Poltekita: Jurnal Ilmu Kesehatan
http://jurnal.poltekkespalu.ac.id/index.php/JIK

Vol.16 No.4 February 2023: Hal. 553-563
p-ISSN: 1907-459X e-ISSN: 2527-7170

Original Article

Prevalence and Determinants Stunting Among Children Under Two Years in Indonesian District

Fahmi Hafid[1]*, Ansar[2], Nasrul[3], Kadar Ramadhan[4], Ardiansyah[5]

[1] Department of Nutrition, Poltekkes Kemenkes Palu, Indonesia
[2]Center for Stunting Studies, STBM and Disaster Health, Poltekkes Kemenkes Palu, Palu, Indonesia
[3]Department of Nursing, Poltekkes Kemenkes Palu, Palu, Indonesia
[4]Department of Midwifery, Poltekkes Kemenkes Palu, Indonesia
[5]Health Office of Tojo Una-una District, Indonesia

(Correspondence author's email, hafid.fahmi79@gmail.com / +62 852-5553-0999)

ABSTRACT

The study aims to analyze the prevalence and determinants of stunting in children under two years of age in Tojo Una-Una District, Indonesia as focus location of stunting. The method is Cross-sectional study design, the sample of 300 children aged 0-23 months, stratified random sampling technique. Data collection in June-July 2022. Stunting data was obtained by measuring body length using the length measuring board. The WHO-Antro 2005 software was used to determine the Z-Score height per age. Univariate, bivariate, and multivariate analyzes used SPSS version 22.00. The Results of this research show that 33.7% of children under the age of two are stunted. Stunting in children under the age of two is associated with child age, birth weight, and food insecurity. In addition to a history of low birth weight (AOR=2.7, 95% CI: 1.2-5.7) and experiencing food insecurity (AOR=1.9, 95% CI: 1.1-3.5), children aged 12-23 months (AOR=3.5, 95% CI: 1.7-7.2) have a higher tendency to experience stunting than those who are not. The Conclusion is the prevalence of stunting which is more than 20 percent is a priority health problem that must be resolved by 2024. Interventions to reduce stunting by reducing the incidence of low birth weight, reducing food insecurity, managing birth spacing > 3 years, number of children less than 3, and breastfeeding.

Keywords : Stunting, Low Birth Weight, Food Insecurity, Malnutrition, Child Health.

https://doi.org/10.33860/jik.v16i4.2246

INTRODUCTION

Stunting is defined as an anthropometric measure of a child's height for age (HAZ) with a Z-score <-2 Standard Deviation from World Health Organization (WHO) standard [1]. Stunting is a diagnostic category in assessing a child's nutritional status that was introduced in 1973 by J. C. Waterlow. Stunting usually appears early in life, is a long-term linear growth obstacle, and is difficult to recover for further growth [2]. According to UNICEF/WHO and the World Bank [1] there are approximately 149 million stunted children worldwide, accounting for 22% of all children. The proportion of stunted children is concentrated in low-income (34.6%) and lower-middle-income (29.1%) countries. In 2020, more than half of all stunted children under the age of five lived in Asia, with Southeast Asia having the highest stunting prevalence (27.4%) [1].

Malnutrition, including stunting, is prevalent in Indonesia [3]. According to Ministry of Health data, the prevalence of stunting in children aged five and under remains high, at 30.8%[4]. Meanwhile, the Indonesian government hopes to reduce stunting to 14% by 2024 [5]. According to the World Bank (2020), Indonesia has done less well than upper middle-income countries and other countries in the region in terms of reducing stunting rates [6]. Stunting prevalence varies by region in Indonesia, with provinces in eastern Indonesia having a higher prevalence of stunting than other regions [4,7]. Central Sulawesi is one of the top ten provinces in Indonesia with the highest prevalence (28.2%), with Tojo Una-una district ranking fifth out of 14 districts [8]. In 2023, Tojo Una-una Regency will be the focus location (locus) for integrated stunting reduction interventions [9].

Stunting has serious consequences for children's physical and cognitive development, resulting in long-term health and well-being issues. Stunted children are more vulnerable to infectious diseases, and their cognitive development may be hampered, resulting in poor educational performance and lower productivity in adulthood [10,11]. Understanding the factors that contribute to stunting is essential for developing effective interventions to prevent and reduce stunting in children.

The most recent research from Rwanda, Gambia, Ethiopia, India, Uganda [12–16], and Indonesia [17,18] indicates that the causes of child stunting vary and are multifactorial. Stunting determinants include low birth weight [18–23], food insecurity [19,23–27], birth spacing [7,28–30], child age [31–34] number of children [35–38], and the inability to breastfeed exclusively [39–42]. Stunting increased significantly in children living in households with three or more children under five years of age, households with 5-7 household members, children whose mothers attended less than four antenatal care services during pregnancy, males, 12–23 months old, and low birth weight [43]. Non-exclusive breastfeeding for the first 6 months, low household socioeconomic status, premature birth, short birth, low maternal height, low education, poor latrines, untreated drinking water, poor access to health care, and living in rural areas are all determinants of stunting in Indonesia [44,45]. A study in Central Sulawesi discovered that low birth weight, poor hand-washing practices, and a lack of a latrine were risk factors for stunting [46–48].

