JKKI: Jurnal Kedokteran dan Kesehatan Indonesia
Indonesian Journal of Medicine and Health
Journal homepage: https://journal.uii.ac.id/JKKI
P-ISSN 2085-4145 | E-ISSN 2527-2950

Association between prenatal factors and incidence of stunting in toddlers aged 0 – 23 months: A case-control study

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Article Info:

Keywords: stunting, prenatal, hemoglobin, maternal height, chronic energy deficiency, iron tablets, antenatal care frequency.

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Article History:

Received: February 2, 2024
Accepted: December 11, 2024
Online: December 27, 2024

DOI: 10.20885/JKKI.Vol15.Iss3.art8

Original Article

ABSTRACT

Background: Stunting is impaired growth caused by chronic malnutrition in the first thousand days of life divided into prenatal and postnatal period. The prenatal period starts from conception until the time of birth. It is caused by multifactor including dietary consumption, infectious diseases, maternal nutrition, socioeconomic factors, and environmental factors.
Objective: This study aims to identify the correlation between prenatal factors and the incidence of stunting in toddlers aged 0-23 months in Guntur II Primary Health Care, Demak Regency.
Methods: This was an analytic observational study with a case control design. Independent variables in this study were hemoglobin levels, iron tablet consumption behaviour, chronic energy deficiency (CED) status, maternal height, and antenatal care (ANC) frequency. Its sampling technique was a purposive and consecutive sampling. Its data were analysed by chi-square for bivariate analysis and logistic regression test for multivariate analysis.
Results: Hemoglobin levels correlated with incidence of stunting (p = 0.012; OR = 4.375); as well as iron tablet consumption behaviour (p= 0,297; OR = 1.727). Next, chronic energy deficiency status correlated with stunting (p = 0.045; OR = 3.333) as well as maternal height (p = 0.045; OR = 3.333). Also, ANC frequency and the stunting correlation was p = 0.067; OR = 2.667. Risk factors for stunting based on multivariate analysis are chronic energy deficiency status (β = 1.703; p = 0.014; OR = 5.489) and frequency of ANC (β = 1.460; p = 0.018; OR = 4.307).
Conclusion: The hemoglobin levels, maternal height, and CED status have significant correlation with incidence of stunting in toddlers aged 0-23 months. The CED status is the dominant risk factor of incidence of stunting in toddlers aged 0-23 months.

INTRODUCTION

Stunting is characterized by a height-for-age Z score of less than -2, meaning it falls two standard deviations below the median for a well-nourished reference population based on age and sex. It refers to growth impairment caused by chronic malnutrition during the first thousand days of life, which includes both the prenatal and postnatal periods, starting from conception. Moreover, it is influenced by various factors such as food intake, infections, maternal nutrition during pregnancy, socioeconomic conditions, adequate micronutrient and macronutrient intake, and environmental factors.[1,2]

The prenatal period spans from conception to time before birth. The impact of prenatal growth will influence a child's development until adulthood. Issues arising during this phase can affect the foetus in utero and the baby after born.[3,4] This critical prenatal stage plays a significant role in the development of stunting in children.

As reported by the World Health Organization (WHO) in 2020, 149.2 million children under five globally experienced stunting, 45.4 million were wasted, and 38.9 million were overweight.[5]

In Indonesia, the stunting prevalence reached 21.6% in 2022, exceeding the WHO's target of 20% for developing countries. Demak Regency showed a notable reduction in stunting rates, from 25.5% in 2021 to 16.2% in 2022.[6] However, stunting rates in Indonesia remain higher than the national goal of 14% for 2024.[7] Demak Regency is one of the focal areas for integrated stunting reduction programs, with targeted interventions implemented since 2019, particularly in Guntur district within the Guntur II Primary Health Care area.[8,9]

A study by Dewi indicates that pregnant women with a mid-upper arm circumference (MUAC) of less than 23.5 cm (indicative of chronic energy deficiency or CED) have a tenfold increased risk of giving birth to a stunted child compared to women with normal MUAC. Additionally, maternal factors such as short stature (height <150 cm), low body mass index (BMI <18.5 kg/m^2), and maternal anemia (hemoglobin levels <11 g/dL) are associated with higher risks of stunting in children.[10,11] Other studies also suggest that inadequate iron supplementation (less than 90 tablets) during pregnancy increases the risks of stunting by 1.05 times compared to mothers who take 90 or more tablets.[12] Moreover, inadequate antenatal care (ANC) frequency correlates significantly with the occurrence of low birth weight, which is a risk factor for stunting.[13]

Demak Regency has made significant strides in reducing the stunting, but it remains a priority area for stunting reduction interventions, as the problem persists above the national target. However, there is limited studies exploring the relationship between prenatal factors and stunting incidence in children aged 0 to 23 months in the working area of Guntur II Primary Health Care.

