016). The low supply of nutrients from the mother caused impaired placental function indicated by the small weight and size of the placenta. CED in pregnant women caused a decrease in blood flow to the placenta due to insufficient cardiac output. The reduced expansion of blood volume resulted in a decrease in the distribution of nutrients to the fetus so that fetal growth became hampered and affected the low birth weight of the baby (Rahayu and Khairiyati, 2014).

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

The result of analysis showed that there was an effect of maternal education on the incidence of stunting among children aged 6-24 months old. This study showed that children aged 6-24 months old who have mothers with low education were more likely to experience stunting. This result was supported by a study by Abuya et al. (2012) which stated that maternal education was one of the main predictors of stunting incident in children.

Low maternal education lead to the lack of access to information and knowledge so that awareness of nutritional needs and clean and healthy life behaviors cannot be applied maximally (Vollmer et al., 2017). Mothers with high leve of education have more mature considerations in making decisions, such as parenting, family planning, and better use of health facilities. The rate of early marriage and the birth of high-risk babies from mothers who were too young can indirectly be prevented because women would spend more time in school (Aldorman and Headey, 2017).

3. The effect of paternal education on the incidence of stunting

The result of analysis showed that there was an effect of fathers' education on the incidence of stunting among children aged 6-24 months old. This research showed that children aged 6-24 months old who have fathers with low education were more likely to experience stunting. This result was supported by a study done by Haile *et al.* (2016) which stated that stunting incident was low among children who have highly-educated fathers.

The father as the head of the household has a big influence on the sustainabilities of the household, one of them was parenting. Fathers with higher formal education have better knowledge and insight into nutritional needs and the application of hygiene. Father's education was also related to better access to family health facilities. Better income can also be obtained by the father with high level of education, this was related to the type of employment (Najnin *et al.*, 2018).

4. The effect of family income on the incidence of stunting

Based on the result of analysis, there was an effect of family income on the incidence of stunting among children aged 6-24 months old. This study showed that children aged 6-24 months old who have low family income were more likely to experience stunting. This result was supported by a study done by Rahayu *et al.* (2018) which stated that low income families were more likely to have children with stunting.

Families with low income were relatively only able to use limited health services. Low income affected the lack of purchasing power, which made it difficult to get adequate access to food. As a result, the quality, quantity, and variety of food consumed was low, especially foods for the growth of children such as sources of protein, vitamins and minerals (Kusumawati et al., 2015). Families with low economic levels also tend to allocate the income for other needs beside food, therefore, family nutrition was not fulfilled (Custodio *et al.,* 2010).

5. The effect of family food allocation on the incidence of stunting

The result of analysis showed that there was an effect of family food allocation on the incidence of stunting among children aged 6-24 months old. This research showed that children aged 6-24 months old who have low family food allocation were more likely to experience stunting. This result was supported by a study done by Masrin *et al.* (2014) which stated that there was an effect of food security on the incidence of stunting.

Food allocation was the basis of food distribution in the household. The high allocation of family food can increase family food security, both in quantity and quality, which has an impact on fulfilling optimal nutritional needs. Higher income to be allocated for food needs would provide adequate energy and protein, thereby reducing the risk of growth delay due to lack of access to food (Masrin *et al.*, 2014).

 e-ISSN: 2549-0257

6. The effect of birth weight on the incidence of stunting

The result of analysis showed that there was an effect of birth weight on the incidence of stunting among children aged 6-24 months old. This result was in line with a study done by Abera *et al*., (2018) which stated that children with low birth weight have higher risk to experience stunting.

Infant birth weight was related to long-term growth and development. LBW babies have a greater risk of disruption of development and growth (Ministry of Health, 2016). LBW was the most dominant risk factor associated with stunting in children. Children with a history of LBW were 5.87 times more likely to suffer from stunting. LBW infants have less anthropometric size so that it influenced the ability to grow and develop in the future (Rahayu et al., 2015). LBW along with inadequate nutritional intake, limited health services, and prone to infection would increase the risk of stunting due to stunted growth (Arifin *et al*., 2012).