Despite the high prevalence of stunting in Tojo Una-Una district, limited research has been conducted on the determinants of stunting among children under two years of age. Therefore, this study aims to determine the prevalence of stunting and identify its determinants among children under two years of age in Tojo Una-Una district.

METHOD

This is a cross-sectional analytic study. Tojo Una-una District is the site of the research. As a stunting locus, there are 23 village areas spread across 9 sub-districts. There are three sub-districts on the mainland and six on the islands. Approximately thirteen to fourteen children under the age of two represent each village. The stratified random sampling technique was used to select the candidates. Nutrition workers who had received 5-day training collected measurement data.

The locus of stunting in a sample of 300 children aged 0-23 months. Data collected from the mothers of the study sample. The Data Technical Person in Charge checked the data for completeness and correctness.

The dependent variable is children's nutritional status, which is classified into two categories: normal and stunting. This category is based on the results of calculating the z-score for HAZ (< -2 SD categorized as stunting) using the WHO-Antro 2005 software. The independent variables are divided into mother and child factors.

Mother factors: the mother's age, mother’s education, type of delivery, drinking water source, family latrine ownership, ownership index, breastfeeding, breastmilk, food insecurity, number of children, delivery distance, residence, utilization of health facilities, smoking family.

Child factors: child's gender, child's age in months, early breastfeeding initiation, birth length, low birth weight, supplementary feeding, receive growth stimulation, illness history, history of Acute Respiratory Illness (ARI), history of diarrhea, history of pulmonary tuberculosis, history of measles, history of intestinal worms, child condition during the study.

Stunting data was obtained by measuring body length using the Length Measuring Board (LMB) and measuring age by

reading the birth certificate or the Maternal Child Handbook (MCH) of the respondent's child. Other data were obtained by filling out the cobocollect questionnaire.

Data were analyzed in 3 stages. The first is univariate analysis to describe the frequency distribution of each variable. Second, bivariate analysis between the dependent variable and the independent variable to calculate the adjusted odds ratio (AOR), namely the relative risk between the stunting group and the normal group with a significant chi-square test p<0.05. The third multivariate analyzes used the backward logistic regression method. All analyzes were performed using SPSS 22.00 software (IBM Corp, Armonk, NY, USA) with a 95% confidence interval (CI) and a significance p-value ≤ 0.05.

Study ethical eligibility was obtained from the Ethics Commission of the Poltekkes, Ministry of Health, Palu Number 0010/KEPK-KPK/IV/2022.

RESULTS

According to our findings (table 1), the prevalence of stunting in toddlers in the Tojo Una-una District stunting locus area is 33.7%. where it was discovered that the characteristics of the mothers of stunted children were mostly aged 20 years or more (34.5%), had an education period of less than 9 years (35.0%), gave birth to their children normally (33.8%), did not breastfeed their children (40.1%), having more than 3 children (41.8%), and having a distance of 3 years or less (42.6%) their children had a higher incidence of stunting. Mothers who use improved drinking water sources (34.5%), own family latrines (34.2%), have a middle down ownership index (37.0%), have food insecurity (44.4%), live on islands (35.4%), and do not smoke (40%) have a higher incidence of stunting in their children.

In our findings also found that food diversity in children under two years of age in the stunting locus is still less diverse, with children under two years of age consuming animal protein sources only 32.0% and vegetable protein sources only 9.3%. Drinking milk other than breast milk was 23.0%, consuming vegetables as sources of vitamin A only 8.3%, dark green vegetables only 19. 3%. Intake of fruit sources of vitamin A only 3.0%, but children under two years of age who had consumed snacks such as crackers or cheese balls were as much as 9.7%.

The most stunted children were aged 12-23 months (42.3%), initiated early breastfeeding (35.0%), born less than 48 cm (37.3%), born with low birth weight (47.2%), given supplementary feeding (39.7%), receiving growth stimulation (37.8%), having a history of illness (33.9%), both history of ARI, diarrhea, lung tuberculosis, and intestinal worms, and children who were in mild pain (41.9%). According to the bivariate analysis from statistical chi-square test showed a relation between stunting in children under two years with breastfeeding (p=0.020), food insecurity (p=0.42), and child's age (p=0.001) (table 1).