This study aims to examine the relationship between the prenatal factors and the incidence of stunting in toddlers aged 0–23 months within the area of Guntur II Primary Health Care in Demak Regency. The findings this study may contribute valuable information for future studies on stunting in this area and provide insight into how prenatal factors influence stunting in children, ultimately helping to guide future stunting prevention efforts.

METHODS

Research design

This study was an analytical observational study using a case-control design. It was conducted between September and October 2023 in the working area of Guntur II Primary Health Care, Demak Regency. The dependent variable for this study was stunting. The independent variables in this study were prenatal factors such as hemoglobin levels, iron supplementation tablet consumption behaviour, CED status, maternal height, and ANC frequency.

Data collection

The stunting was assessed by comparing a child's height-for-age Z score (HAZ) to a standard growth reference, with a score below -2 SD indicating stunting according to the WHO classification. The prenatal factors referred to the occurrences and conditions occurring during pregnancy that influence foetal development. These factors included maternal hemoglobin (Hb) levels, iron tablet consumption, CED status, maternal height, and ANC frequency, all of which were extracted from health books of the mother and her child.

For toddlers who could stand properly, their height was measured using a stadiometer, which consists of a ruler and a sliding horizontal headpiece to provide a clear measurement. For toddlers unable to stand, their length was measured using an infantometer, which accurately measures an infant's recumbent length by securely positioning the child. The height measurements using the stadiometer were preceded by calibration of the instrument. The child stood on the stadiometer’s base with their spine, buttocks, and heels touching the scale pole, chin raised, body upright, and looking straight ahead. The head slider was lowered until it contacted the head, and the final measurement was recorded. For the length measurement with the infantometer, the instrument was placed on a flat surface. The child was laid in a supine position, with their soles pressed against the fixed panel. The child’s legs were held together and straightened to ensure the knees were in contact with the measuring tool, and the feet formed a

right angle. The sliding panel was moved until it touched the child's head, and the length was recorded.

Maternal variables were categorized into binomial caterogy. The maternal hemoglobin levels were classified as anemia if the maternal Hb level was < 11 g/dL in the first and third trimesters, < 10.5 g/dL in the second trimester, and normal if the Hb level was ≥ 11 g/dL. Pregnant women who consumed iron supplementation tablets daily or took at least 90 iron supplementation tablets were classified as routine, while those who took fewer than 90 iron supplementation tablets or did not take them daily were classified as non-routine. The pregnant women were categorized as CED if their MUAC was < 23.5 cm and as normal if it was ≥ 23.5 cm. The maternal height was classified as short if the woman's height was < 150 cm and as normal if it was ≥ 150 cm. The ANC frequency was considered routine if the woman attended at least six visits (two in the first trimester, one in the second trimester, and three in the third trimester), and non-routine if the number of visits was fewer or irregular.

Sampling size determination

The villages in the Guntur district were selected using a purposive sampling technique, and the samples were collected through consecutive sampling according to the inclusion and exclusion criteria. The sample size was determined using a case-control formula below.

$$n = \frac{(Z\alpha\sqrt{2PQ} + \mathrm{Z}\beta\sqrt{P1Q1 + P2Q2})^2}{(\mathrm{P1} - \mathrm{P2})^2}$$

A total of 30 samples were selected for each the case and control groups. The participants in this study were mothers of toddlers aged 0–23 months, either diagnosed with stunting (a case group) or not diagnosed with stunting (a control group), in the working area of Guntur II Primary Health Care, Demak Regency. The inclusion criteria included mothers whose toddlers aged 0-23 months with complete records in their health books, who had not moved since their child's birth, whose children had received complete immunizations, who had a history of exclusive breastfeeding, and who had at least a junior high school education. Additionally, mothers with no history of infections during pregnancy were included. Toddlers with congenital abnormalities or physical disabilities and mothers who declined participation in the study were excluded. In total, 36 samples were collected for the case group and 40 samples for the control group. However, 6 participants from the case group and 10 from the control group were excluded due to incomplete or missing information in their health books.

Statistical methods

The data were analyzed using IBM SPSS Statistics 25 software, with chi-square and logistic regression tests. The Chi-square test was used for bivariate analysis with a p value <0.05, indicating a significant relationship between a variable and the incidence of stunting. The variables that had a p-value <0.25 were continued to multivariate analysis. The logistic regression test was used for multivariate analysis, where the p-value <0.05 with the largest odds ratio indicated the dominant risk factor for stunting in toddlers.