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

Based on the result of analysis, there was an effect of exclusive breastfeeding on the incidence of stunting among children aged 6-24 months old. This result was supported by a study done by Uwiringiyimana *et al*. (2018) which stated that children with a history of exclusive breastfeeding were less likely to experience stunting.

Exclusive breastfeeding provided all the important nutrients that were useful in the growth and development of children in the first 6 months of life that can prevent stunting (Uwiringiyimana et al., 2018). Breast milk contained vitamins A, D, E, K, B12, and substances that helped in the absorption of calcium and basic minerals. Breast milk also contained growth hormones that increased the growth process in the infants digestive system and protect the babies against bacteria and viruses (Kismul *et al.,* 2018).

8. The effect of complementary feeding on the incidence of stunting

The result of analysis showed that there was an effect of complementary feeding on the incidence of stunting among children aged 6-24 months old. This research showed that children aged 6-24 months old who got inadequate complementary feeding were more likely to experience stunting. This result was supported by a study done by Uwiringiyimana *et al*. (2018) which stated that complementary food intake that was not optimal was one of the main factors in the incidence of stunting in children other than LBW, non-exclusive breastfeeding, and exposure to disease.

Complementary food has an important role in introducing new types of food to babies, fulfilling the nutritional needs of the baby's body which can no longer be supported by breast milk, and supporting the development of the child's immunological system for food and drink. The correct complementary food was given in adequate amount, time, texture, variety, method of administration, and the principle of hygiene. Impaired growth at the beginning of life was caused by chronic malnutrition since in the womb, the inproper time of giving the complementary food, complementary food which was not nutritionally adequate according to the baby's needs, and inaccurate pattern of complementary food according to age. Children who have received complementary food prematurely were 2.8 times more likely to have stunting than children who got complementary food in the right time (Khasanah et al., 2016). Poor complementary food intake resulted in an increase in the prevalence of stunting in children. This was due to an imbalance in regulating energy intake and output in the body (Sarma *et al.*, 2017).

This study concluded that stunting was influenced by maternal MUAC at the beginning of pregnancy, maternal education, father's occupation, family income, family food allocation, infant birth weight, exclusive breastfeeding, and complementary feeding.Maternal MUAC in early pregnancy of <23.5 cm, low maternal education, low father education, low family income, low family food allocation, low birth weight, non-exclusive breastfeeding, and inadequate complementary food intake increased the incidence of stunting in children aged 6- 24 months old.

REFERENCE

Abera L, Dejene T, Laelago T (2018). Magnitude of stunting and its determinants in children aged 6–59 months among rural residents of Damot Gale District; Southern Ethiopia. BMC Research Notes. 11(557): 1-6. doi: 10.-1186/s13104-018-3666-1.

Abuya BA, Ciera J, Murage EK (2012). Effect of mother's education on child's nutritional status in the slums of Nairobi. BMC Pediatr. 80. doi: 10.11-86/1471-2431-12-80.

Aldorman H, Headey DD (2017). How important is parental education for child nutrition?. World Development. 94: 448–64. https://doi.org/10.1016/j.-worlddev.2017.02.007.

Arifin DZ, Irdasari SY, Sukandar H (2012). Analisis sebaran dan faktor risiko stunting pada baduta di Kabupaten Purwakarta. Bandung: Universitas Padjajaran. http://pustaka.unpad.ac.-id/wp-content/uploads/2013/07/-pustaka_unpad_analisis_sebaran-_dan_faktor_risiko_stunting.pdf.

Aryastami NA, Shankar N, Kusumawardani B, Besral AB, Jahari, Achadi E (2017). Low birth weight was the most dominant predictor associated with Stunting among children aged 12–23 months. BMC Nutrition, 3(6): 1-6. Doi: https://doi.org/10.1186/s40795-017-0130-x.

Atsu BK, Guure C, Laar AK (2017). Determinants of overweight with concurrent stunting among Ghanaian children. BMC Pediatric 17:177. doi 10.11-86/s12887-017-0928-3.

Custodio E, Descalzo MA, Roche J, Molina L, Sanchez I, Lwanga M, Torres AM, Fernandez-Zincke E, Bernis C, Villamor E, Baylin A (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): 80–7. https://doi.org/10.1016/j.ehb.200-9.10.001.