Table 1. Respondent characteristics and cross tabulation with stunting prevalence

Variable	Nutritional Status				p-value
	Stunting		Normal		
	n (101)	%	n (199)	%	
Mother's characteristics					
Mother's age (year)					
<20	12	28.6	30	71.4	0.451
≥20	89	34.5	169	65.5	
Mother's education					
<9 years	72	35.0	134	65.0	0.486
≥9 years	29	30.9	65	69.1	
Type of delivery					
Normal	93	33.8	182	66.2	0.854
Sectio Secarea	8	32.0	17	68.0	
Breast milk					
Not exclusive	68	33.0	138	67.0	0.863
Exclusive	31	33.0	63	67.0	
Breastfeeding					
No	59	40.1	88	59.9	0.020*
Yes	42	27.5	111	72.5	

Number of children					
>3 children	23	41.8	32	58.2	0.157
≤3 children	78	31.8	167	68.2	
Delivery Distance					
≤3 years	29	42.6	39	57.4	0.075
>3 years	72	31.0	160	69.0	
Utilization of health facilities					
No	12	33.3	24	66.7	0.964
Yes	89	33.7	175	66.3	
Drinking water Source					
Not Improved	5	22.7	17	77.3	0.259
Improved	96	34.5	182	65.5	
Family Latrine Ownership					
No	32	32.7	66	67.3	0.796
Yes	69	34.2	133	65.8	
Ownership index					
Middle down	57	37.0	97	63.0	0.208
Middle to above	44	30.1	102	69.9	
Food insecurity					
Yes	28	44.4	35	55.6	0.042*
No	73	30.8	164	69.2	
Residence					
Island	80	35.4	146	64.6	0.267
Non-island	21	28.4	53	71.6	
Smoking family					
No	8	40.0	12	60.0	0.535
Yes	93	33.2	187	66.8	
Child's characteristics					
Child age (month)					
0-6	18	27.3	48	72.7	0.001**
7-11	12	18.2	54	81.8	
12-23	71	42.3	97	57.7	
Early Breastfeeding Initiation					
No	43	30.7	97	69.3	0.599
Yes	56	35.0	104	65.0	
Birth Length					
<48 cm	28	37.3	47	62.7	0.438
≥48 cm	73	32.4	152	67.6	
Low birth weight					
Yes	17	47.2	19	52.8	0.067
No	84	31.8	180	68.2	
Supplementary feeding					
No	53	29.6	126	70.4	0.070
Yes	48	39.7	73	60.3	
Receive growth stimulation					
No	39	28.7	97	71.3	0.096
Yes	62	37.8	102	62.2	
Illness history					
No	14	32.6	29	67.4	0.868
Yes	87	33.9	170	66.1	
History of ARI					
No	60	30.9	134	69.1	0.174
Yes	41	38.7	65	61.3	
History of diarrhea					
No	92	33.5	183	66.5	0.797
Yes	9	36.0	16	64.0	
History of pulmonary tuberculosis					
No	100	33.6	198	66.4	0.642
Yes	1	50.0	1	50.0	

History of measles					
No	87	33.7	171	66.3	0.961
Yes	14	33.3	28	66.7	
History of intestinal worms					
No	97	33.4	193	66.6	0.666
Yes	4	40.0	6	60.0	
Child condition during the study					
Mild pain	18	41.9	25	58.1	0.219
Healthy	83	32.3	174	67.7	
Total	101	33.7	199	66.3	

***p < 0.05; **p < 0.001**

Table 2 presents the results of the multivariate analysis where showed that children aged 12-23 months are 3.5 times more likely to experience stunting (95% CI 1.7-7.2) than children aged 0-6 months. Children under two years of age who were born with low birth weight were 2.7 times more likely to experience stunting (95% CI 1.2-5.7) compared to them who were born with normal weight. Children under two years of age who experience food insecurity are likely to experience stunting 1.9 times (95% CI 1.1-3.5) compared to them who do not experience food insecurity.

Table 2. Multivariate Analysis of Determinants of Stunting in Children Under Two Years Age in Indonesian District.

Variables	p-value	AOR	95%CI	
			Lower	Upper
Child age				
0-6	reff	1.0		
7-11	0.105	1.7	0.9	3.4
12-23	0.001**	3.5	1.7	7.2
Low birth weight				
No	reff	1.0		
Yes	0.011*	2.7	1.2	5.7
Food insecurity				
No	reff	1.0		
Yes	0.034*	1.9	1.1	3.5
Number of children				
>3 children	reff	1.0		
≤3 children	0.136	1.6	0.9	3.0
Birth spacing				
≤3 years	reff	1.0		
>3 years	0.066	1.7	1.0	3.1
Breastfeeding				
No	reff	1.0		
Yes	0.168	1.4	0.9	2.4

***p < 0.05; **p < 0.001**

DISCUSSION

The stunting rate in children under two years of age is one of the most important health indicators globally [37]. The prevalence of stunting under two years of age in the stunting locus area of Tojo Una-una District in 2022 in this study is 33.7%. In other studies, the results of a survey on the nutritional status of Indonesian children under five conducted by the Ministry of Health of the Republic of Indonesia showed that there was an increase in the prevalence trend of child stunting in Tojo Una-Una District from 29.4% [49] in 2021 to 31.3% [50] in 2022 or an increase of 1.9% in a year. The results of this study indicate that the incidence

of stunting is significantly increasing in children born with a body weight <2500 gram, have a low level of food security, and are aged 12-23 months.

