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DETERMINANTS OF STUNTING IN CHILDREN AGED 6-59 MONTHS IN GLAGAH SUB-DISTRICT, INDONESIA

Determinan Kejadian Stunting Pada Balita Usia 6-59 Bulan di Kecamatan Glagah, Indonesia

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ABSTRACT

Background: According to basic health research in Indonesia from 2018, the national prevalence of stunting among children under five is 30.80%. Half of the ten highest-priority villages for national stunting interventions in the Lamongan District are located in Glagah Sub-district. **Purpose:** This study aimed to identify the determinants of stunting in children aged 6 to 59 months in the Muslim population in the Glagah Sub-district, Lamongan District, 2019. **Methods:** The design of this study was an analytic observational case-control. The population was mothers with children aged 6 to 59 months in Glagah Sub-district. The samples comprised 44 cases and 88 controls. They were paired with matching variables, including gender and clean water sources. Cluster sampling techniques and probability proportional to the size sampling method were utilized to calculate the sample size for each cluster. Data collection was carried out using a modified research questionnaire. Research was carried out in June–July 2019. Bivariate analysis was performed with chi-square and independent *t*-tests at the significance level α= 0.05. **Results:** The factors found to be related to stunting were bodyweight at birth (*p*-value 0.01; eta^2 0.09), protein intake (*p*-value 0.01; eta^2 0.12), energy intake (*p*-value 0.01; eta^2 0.19), maternal height (*p*-value 0.01; eta^2 0,08), and parenting pattern (*p*-value 0.03; $OR_{permissive}$ 3.33, $OR_{moderate}$ 1.69). **Conclusion:** Determinants associated with stunting were bodyweight at birth, protein and energy intake, maternal height, and parenting pattern. Integrated Service Post officers can provide education and workshops on good parenting patterns to parents of toddlers.

ABSTRAK

Latar Belakang: *Berdasarkan hasil riset kesehatan dasar Indonesia tahun 2018, prevalensi stunting balita nasional sebesar 30,80%. 5 dari 10 desa prioritas intervensi stunting nasional di Kabupaten Lamongan tahun 2018 berada di Kecamatan Glagah.* ***Tujuan:*** *Penelitian ini bertujuan untuk mengetahui faktor yang berhubungan dengan kejadian stunting balita 6-59 bulan di Kecamatan Glagah, Kecamatan Lamongan, tahun 2019.* ***Metode:*** *Desain penelitian ini adalah case-control observasional analitik. Populasi adalah ibu dengan balita usia 6-59 bulan di Kecamatan Glagah. Sampel terdiri dari 44 kasus dan 88 kontrol dan dipasangkan dengan variabel matching yaitu jenis kelamin dan sumber air bersih. Pengambilan sampel menggunakan teknik cluster sampling dan probability proporsionate to size untuk menghitung besar sampel setiap klaster. Pengumpulan data dilakukan dengan kuesioner penelitian. Penelitian dilakukan pada Bulan Juni-Juli 2019. Analisis bivariat dilakukan dengan uji chi-square dan uji T independen pada taraf nilai signifikansi α = 0,05.* ***Hasil:*** *Faktor yang berhubungan dengan stunting adalah berat badan ketika lahir (p-value 0.01; eta^2 0,09), asupan protein (p-value 0.01; eta^2 0,13), asupan energi (p-value 0.01; eta^2 0,19), tinggi badan ibu (p-value 0.01; eta^2 0,08), and pola asuh orang tua (p-value 0.03; $OR_{permisif}$ 3,33, $OR_{moderat}$ 1,69).* ***Kesimpulan:*** *Determinan yang terkait dengan stunting adalah berat badan saat lahir, asupan protein dan energi, tinggi badan ibu, dan pola orang tua asuh. Petugas pos pelayanan terpadu dapat memberikan edukasi dan workshop mengenai pola parenting yang baik kepada para orang tua yang memiliki balita*