Dhungana GP (2017). Nutritional status and the associated factors in under five years children of Lamjung, Gorkha and Tanahun Districts of Nepal. Nepalese Journal of Statistics 1(15-28): 17. Doi: https://doi.org/10.3126-/njs.v1i0.18814.

Dinas Kesehatan Kabupaten Purworejo (2016). Profil Kesehatan Kabupaten Purworejo. Purworejo: Pemerintah Kabupaten Purworejo. http://www.-depkes.go.id/resources/download /profil/PROFIL_KAB_KOTA_2015/ 3306_Jateng_Kab_Purworejo_2015. pdf.

Haile D, Azage M, Tegegn M, Rainey R (2016). Exploring spatial variations and factors associated with childhood stunting in Ethiopia: Spatial and multilevel analysis. BMC Pediatr. 16-49. doi: 10.1186/s12887-016-0587-9.

Hossain M, Choudhury M, Abdullah KAB, Mondal P, Jackson AA, Walson J, Ahmed T (2017). Evidence-based approaches to childhood stunting in low and middle income countries: A systematic review. Archives of Disease in Childhood. 102(10): 903-9 doi: 10.1136/archdischild-2016-311050.

Kementerian Kesehatan Republik Indonesia (2015). Stunting di Indonesia, masalah, dan solusinya. Jakarta: Badan Penelitian dan Pengembangan Kesehatan. http://pdgmi.org/wp-content/uploads/2016/08/Stunting-di-Indonesia-A5-rev-7.pdf.

Kementerian Kesehatan Republik Indonesia (2016). Situasi balita pendek. Jakarta: Pusat Data dan Informasi Kementerian Kesehatan RI. http://-www.depkes.go.id/resources/download/pusdatin/infodatin/situasi-balita-pendek-2016.pdf.

Khasanah DP, Hadi H, Paramashanti BA (2016). Waktu pemberian makanan pendamping ASI (MP-ASI) berhubungan dengan kejadian stunting anak usia 6-23 bulan di Kecamatan Sedayu. Jurnal Gizi Dan Dietetik Indonesia. 4(2): 105-11. Doi: http://-dx.doi.org/10.21927/ijnd.2016.4(2).105-111.

Kismul H, Acharya P, Mapatano MA, Hatloy A (2018). Determinants of childhood stunting in the Democratic Republic of Congo: Further Analysis of Demographic and Health Survey 2013–14. BMC Public Health. 18(74): 1-14. doi: 10.1186/s12889-017-4621-0.

Kuchenbecker J, Jordan I, Reinbott A, Herrmann J, Jeremias T, Kennedy G, Muehlhoff E, Mtimuni B, 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. doi: 10.1179/2046905514Y.0000000134.

Kusumawati W, Rahardjo S, Sari HP (2015). Model pengendalian faktor risiko stunting pada anak usia di bawah tiga tahun. Jurnal Kesehatan Masyarakat Nasional. 9(3): 249-56. https://media.neliti.com/media/publications/39896-ID-model-pengendalian-faktor-risiko-stunting-pada-anak-bawah-tiga-tahun.pdf.

Masrin, Paratmanitya Y, Aprilia V (2014). Ketahanan pangan rumah tangga berhubungan dengan stunting pada anak usia 6-23 bulan. Jurnal Gizi dan Dietetik Indonesia. 2(3): 103-15. https://-ejournal.almaata.ac.id/index.php/IJND/article/download/296/268.

Najnin N, Bennett CM, Luby SP (2011). Inequalities in care-seeking for febrile illness of under-five children in Urban Dhaka, Bangladesh. J Health Popul Nutr. 29(5): 523–31. http://www.ghspjournal.org/content/ghsp/1/3/local/complete-issue.pdf.

Nkurunziza S, Meessen B, Geetruyden JPV, Korachais C (2017). Determinants of stunting and severe stunting among Burundian children aged 6-23 months: Evidence from a National Cross-Sectional Household Survey, 2014. BMC Pediatr. doi: 10.1186/s12887-017-0929-2.

Prendergast AJ, Humphrey JH (2014). The stunting syndrome in developing countries. Paediatrics and International Child Health. 34(4): 257 doi: 10.1179/2046905514Y.00000000158.