Ethics

This research received approval from the Research Bioethics Commission of the Faculty of Medicine, Universitas Islam Sultan Agung Semarang, under a reference number 323/VIII/2023/Bioethics Commission.

RESULTS

Table 1 presented the characteristics of the subjects, including age, sex, maternal age, the highest level of maternal education, and occupation. This study found that the majority of both stunted (63.3%) and non-stunted (60.0%) toddlers were aged between 13 and 23 months. In terms of sex, most children in both the stunted and non-stunted groups were male (56.7%). A

large proportion of mothers with stunted (53.3%) and non-stunted (53.3%) children were aged 26-30. The highest level of education for most mothers was at the intermediate level (junior high school, high school, or equivalent) in both the stunted (100%) and non-stunted (93.3%) groups. Additionally, most respondents were unemployed, with 73.3% in the stunted group and 80.0% in the non-stunted group.

Table 1. Characteristics of subjects

Variable	Stunting		Non-Stunting		p-value
	n	%	n	%	
Child's age					
0 – 12 months	11	36.7%	12	40.0%	0.791
13 – 23 months	19	63.3%	18	60.0%	
Child's sex					
Male	17	56.7%	17	56.7%	1.000
Female	13	43.3%	13	43.3%	
Mother's age					
20 – 25 years	5	16.7%	9	30.0%	
26 – 30 years	16	53.3%	16	53.3%	0.319
31 – 35 years	9	30.0%	5	16.7%	
Mother's education					
Intermediate (JHS/SHS/equivalent)	30	100%	28	93.3%	0.492
High (Bachelor/Diploma/equivalent)	0	0.0%	2	6.7%	
Mother's occupation					
Unemployed	22	73.3%	24	80.0%	0.542
Employed	8	26.7%	6	20.0%	
Total	30	100%	30	100%	-

JHS: Junior High School; SHS: Senior High School

From Table 1 it can be concluded that the entire demographic data of the respondents show a p-value > 0.05, indicating that all characteristics of the respondents are equal between toddlers with stunting and toddlers without stunting. This analysis is aimed to minimize selection bias in the study. Prenatal factors percentages of the entire subjents were presented in Table 2.

Table 2. Prenatal factors

Variable	Stunting n (%)	Non-Stunting n (%)
Hemoglobin levels		
Anemia	14 (46.7%)	5 (16.7%)
Normal	16 (53.3%)	25 (83.3%)
Iron tablet consumption behaviour		
Routine	15 (50.0%)	11 (36.7%)
Non-routine	15 (50.0%)	19 (63,3%)
CED status		
CED	12 (40.0%)	5 (16.7%)
Normal	18 (60.0%)	25 (83.3%)
Maternal height		
Short	12 (40.0%)	5 (16.7%)
Normal	18 (60.0%)	25 (83.3%)
ANC frequency		
Routine	16 (53.3%)	9 (30.0%)
Non-routine	14 (46.7%)	21 (70.0%)

ANC: Antenatal Care; MUAC: Mid Upper Arm Circumference; CED: Chronic Energy Deficiency.

To assess the relationship between variables we conducted Chi square tests. Hemoglobin levels, CED, maternal height, and ANC frequency demonstrate significant association with the stunting incidence (Table 3). These variables then underwent multiple regression.

Table 3. Association between prenatal factors and incidence of stunting

Variable	Stunting n (%)	Non- stunting n (%)	p	OR (CI 95%)
Hemoglobin levels				
Anemia	14 (46.7%)	5 (16.7%)	0.012*	4.375
Normal	16 (53.3%)	25 (83.3%)		(1.320-14.504)
Iron tablet consumption behaviour				
Routine	15 (50.0%)	11 (36.7%)	0.297	1.727
Non-routine	15 (50.0%)	19 (63.3%)		(0.616-4.845)
CED status				
CED	12 (40.0%)	5 (16.7%)	0.045*	3.333
Normal	18 (60.0%)	25 (83.3%)		(0.998-11.139)
Maternal height				
Short	12 (40.0%)	5 (16.7%)	0.045*	3.333
Normal	18 (60.0%)	25 (83.3%)		(0.998-11.139)
ANC frequency				
Routine	16 (53.3%)	9 (30.0%)	0.067	2.667
Non-routine	14 (46.7%)	21 (70.0%)		(0.924-7.699)

*p-value < 0,05 means there was significant correlation. ANC: Antenatal Care; MUAC: Mid Upper Arm Circumference; CED: Chronic Energy Deficiency.