INTRODUCTION

Indonesia's projected demographic growth in 2030 should provide momentum to optimize the development of human resources, which must be prioritized from now on, however, rather than maximizing this momentum, Indonesia is also overshadowed by the threat of a lose generation due to the high prevalence of stunting among children under five years old, linked with chronic nutritional problems in the community; this has resulted in impaired cognitive and physical development. In the long run, stunting has an impact on psychomotor and cognitive disorders in later life. The prevalence of stunting in the Asian region in 2015 was 30.60%. Over the last fifteen years (2000–2015), the prevalence of stunting among children under the age of five in Indonesia continued to increase by 36% in 2000, 39% in 2007, and 40.20% in 2015 (Trihono et al., 2015). The latest results of the 2018 Indonesia basic health research (Riskesdas) stated that the percentage of stunting among children under five years old in Indonesia was 30.80%. The five years

and under age group exhibited a prevalence of 29.60% in 2017, which exceeded the prevalence in the two years and under age group at 20.10% (Ministry of Health RI, 2019). This result indicates that children under five are likely at greater risk than children under two.

In East Java Province, the prevalence of stunting in 2018 was 35%. Lamongan District is the district with the fourth highest prevalence of stunting in East Java, with a prevalence of 48.87%, and is classified as affected by chronic community nutrition problems (Ministry of Health RI, 2019). Based on the analysis of the poverty index and malnutrition in the village conducted by Ministry of National Development Planning & TNP2K (2018), there are five priority stunting intervention districts in Lamongan District; this same analysis also showed that five villages out of the 10 national top priority villages in Lamongan District are located in the Glagah Sub-district.

Stunting intervention is carried out with a sensitive and specific program approach to adjust for the highly diverse stunting risk factors. Interventions should ideally be carried out with a

plan based on local wisdom that is in turn based on research data; however, despite the vast number of toddler stunting studies that have been conducted in the past, these have not been sufficient to create a strong association and consistency criteria regarding risk factors for stunting events, moreover, despite being a district with stunting interventions that has attracted government attention, no stunting research has been conducted in Glagah Sub-district. A previous study found no association between hypertension during pregnancy and the incidence of stunting in children under five, while the WHO framework showed the opposite results with the same variables (Sumiaty, 2017; World Health Organization, 2017). Other interesting findings indicate a significant relationship between adherents of the Muslim religion and the incidence of stunting in children under five years old, which can be explained through the self-regulation of parents/caregivers (Atsu, Guure, & Laar, 2017). As a country with a Muslim-majority population, self-regulation will be influenced by parents' religious values, including in terms of childcare (Padjrin, 2016). In addition, religious differences also have an impact on differences in food behaviors and parenting paradigms. Therefore, this study aims to identify the determinants of stunting in children aged 6 to 59 months in the Muslim population in the Glagah Sub-district, Lamongan District, East Java Province, Indonesia.

METHODS

A quantitative analytical approach was implemented using a paired matched case-control study design with a ratio of 1:2 between cases and controls. Comparisons were drawn to anticipate confounding factors between population groups and increase the causality of the resulting relationship. Matching was carried out based on gender and clean water source variables in the case and control groups to reduce exposure bias; in other words, control group characteristics will be adjusted with reference to case group characteristics. The type of clean water source was assessed by the researcher before respondents filled out the questionnaire and without laboratory testing. In addition, the availability of clean water sources was found to have a significant relation with stunting in other studies (Beal, Tumilowicz, Sutrisna, Izwardy, & Neufeld, 2018).

Case and control samples were selected based on the following inclusion criteria, which are parents of children who were willing to become research respondents, had children aged 6 to 59 months, used gas/electric fire stoves, and are Muslim. The inclusion criteria for the control sample were added by adjusting the matching variables to the case sample (gender and clean water source). Children who died or moved outside the area will be excluded from each sample. The use of gas/electric fire stoves is controlled to equalize the possibility of exposure to smoke, which can cause Acute Respiratory Infections (ARI) or other infectious diseases. Moreover, the Muslim population is chosen to anticipate differences in beliefs so that the variation in Islamic parenting measured has the same belief.