This study shows that the strongest predictor of stunting is in Tojo Una-Una districts is child's age. This study found that children under the age of 12-23 months had a significantly increased likelihood of experiencing stunting compared to children aged <12 months. Other study shows that the difference in body length between normal birth weight babies and low birth weight babies is increasingly visible starting from the age of 12 months until reaching the age of 2 years [51,52]. Inadequate growth with increasing age can be associated with the transition of feeding from exclusive breastfeeding to complementary foods [53]. Problems with child growth will occur if continued breastfeeding is not accompanied by adequate complementary breastfeeding based on age. An increase in the need for nutrients if accompanied by an insufficient intake of nutrients can cause a slowdown in growth [54,55]. In addition, exposure to various diseases and conditions as a consequence of increasing age, such as exposure to poor food hygiene and environmental sanitation, can have an impact on slowing growth [53]. As a result, adequate nutrition and a healthy environment are important during this critical period to promote healthy growth and development of the children.

This study shows that one of the strong predictors of stunting in Tojo Una-una is low birth weight of the baby which is in line with the findings of previous studies [45,56–58]. Studies in Indonesia, Rwanda, Malawi, India, Africa [18–23], Pakistan and Tanzania have also consistently demonstrated that low birth weight is a major risk factor for stunting [22,59–61]. A study in Tojo Una-una shows that low birth weight is 2.7 times more likely to experience stunting (95% CI 1.2-5.7) with children under two years of age who are born with normal weight, relevant to a study by Aryastami, et al (2017) which shows that babies born with low birth weight are 1.74 times more likely to experience stunting (95% CI 1.38-2.19) compared to babies born with normal weight [45]. Stunting usually begins in pregnancy, so the possibility of low birth weight babies experiencing underweight tends to persist in early childhood. The growth of low birth weight babies is reported to tend to be lower than normal birth weight babies [51,52]. The growth that is not optimal during the perinatal period is a contribution from maternal malnutrition. However, in the postnatal period, these growth disturbances can be corrected by optimal feeding practices [53,56]. Therefore, in the postnatal period, if food intake (nutrients) is insufficient, compounded by unhealthy environmental conditions, toddlers will be susceptible to infectious diseases, which will reduce the body's ability to absorb nutrients and ultimately interfere with growth [53]. Birth weight is a strong predictor of stunting [48], as a result fulfillment of maternal nutritional intake before and during pregnancy is optimized so that children do not experience low birth weight, in this way it is hoped that the incidence of stunting will also decrease.

Lack of nutritional intake in children and mothers can be triggered by a low level of food security in the family. This study also shows that another strong predictor of stunting is family food security. Other studies have reported that the relationship between socioeconomic level and the incidence of stunting is generally mediated by food security [62,63]. In addition, a low level of food security will have an impact on low food diversity in toddler food intake [62,64]. The characteristics of complementary foods for children under two years of age are reflected in the diversity of foods that are still lacking in variety. Concerning stunting, the intake of animal protein sources for under-fives such as beef, chicken, fish, and eggs is still very low or less than 50%. Findings in Northern Ethiopia protein intake is very low [65]. Likewise, in areas in Indonesia where the prevalence of stunting is high, intake of animal protein is only 19.3% [66]. It also includes that food diversity also greatly influences the incidence of stunting in children[67,68]. Low dietary diversity is related to stunting. A study by Hlaing LM (2016) recommended local food-based complementary foods which were developed to increase problematic nutritional intake in children aged 12-23 months. Nutrients Ca, Zn, niacin, folate, and Fe are nutrients that do not achieve 100% of the recommended nutrient intake even when the diet is optimized. Chicken liver and anchovies are locally available nutrient-dense foods that will fill these nutritional gaps, however, alternative interventions, such as fortification, are still needed to ensure an adequate supply of all the required nutrients [69]. In line with Harper A (2022), this study

suggests that interventions that can improve household food security and nutritional status during the periconception and antenatal periods can reduce the prevalence of low birth weight and stunting in children [59]. Therefore, ensuring family food security is essential in preventing stunting and promoting healthy growth and development in children.

The results of this study indicate the importance of interventions to address these factors. Interventions focus on a multi-sectoral approach to address stunting effectively [70]. Strengthen the family planning program because larger families also have a higher risk of having stunted children [71]. The role of midwives and the implementation of sustainable midwifery care can help this program be implemented [72,73]. Specific intervention behavior in preventing stunting even in post-disaster conditions is breastfeeding for up to 2 years [39]. These interventions are expected to improve the socioeconomic status, sanitation, and hygiene. In addition, it is necessary to carry out agricultural development interventions to improve nutrition which will increase family food security, especially for households with many members and households with more than two children under five.