Rahayu A, Khairiyati L (2014). Risiko pendidikan ibu terhadap kejadian stunting pada anak 6-23 bulan. Penel Gizi Makan. 37(2). http://ejournal.-litbang.depkes.go.id/index.php/pgm-/article/view/4016/3833.

Rahayu A, Yulidasari F, Putri AO, Rahman F (2015). Riwayat berat badan lahir dengan kejadian stunting pada anak usia bawah dua tahun. Jurnal Kesehatan Masyarakat Nasional. 10(2): 67-73. Doi: http://dx.doi.org/10.21109/kesmas.v10i2.882.

Rahayu RM, Pamungkasari EP, Wekadigunawan CSP (2018). The biopsychosocial determinants of stunting and wasting in children aged 12-48 months. Journal of Maternal and Child Health. 3(2): 105-18. https://doi.org/10.26911/thejmch.2018.03.02.03.

Rosha BC, Hardinsyah, Baliwati YF (2012). Analisis determinan stunting anak 0-23 bulan pada daerah miskin di Jawa Tengah dan Jawa Timur. Penel Gizi Makan, 35(1). http://ejournal.litbang.depkes.go.id/index.php/pgm/article/view/3081.

Sarma H, Khan JR, Asaduzzaman M, Uddin F, Tarannum S, Hasan M, Rahman AS, Ahmed T (2017). Factors influencing the prevalence of stunting among children aged below five years in Bangladesh. Food and Nutrition Bulletin. 38(3): 291-301. doi: 10.1177/0379572117710103.

Sukmawati, Hendrayati, Chaerunnimah, & Nurhumaira (2018). Status gizi ibu saat hamil, berat badan lahir bayi dengan stunting pada balita. Media Gizi Pangan. 25(1): 18-24. https://media.neliti.com/media/publications/265332-status-gizi-ibu-saat-hamil-berat-badan-l-8054 beb3.pdf.

Sumarmi MS (2016). Maternal short stature and neonatal stunting: an intergenerational cycle of malnutrition. International conference on health and well-being (ICHWB). 265-72. https://publikasiilmiah.ums.ac.id/bitstream/handle/11617/7411/32%20-%20Sri%20Sumarmi.pdf?sequence=1

Torlesse H, Cronin AA, Sebayang SK, Nandy R (2016). Determinants of stunting in Indonesian children: evidence from a cross-sectional survey indicate a prominent role for the water, sanitation, and hygiene sector in stunting reduction. BMC Public Health. doi: 10.1186/s12889-016-3339-8.

UNICEF (2018). Malnutrition rates remain alarming: stunting is declining too slowly while wasting still impacts the lives of far too many young children, https://data.unicef.org/topic/nutrition/malnutrition/.

UNICEF (2013). Improving child nutrition: the achievable imperative for global progress. United Nations Publications Sales. https://www.unicef.org/ gambia/Improving_Child_Nutrition_-the_achievable_imperative_for_-global_progress.pdf.

Utami NH, Sisca DKP (2015). Resiko terjadinya kegemukan pada anak usia 3-5 tahun dengan status gizi pendek di Indonesia. Jurnal Ekologi Kesehatan. 14(3): 273-83. https://media.neliti.com/media/publications/82080-ID-resiko-terjadinya-kegemukan-pada-anak-us.pdf.

Uwiringiyimana V, Ocke MC, Amer S, Veldkamp A (2018). Predictors of Stunting with Particular Focus on Complementary Feeding Practices: A Cross-Sectional Study in the Northern Province of Rwanda. Nutrition, 1-28. doi: 10.1016/j.nut.2018.07.016.

Vollmer S, Bommer C, Krishna A, Harttgen K, Subramanian SV (2017). The association of parental education with childhood undernutrition in low and middle income countries: comparing the role of paternal and maternal education. International Journal of

Epidemiology. 46(1): 312–23. doi: 10.1093/ije/dyw133.
WHO (2014). Nutrition landscape information system (NLIS) country profile indicators: Interpretation guide. https://www.who.int/nutrition/nlis_interpretationguide_isbn9789241599955/en/.