Large sample calculations use the Lemeshow formula with values α=5%, 1-β (power)=80%, estimated effect design (Deff)=1.50, and estimated drop out of 10%. Power=80% was chosen to improve previous research, such as research on hypertension assessment, which has a power=44.12% (Sumiaty, 2017). The case sample was 44 children selected via purposive sampling. The control sample was 88 sample children who were randomly selected via an online website. The sampling frame was drawn from the data of children under five in the Integrated Service Post in each selected village. Sampling was conducted using a cluster sampling technique purposively in five out of 29 villages with the highest incidence of stunting in the Glagah Sub-district. As for the large sample in each cluster, this was calculated using the Probability Proportionate to Size (PPS) technique, adjusting to the number of children under five in the selected villages.

The study was conducted in Glagah Sub-district from June to July 2019. The case population was mothers with children who had anthropometric index values of Height-for-Age Z-score (HAZ) less than –2 who attended elementary school and lived in Glagah Sub-district, Lamongan, from June to July 2019. The control population was mothers with children under five who had the anthropometric index value HAZ ≥ –2, attended elementary school, and lived in Glagah Sub-district, Lamongan, in the same period. HAZ scores were obtained from the WHO ANTRO application using data from the measurement of the children's height (World Health Organization, 2017).

The characteristics of the respondents were retrieved using a structured interview method with a questionnaire that had been previously validated by researchers in populations with similar socio-demographic characteristics in other villages not

included in the sampling frame. The height of toddlers who can stand upright and their mothers were measured with a microtoise with a precision of 1 mm, while a length board was used to measure the heights of toddlers who cannot stand upright with the same accuracy. The HAZ value is obtained from software WHO Anthro calculation results. Energy and protein intake was assessed from the Semi-Quantitative-Food Frequency Questionnaires (SQ-FFQ), which were processed with the Indonesian NutriSurvey software. Moreover, the level of maternal nutritional knowledge assesses nutritional content and its benefits and impacts. This is divided into three categories according to percentile value: low for ≤ 55 percentile values, moderate for 56–75 percentile values, and high for values > 75 percentile (Muhammad, 2015).

Pregnancy hypertension is a combination of systolic blood pressure and diastole in the third trimester, which is classified into hypertension, prehypertension, and normal. Parental care pattern score was transformed into percentile values and then categorized into three groups: Permissive (value ≤ 33.30 percentile), Authoritarian (33.30 percentile < value ≤ 66.67 percentile), and Democratic (value > 66.67 percentile). The sequence was adjusted to the procedures for nurturing according to Islam, which suggests maintaining a balanced interaction to educate children by providing nutritional intake and daily activities (Padjrin, 2016). Socioeconomic status was indicated by income per capita per month, adjusted for poverty indicators in Indonesia. History of infection was determined based on symptoms experienced by toddlers in the last three months, including symptoms of diarrhea, dengue, TB in children, malaria, and acute tract infection (Dodos et al., 2018). Toddlers' weight at birth was obtained from the observations of the Maternal and Child Health (MCH) book. At the same time, exclusive breastfeeding was determined based on the duration of breastfeeding and the absence of other food intakes.

Bivariate data analysis was calculated using statistical computer software. A chi-square test was performed on categorical data and produced p-values and Odds Ratio (OR). An independent *t*-test and Kruskal Wallis test for non-parametric values were carried out on numeric-categorical data and produced *p*-values. Additional analysis was performed to determine the value of eta-squared on numeric-categorical data with a significant relationship in order to assess the magnitude of the contribution of the independent variable. Informed consent was included in the research questionnaire to ensure mothers were voluntarily acting as research respondents. Moreover, ethics approval was provided by the Ethics Commission of the Faculty of Health Sciences of UIN Syarif Hidayatullah, Jakarta, in May 2019 (number Un.01/F10/KP.01.1/KE.SP/05.06.024/2019).

RESULTS

As Table 1 shows, 31.80% of the participants from the case group and 30.70% of the participants from the control group came from Glagah village. The majority of children in the case group were aged 13 to 36 months (50.00%), while those in the control group were aged 37 to 59 months (42.00%). The majority of clean water sources were from groundwater through dug wells (56.80%). The average age of mothers in the case group was 31.23 years (*SD* 5.37 years), while those in the control group were aged 31.05 years on average (*SD* 5.41 years).