CONCLUSION

The determinants of stunting of children under two years are children aged 12-23 months, low birth weight, food insecurity, birth spacing between children less than 3 years, number of children over 3, and not breastfeeding. It is suggested to program implementers that stunting prevention campaigns be carried out as early as possible for pregnant women, and pre-conception mothers, to arrange the spacing of children more than 3 years and the number of children not to exceed 3 children, through the family planning program. The role of midwives and the implementation of sustainable midwifery care can help this program to be implemented. To effectively address stunting, interventions should take a multi-sectoral approach. These interventions are intended to improve socioeconomic conditions, sanitation, and hygiene.

ACKNOWLEDGMENTS

Director General of Health Workers of the Ministry of Health of the Republic of Indonesia and Director of Vocational Studies of the Ministry of Education and Culture of the Republic of Indonesia for research funding and article publication.

CONFLICTS OF INTEREST

The authors declare no conflict of interest.

REFERENCE

1. Kahssay M, Woldu E, Gebre A, Reddy S. Determinants of stunting among children aged 6 to 59 months in pastoral community, Afar region, North East Ethiopia: unmatched case control study. BMC Nutr. 2020 Dec;6(1):9.
2. Holdsworth EA, Schell LM. Stunting. Int Encycl Biol Anthropol. 2018;1–3.
3. UNICEF/WHO/WORLD BANK. Levels and trends in child malnutrition UNICEF / WHO / World Bank Group Joint Child Malnutrition Estimates Key findings of the 2021 edition. World Heal Organ [Internet]. 2021;1–32. Available from: https://www.who.int/publications/i/item/9789240025257
4. Kementerian kesehatan RI. Hasil Utama Riskesdas 2018. Jakarta; 2018.
5. Kementerian Perencanaan Pembangunan Nasional/Badan Perencanaan Pembangunan Nasional. *Rancangan Rencana Pembangunan Jangka Menengah Nasiional (RPJMN) 2020-2024*. Rencana Pembang Jangka Menengah Nas 2020-2024. 2019;313.
6. The World Bank. Spending Better to Reduce Stunting in Indonesia: Findings from a Public Expenditure Review. World Bank [Internet]. 2020; Available from: https://elibrary.worldbank.org/doi/abs/10.1596/34196
7. B.S. P, Guddattu V. Understanding the Change in the Prevalence and Factors Influencing the Childhood Stunting Using District-Level Data from NFHS-4 and NFHS-5 in India. Inq J Heal Care Organ Provision, Financ. 2022 Jan;59:004695802211271.
8. Kemenkes. Hasil Survei Status Gizi Indonesia (SSGI) 2022. 2023;1–7.
9. Bappeda Sulawesi Tengah. Rembuk Stunting dan Pemberian Penghargaan

Tahun 2022 Tingkat Provinsi Sulawesi Tengah [Internet]. 2022 [cited 2023 Mar 7]. Available from: https://bappeda.sultengprov.go.id/rembuk-stunting-dan-pemberian-penghargaan-tahun-2022-tingkat-provinsi-sulawesi-tengah/

10. Ekholuenetale M, Barrow A, Ekholuenetale CE, Tudeme G. Impact of stunting on early childhood cognitive development in Benin: evidence from Demographic and Health Survey. Egypt Pediatr Assoc Gaz [Internet]. 2020;68(1):31. Available from: https://doi.org/10.1186/s43054-020-00043-x
11. De Sanctis V, Soliman A, Alaaraj N, Ahmed S, Alyafei F, Hamed N. Early and Long-term Consequences of Nutritional Stunting: From Childhood to Adulthood. Acta Biomed. 2021 Feb;92(1):e2021168.
12. Umwali N, Kunyanga CN, Kaindi DWM. Determinants of stunting in children aged between 6–23 months in Musanze region, Rwanda. Front Nutr. 2022 Nov;9.
13. Asmare AA, Agmas YA. Determinants of coexistence of stunting, wasting, and underweight among children under five years in the Gambia; evidence from 2019/20 Gambian demographic health survey: application of multivariate binary logistic regression model. BMC Public Health. 2022 Aug;22(1):1621.
14. Fufa DA. Determinants of stunting in children under five years in dibate district of Ethiopia: A case-control study. Hum Nutr Metab. 2022 Dec;30:200162.
15. Das D. Evaluating Changes in Determinants of Stunting among Children Under 2 Years and Assessing Their Contribution to Socioeconomic Disparity in Child Nutritional Status across India. Indian J Community Med. 2022;47(1):96.
16. Namirembe G, Ghosh S, Ausman LM, Shrestha R, Zaharia S, Bashaasha B, et al. Child stunting starts in utero: Growth trajectories and determinants in Ugandan infants. Matern Child Nutr. 2022 Jul;18(3).
17. Eryando T, Sipahutar T, Budhiharsana MP, Siregar KN, Nur Aidi M, Minarto, et al. Spatial analysis of stunting determinants in 514 Indonesian districts/cities: Implications for intervention and setting of priority. Geospat Health. 2022 May;17(1).
18. Widyaningsih, Mulyaningsih, Rahmawati, Adhitya. Determinants of socioeconomic and rural-urban disparities in stunting: evidence from Indonesia. Rural Remote Health. 2022 Mar;22(1):1–9.
19. Niragire F, Ndikumana C, Nyirahabimana MG, Mugemangango C. Child stunting and associated risk factors in selected food-insecure areas in Rwanda: an analytical cross-sectional study. Pan Afr Med J. 2022 Apr;43:49–61.
20. Toledo G, Landes M, van Lettow M, Tippett Barr BA, Bailey H, Crichton S, et al. Risk factors for stunting in children who are HIV-exposed and uninfected after Option B+ implementation in Malawi. Matern Child Nutr. 2023 Jan;19(1).
21. Noor MS, Andrestian MD, Dina RA, Ferdina AR, Dewi Z, Hariati NW, et al. Analysis of Socioeconomic, Utilization of Maternal Health Services, and Toddler's Characteristics as Stunting Risk Factors. Nutrients. 2022 Oct;14(20):4373.
22. Halli SS, Biradar RA, Prasad JB. Low Birth Weight, the Differentiating Risk Factor for Stunting among Preschool Children in India. Int J Environ Res Public Health. 2022 Mar;19(7):3751.
23. Quamme SH, Iversen PO. Prevalence of child stunting in Sub-Saharan Africa and its risk factors. Clin Nutr Open Sci. 2022 Apr;42:49–61.
24. Ndagijimana S, Kabano I, Ntaganda J. Analysis of risk factors that influence stunting among Rwandan children under the age of five. African J Food, Agric Nutr Dev. 2022 Jul;22(5):20480–97.
25. Islam MS, Zafar Ullah AN, Mainali S, Imam MA, Hasan MI. Determinants of stunting during the first 1,000 days of life in Bangladesh: A review. Food Sci Nutr. 2020 Sep;8(9):4685–95.
26. Yazew T. Risk Factors of Stunting and Wasting among Children Aged 6–59 Months in Household Food Insecurity

of Jima Geneti District, Western Oromia, Ethiopia: An Observational Study. S. Razzaque M, editor. J Nutr Metab. 2022 Jan;2022:1–8.
27. Afolabi RF, Palamuleni ME. Exploring determinants of under-5 stunting in malawi using a generalised linear mixed model. SAJCH South African J Child Heal. 2021;15(1):18–24.
28. Tamirat KS, Tesema GA, Tessema ZT. Determinants of maternal high-risk fertility behaviors and its correlation with child stunting and anemia in the East Africa region: A pooled analysis of nine East African countries. Spradley FT, editor. PLoS One. 2021 Jun;16(6):e0253736.
29. Wati EK, Wahyurin IS, Sari HP, Zaki I, Dardjito E. Stunting Incidence in Infant Related to Mother's History During Pregnancy. J Kesehat Masy. 2022 Mar;17(4):535–41.
30. Dhingra S, Pingali PL. Effects of short birth spacing on birth-order differences in child stunting: Evidence from India. Proc Natl Acad Sci. 2021 Feb;118(8).
31. Adeyemi O, Toure M, Covic N, van den Bold M, Nisbett N, Headey D. Understanding drivers of stunting reduction in Nigeria from 2003 to 2018: a regression analysis. Food Secur. 2022 Aug;14(4):995–1011.
32. Nsubuga EJ, Arinda Kato I, Lee S, Ssenyondo M, Isunju JB. Predictors of Stunting and Underweight Among Children Aged 6 to 59 months in Bussi Islands, Wakiso District, Uganda: A Cross-Sectional Study. Nutr Metab Insights. 2022 Jan;15:117863882211251.
33. Suratri MAL, Putro G, Rachmat B, Nurhayati, Ristrini, Pracoyo NE, et al. Risk Factors for Stunting among Children under Five Years in the Province of East Nusa Tenggara (NTT), Indonesia. Int J Environ Res Public Health. 2023 Jan;20(2):1640.
34. Tello B, Rivadeneira MF, Moncayo AL, Buitrón J, Astudillo F, Estrella A, et al. Breastfeeding, feeding practices and stunting in indigenous Ecuadorians under 2 years of age. Int Breastfeed J. 2022 Dec;17(1):19.
35. Aheto JMK, Dagne GA. Geostatistical analysis, web-based mapping, and environmental determinants of under-5 stunting: evidence from the 2014 Ghana Demographic and Health Survey. Lancet Planet Heal. 2021 Jun;5(6):e347–55.
36. Afzal A. Determinants of stunting among under five children in pakistan: A cross sectional study. Pakistan Paediatr J. 2021;45(3):327–31.
37. Yunitasari E, Pradanie R, Arifin H, Fajrianti D, Lee BO. Determinants of Stunting Prevention among Mothers with Children Aged 6–24 Months. Open Access Maced J Med Sci. 2021 May;9(B):378–84.
38. Vale D, Andrade ME da C, Dantas NM, Bezerra RA, Lyra C de O, Oliveira AGR da C. Social Determinants of Obesity and Stunting among Brazilian Adolescents: A Multilevel Analysis. Nutrients. 2022 Jun;14(11):2334.
39. Hafid F, Taqwin T, Linda L, Nasrul N, Ramadhan K, Bohari B. Specific Interventions to Prevent Stunting in Children Under 2 Years after the Natural Disaster. Open Access Maced J Med Sci. 2021 Feb;9(E):64–9.
40. Hendraswari CA, Purnamaningrum YE, Maryani T, Widyastuti Y, Harith S. The Determinants of Stunting in 24-59 Month-Old Children in Kulon Progo District 2019. Kesmas Natl Public Heal J. 2021 May;16(2):71–7.
41. Huriah T, Handayani P, Sudyasih T, Susyanto BE. The determinant factors of stunting among children in urban slums area, Yogyakarta, Indonesia. Open Access Maced J Med Sci. 2021;9(T4):1–5.
42. Podungge Y, Yulianingsih E, Porouw HS, Saraswati E, Tompunuh MM, Claudia JG, et al. Determinant Factors of Stunting in Under-Five Children. Open Access Maced J Med Sci. 2021 Dec;9(B):1717–26.
43. Titaley CR, Ariawan I, Hapsari D, Muasyaroh A, Dibley MJ. Determinants of the Stunting of Children Under Two Years Old in Indonesia: A Multilevel Analysis of the 2013 Indonesia Basic Health Survey. Nutrients. 2019 May;11(5):1106.
44. Beal T, Tumilowicz A, Sutrisna A, Izwardy D, Neufeld LM. A review of child stunting determinants in