Table 2 further shows that the majority of the control group (70.50%) and case group (76.10%) were breastfeeding exclusively. Within three months, the majority of control group (68.20%) and case group (54.50%) had no history of infection. Among as many as 79.50% of the mothers of children under five from the case group had good knowledge about nutritional knowledge for their children, while this figure was 80.70% among the control group. Meanwhile, 6.80% of mothers in the case group and 4.50% of those in the control group had a history of pregnancy hypertension. In the case group, the most prevalent tendency was permissive parenting (56.80%), while mothers in the control group most commonly exhibited democratic parenting (36.40%).

Bivariate analysis showed no significant relationship between stunting with exclusive breastfeeding (*p*-value 0.62), infection history (*p*-value 0.18), maternal nutritional knowledge (*p*-value 0.53), and pregnancy hypertension (*p*-value 0.37). There is a significant relationship between parenting pattern, with the incidence of stunting children (*p*-value 0.03) (Table 2).

On the parenting variable, the $OR_{permissive}$ values obtained were 3.33 (95% CI 1.30 to 8.52), indicating that permissive parenting can increase the chance of stunting by 233%, moreover, the $OR_{authoritarian}$ value of 1.69 (95% CI 0.59 to 4.82) suggests that authoritarian parenting can increase

the chance of stunting in children by 69% (Table 2).

The average body weight of infants at birth was 3175.30 gr; in the case group, this value was 2988.41 gr, while the figure for the control group was 3268.75 gr. There is a relationship between children's weight at birth and the incidence of stunting (*p*-value 0.01). The eta-squared birth weight value of 0.09 means that birth weight contributes 9.00% to the incidence of stunting in children under five years of age. The average maternal height was 155.64 cm. The average height of the mothers in the case group was 152.95 cm; this figure was 156.98 cm in the control group. A significant relationship exists between maternal height and the incidence of stunting among children under five years of age (*p*-value 0.01). An eta-squared value of 0.08 indicates that maternal height explains an 8.00% incidence of stunting in children under five years old (Table 2).

DISCUSSION

Our findings indicate that birth weight below the normal average (> 2500 grams) is relevant to the performance of village midwives in optimal pregnancy delivery services. A previous study employing a categorical measurement scale reveals a significant relationship (Savanur &

Ghugre, 2016; Xie et al., 2016). The results of statistical calculations show that a 9.0% incidence of stunting in children can be explained by birth weight. Low birth weight (LBW) is closely related to infant mortality and morbidity, growth inhibition, reduced cognitive development, and chronic disease in adulthood. The risk of stunting will be smaller in children with LBW who receive adequate nutritional therapy and protection from infection compared to children of normal birth weight who do not receive a balanced and susceptible nutritional intake, adjusted for gender variation (Kismul, Acharya, Mapatano, & Hatløy, 2017). In addition, interventions that take place over a long timeframe have a special focus on stunting (Rabaoarisoa et al., 2017).

A significant relationship exists between both energy and protein intake and the incidence of stunting in children under five years of age. The protein intake results are relevant to some previous studies (E. M. Sari, Juffrie, Nurani, & Sitaresmi, 2016). The same relevance is also found in the results for energy intake (Danaei et al., 2016; Tessema et al., 2018). Based on the eta-squared value, our findings indicate that energy intake (18.90%) can explain more about the incidence of stunting in children under five compared to protein intake (12.30%) (Himaz, 2018; Latif & Istiqomah, 2017).