Indonesia. Matern Child Nutr. 2018 Oct;14(4):e12617.
45. Aryastami NK, Shankar A, Kusumawardani N, Besral B, Jahari AB, Achadi E. Low birth weight was the most dominant predictor associated with stunting among children aged 12–23 months in Indonesia. BMC Nutr. 2017 Dec;3(1):16.
46. Nasrul. Pengendalian Faktor Risiko Stunting Anak Baduta di Sulawesi Tengah. Promot J Kesehat Masy. 2018;8(2):131–46.
47. Nasrul N, Taqwin T, Hafid F. The Prevention Against Morbidity and Stunting Through Vitamin A Supplementation In Sigi and Touna Districts. In: Pontianak International Health Conference (PIHC). ISBN 978-602-51424-0-6; 2017. p. 317–25.
48. Nasrul, Hafid F, Razak Thaha A, Suriah. Faktor Risiko Stunting Usia 6-23 Bulan di Kecamatan Bontoramba Kabupaten Jeneponto. Media Kesehat Masy Indones. 2015;11(3):139–46.
49. Kementrian Kesehatan Republik Indonesia. Buku Saku Hasil Studi Status Gizi Indonesia (SSGI) Tahun 2021. Jakarta: Badan Litbangkes - Kementerian Kesehatan Republik Indonesia; 2021.
50. Kementerian Kesehatan Republik Indonesia. Buku Saku Hasil Studi Status Gizi Indonesia (SSGI) Tahun 2022. Kemenkes RI. Jakarta: Badan Kebijakan Pembangunan Kesehatan Kementerian Kesehatan; 2022. 1–154 p.
51. Mbuya MNN, Chidem M, Chasekwa B, Mishra V. Biological, Social, and Environmental Determinants of Low Birth Weight and Stunting among Infants and Young Children in Zimbabwe. Zimbabwe Work Pap No7 Calverton, Maryland, USA ICF Macro. 2010;(7).
52. Martorell R, Flores R, Hickey M. Stunting in Guatemala: analyses of change over 15 years. Bethesda Abt Assoc Inc. 2002;
53. Akombi B, Agho K, Hall J, Wali N, Renzaho A, Merom D. Stunting, Wasting and Underweight in Sub-Saharan Africa: A Systematic Review. Int J Environ Res Public Health. 2017 Aug;14(8):863.
54. Derso T, Tariku A, Biks GA, Wassie MM. Stunting, wasting and associated factors among children aged 6–24 months in Dabat health and demographic surveillance system site: A community based cross-sectional study in Ethiopia. BMC Pediatr. 2017 Dec;17(1):96.
55. Thiombiano-Coulibaly N, Rocquelin G, Eymard-Duvernay S, Zougmoré ON, Traoré SA. Effects of early extra fluid and food intake on breast milk consumption and infant nutritional status at 5 months of age in an urban and a rural area of Burkina Faso. Eur J Clin Nutr. 2004 Jan;58(1):80–9.
56. Rahman MS, Howlader T, Masud MS, Rahman ML. Association of Low-Birth Weight with Malnutrition in Children under Five Years in Bangladesh: Do Mother's Education, Socio-Economic Status, and Birth Interval Matter? Islam FMA, editor. PLoS One. 2016 Jun;11(6):e0157814.
57. Islam MM, Alam M, Tariquzaman M, Kabir MA, Pervin R, Begum M, et al. Predictors of the number of under-five malnourished children in Bangladesh: application of the generalized poisson regression model. BMC Public Health. 2013 Dec;13(1):11.
58. Mishra K, Kumar P, Basu S, Rai K, Aneja S. Risk Factors for Severe Acute Malnutrition in Children below 5 y of Age in India: A Case-Control Study. Indian J Pediatr. 2014 Aug;81(8):762–5.
59. Harper A, Rothberg A, Chirwa E, Sambu W, Mall S. Household Food Insecurity and Demographic Factors, Low Birth Weight and Stunting in Early Childhood: Findings from a Longitudinal Study in South Africa. Matern Child Health J. 2022 Sep;
60. Abbas F, Kumar R, Mahmood T, Somrongthong R. Impact of children born with low birth weight on stunting and wasting in Sindh province of Pakistan: a propensity score matching approach. Sci Rep. 2021 Dec;11(1):19932.
61. Mtongwa RH, Festo C, Elisaria E. A comparative analysis of determinants of low birth weight and stunting among