Table 1
Characteristic Frequency Distribution for Children in Study Population

Variables	Stunting		Control		Total		p-values
	n	%	n	%	n	%	
Village							0,81
Glagah	14	31.80	27	30.70	41	31.10	
Jatirenggo	11	25.00	18	20.50	29	22.00	
Karangturi	6	13.60	16	18.20	22	16.70	
Konang	2	4.50	8	9.10	10	7.60	
Wonorejo	11	25.00	19	21.60	30	22.70	
Age (month)							0,08
7 to 12	2	4.50	12	13.60	14	10.60	
13 to 36	22	50.00	37	42.00	59	44.70	
37 to 59	20	45.50	39	44.30	59	44.70	
Sex							Mathced
Male	22	50.00	44	50.00	66	50.00	variable
Female	22	50.00	44	50.00	66	50.00	
Clean water source							Matched
Local waterwork	1	2.30	2	2.30	3	2.30	variable
Dug wells	25	56.80	50	56.80	75	56.80	
Artesian wells	16	36.40	32	36.40	48	36.40	
Others	2	4.50	4	4.50	6	4.50	
Mother's age (mean±SD)	31.61±5.33		31.05±5.41		31.23±5.37		0.43
Total	44	33.33	88	66.67	132	100.00	

Table 2
Distribution of the Proportion of Categorical Variables and Bivariate Analysis

Variables	Stunting		Control		Total		*p*-value	OR (95% CI)
	n	%	n	%	N	%		
Breastfeeding								
Non-exclusive	13	29.50	21	23.90	34	25.80	0.62	1.33 (0.59 – 3.01)
Exclusive	31	70.50	67	76.10	98	74.20		Reference
Infection History								
Yes	20	45.50	28	31.80	48	36.40	0.18	1.79 (0.85 – 3.76)
No	24	54.50	60	68.20	84	63.60		Reference
Mother's nutritional knowledge								
Low	4	9.10	4	4.50	8	6.10	0.53	2.03 (0.48 – 8.59)
Moderate	5	11.40	13	14.80	18	13.60		0.78 (0.26 - 2.36)
High	35	79.50	71	80.70	106	80.30		Reference
Gestational hypertension								
Hypertension	3	6.80	4	4.50	7	5.30	0.37	1.67 (0.35 - 7.86)
Prehypertension	6	13.60	6	6.80	12	9.10		2.23 (0.67 - 7.40)
Normal	35	79.50	78	88.60	113	85.60		Reference
Parenting								
Permissive	25	56.80	30	34.10	55	41.70	0.03*	3.33 (1.30 - 8.52)
Authoritarian	11	25.00	26	29.50	37	28.00		1.69 (0.59 - 4.82)
Democratic	8	18.20	32	36.40	40	30.30		Reference
Birth Weight (mean±SD)	2988.4±393.6		3268.7±440.2		3175.3±444.0		0.01[a]	0.09[b]
Maternal Height (mean±SD)	152.95±6.9		156.98±6.4		155.64±6.8		0.01[a]	0.08[b]
Income Per Capita (mean±SD)	469.3±349.4		506.0±346.5		493.8±246.6		0.26	-
Energy Intake (mean±SD)	71.51±24.0		101.23±31.5		91.32±32.3		0.00[a]	0.19[b]
Protein Intake (mean±SD)	114.22±47.4		157.40±57.89		143.00±58.1		0.00[a]	0.12[b]
Total	44	33.33	88	66.67	132	100.00		

[a] significant at value α 0.05; [b] values eta-squared on a significant variable

Protein and energy are two macronutrients that play a major role in the growth and development of toddlers. During infancy, adequate protein and energy intake must be provided longitudinally and continuously. This is because of the bone growth mechanism that gradually adjusts to the age of the children, moreover, it also works to prevent acute nutritional deficiencies. New stunting will occur when protein and energy deficiency occurs over a long period, meaning that bone metabolism slows down due to the lack of ingredients and nutrients over this time. The findings in this study suggest that both the case and control groups have a protein intake value above 80% RDA. This therefore indicates that in addition to the quantity of external intake, the toddler's internal digestive processes and also and sex both play a role in the absorption of nutrients into the body (Himaz, 2018; Latif & Istiqomah, 2017). This also answers why energy intake contributes more than protein intake in this study.

Our findings regarding the prevalence of a history of pregnancy hypertension are higher than the national prevalence (Ministry of Health RI, 2019), however, there was no significant relationship found between pregnancy hypertension and stunting in children under five years of age. These findings are relevant to several previous studies (Sumiaty, 2017; Xie et al., 2016). The results also differ from another study in a different country (Reid et al., 2018). The findings do not follow the WHO's stunting framework (World Health Organization, 2017). This has occurred due to differences in measurement time (trimester) and the operational definition of the research. Pregnancy hypertension affects the

physiology of the activity of renin-angiotensin-aldosterone, which can decrease blood plasma volume (de Haas, Ghossein-Doha, van Kuijk, van Drongelen, & Spaanderman, 2017; N. K. Sari, Rahayujati, & Hakimi, 2018). In the long term, it can cause preeclampsia, LBW, and other child developmental disorders (Reid et al., 2018).

Maternal height is significantly related to stunting in children under five years of age, with an 8.00% incidence of stunting in children within this age group being explained by maternal height. The results of previous research indicate the importance of this relationship (Xie et al., 2016). The genetic role of bone growth with socio-economic and environmental characteristics influences the amount of contribution to growth. The contribution of the father and mother to the growth of child height in Indonesia is 50:50; thus, the height of the mother is considered sufficient to represent the growth of the child (Marouli et al., 2017).

Parenting style is significantly related to stunting in children under five years of age, as has been stated in a previous study (Handayani, 2017). Most studies assess parenting style with operational definitions that include breastfeeding or complementary feeding. This differs from the operational definition of parenting used in the present study. This study instead focuses on the testable hypotheses, which are perception, parenting attitudes, and feeding patterns, with an approach that involves emotional, social, and physical aspects. On the other hand, the age difference of respondents may be another potential cause for the different results observed in this study. The older the child, the greater its independence, meaning that dependence on care (specifically parental care) will subsequently decrease. On the other hand, parents continue to provide the same pattern of care. This independence causes the child to carry out activities broadly or nutritional fulfillment activities specifically in an independent manner, with or without parental care (Primasari & Anna Keliat, 2020).

The permissive parenting pattern is an indirect factor that causes stunting in children under the age of five. Our findings showed that a permissive parenting pattern could increase the probability of children under five experiencing stunting by 233%. This is relevant to the framework of sensitive nutrition programs established by the government, where parenting is the focus of the intervention (Ministry of National Development Planning & TNP2K, 2018).

Democratic parenting has the most optimal developmental effects on children in terms of stunting prevention. Islam advocates caring for children with compassion and attention, while also inviting them to actively understand and be grateful to God for the creation of the universe and religious favors. This advice is primarily to be carried out by a mother according to one of the hadiths, which says that the mother provides a child with their first opportunity to study; this means that the mother is the person who is closest to the child and has the greatest role in raising or educating the child, such that parenting determines how the child will develop. Islam, as a religion that offers steps to educate children, specifically a family-based solution that operates according to the instructions of the Qur'an and al-Hadith. Qur'an Surah Al-Maryam verses 12 to 13 also explain the importance of the relationship of love between parents and children as a form of *taqwa* (piety, or fear of God) to Allah SWT (Padjrin, 2016).

Research Limitations

The key limitation of this study is the cluster selection, which uses purposive sampling. Risk factors that have a significant relationship to stunting in children under five years of age can differ in clusters with a low prevalence of stunting. Moreover, sources of historical infectious disease data that are based solely on maternal symptoms and memory recall reduce the validity of variables when it comes to describing the real situation.

CONCLUSION

Determinants significantly associated with stunting in children aged 6 to 59 months in Glagah Sub-district were body weight at birth, protein intake, energy intake, maternal height, and parenting patterns (permissive and authoritarian). Exclusive breastfeeding, history of infection, pregnancy hypertension, maternal nutrition knowledge, and socioeconomic family status were not significantly related to the incidence of stunting among children aged 6 to 59 months in the Glagah Sub-district. Through empowering family welfare and integration of health worker volunteering, the village government can carry out education and mentoring regarding ideal family parenting. Moreover, health center staff can organize workshops and nutrition education about healthy food for toddlers by maximizing the potential of local food.

CONFLICT OF INTEREST

No conflict of interest

AUTHOR CONTRIBUTIONS

MTAA contribute in conceptualization and protocol development, collecting data, data analysis, writing, and approval of the manuscript. FA contribute in conceptualization and protocol development and approval of the manuscript.

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