under five children of adolescent and non-adolescent mothers using 2015/16 Tanzania Demographic and Health Survey (TDHS). BMC Nutr. 2021 Dec;7(1):64.
62. Roesler AL, Smithers LG, Wangpakapattanawong P, Moore V. Stunting, dietary diversity and household food insecurity among children under 5 years in ethnic communities of northern Thailand. J Public Health (Bangkok). 2019 Dec;41(4):772–80.
63. Mahmudiono T, Nindya T, Andrias D, Megatsari H, Rosenkranz R. Household Food Insecurity as a Predictor of Stunted Children and Overweight/Obese Mothers (SCOWT) in Urban Indonesia. Nutrients. 2018 Apr;10(5):535.
64. Ahmad I, Khalique N, Khalil S, Urfi, Maroof M. Dietary diversity and stunting among infants and young children: A cross-sectional study in Aligarh. Indian J Community Med. 2018;43(1):34.
65. Haileselassie M, Redae G, Berhe G, Henry CJ, Nickerson MT, Mulugeta A. The influence of fasting on energy and nutrient intake and their corresponding food sources among 6-23 months old children in rural communities with high burden of stunting from Northern Ethiopia. Nutr J. 2022 Dec;21(1):4.
66. Kusumawardani HD, Ashar H. Food Consumption Patterns for Children Under Two Years (Toddler) in Areas with High Stunting Prevalence. IOP Conf Ser Earth Environ Sci. 2022 May;1024(1):012071.
67. Gassara G, Chen J. Household Food Insecurity, Dietary Diversity, and Stunting in Sub-Saharan Africa: A Systematic Review. Nutrients. 2021 Dec;13(12):4401.
68. Adachi M, Urabe D. Diet diversity was limited in Malawi resulting in stunting despite availability of foods in markets. Pediatr Int. 2021 Mar;63(3):311–5.
69. Hlaing LM, Fahmida U, Htet MK, Utomo B, Firmansyah A, Ferguson EL. Local food-based complementary feeding recommendations developed by the linear programming approach to improve the intake of problem nutrients among 12–23-month-old Myanmar children. Br J Nutr. 2016 Jul;116(S1):S16–26.
70. Marume A, Archary M, Mahomed S. Predictors of stunting among children aged 6-59 months, Zimbabwe. Public Health Nutr. 2023 Jan;1–27.
71. Saha UR, van Wesenbeeck CFA. Changes in the determinants and spatial distribution of under-five stunting in Bangladesh: Evidence from Bangladesh Demographic Health Surveys (BDHS) 1996–97, 2014 and 2017/18. Bora JK, editor. PLoS One. 2022 Dec;17(12):e0278094.
72. Nurfatimah N, Ramadhan K, Entoh C, Longgupa LW, Hafid F. Continuity of Midwifery Care Implementation to Reduce Stunting. Open Access Maced J Med Sci. 2021 Dec;9(E):1512–6.
73. Sumiaty S, Ali MN, Muhamad H, Hafid F. Roles of Midwives and Indonesian Midwives Association in Reducing Risk Factors for Stunting in Indonesia. Open Access Maced J Med Sci. 2021 Jul;9(G):8–13.