Table 4 presented the results of the multivariate analysis conducted using a backward stepwise logistic regression test. In the final model, two variables were identified with p-values below 0.05: chronic energy deficiency status and frequency of ANC visits. The confidence intervals were greater than 1 suggesting that both CED and ANC frequency served as risk factors for stunting. The OR for CED status was higher than that for ANC frequency, indicating that CED was a more significant risk factor for stunting among the toddlers aged 0–23 months in the Guntur II Primary Health Care.

Table 4. Multivariate analysis

Variable	Coefficient	p-value	OR (CI 95%)
Chronic Energy Deficiency status	1.703	0.014*	5.489 (1.417 – 21.263)
Antenatal Care Frequency	1.460	0.018*	4.307 (1.287 – 14.417)
Constant	-5.241	0.004	0.005

* p-value < 0,05 (risk factor for the incidence of stunting)

DISCUSSION

Low levels of hemoglobin, erythrocytes, and hematocrit contribute to anemia. During pregnancy, physiological changes in the mother elevate the risk of anemia, particularly between 20 and 24 weeks of gestation.[14] Maternal hemoglobin levels tend to decrease between 0–12 weeks, to reach their lowest between 13–28 weeks, and to gradually rise from 29–40 weeks of pregnancy. Pregnant women with hemoglobin levels below 11 g/dL are classified as having maternal anemia.[15] This current study reveals an association between the maternal hemoglobin levels and the stunting incidence, consistent with previous study which also identified a correlation between maternal hemoglobin during pregnancy and stunting, with a p-value of 0.008 and an OR of 5.444. This means mothers with lower hemoglobin levels are 5.444 times more likely to have stunted children (z-score < -2 SD) than mothers with normal hemoglobin levels.[11] The main cause for low hemoglobin levels during pregnancy is inadequate iron intake. However, other factors such as poor iron absorption due to infections like tuberculosis, malaria, and parasitic diseases, as well as bleeding, nutritional deficiencies, or abnormal hemoglobin production can also contribute. Maternal anomia can affect foetal development by limiting the supply of nutrients and oxygen, hindering the growth of body and brain cells, and potentially leading to shorter stature in children. To prevent anemia, the WHO recommends iron supplementation or oral iron intake during pregnancy, aiming to reduce anemia by 70% and iron deficiency by 57%.[14,16]

Consuming iron tablets daily during pregnancy, with a minimum of 90 tablets, is regarded as a preventive measure against anemia in pregnant women.[16] This current study also found no significant relationship between the practice of taking iron tablets during pregnancy and the incidence of stunting in toddlers. This finding aligns with previous conducted in Jombang and Pasuruan regency from April to June 2019, which also reported no significant correlation between iron tablet consumption during pregnancy and stunting. While iron tablet intake during pregnancy may not shield infants from stunting, it does reduce the risk of maternal anemia and low birth weight (LBW) in infants.[17] In Indonesia, a lot of anemia cases are attributed to low intake of iron-rich foods, particularly heme iron from animal-based food sources.[18] The effectiveness of iron tablet intake in reducing anemia risk depends not only on the frequency of consumption but also on the quality and method of intake. Iron absorption can be improved by consuming iron tablets with vitamin C-rich fruits, whereas combining them with high-caffeine drinks, milk, antacids, or high-dose calcium tablets can inhibit absorption, making it less effective in reducing the anemia risk.[16]

Fetal nutrition intake relies on the mother's nutrition during pregnancy, making the mother's nutritional status before and during pregnancy essential for meeting foetal nutritional needs. Mid-upper arm circumference reflects muscle and fat reserves, and a below-normal MUAC suggests insufficient energy and protein intake, which can lead to CED.[2] This current study pointed out that CED status was linked to an increased likelihood of short stature in children under two years. This aligns with previous study conducted in Semarang Regency in June 2022 using a retrospective cohort design, indicating that mothers with a low MUAC had a higher risk of stunting in children under 3 years old (RR = 1.87, 95% CI: 0.86–4.09).[19] Long-term nutritional deficiencies can reduce the nutrient supply to the foetus, impacting growth and development during pregnancy. Preventing CED in pregnant women involves consuming nutrient-rich foods and essential supplements, including iron, calcium, zinc, vitamin D, vitamin A, and iodine.[20]

Genetic factors are inherited from parents to their children through both physical and psychological traits starting at conception. A child's growth and development begin at conception and continued into adulthood.[21] Maternal height is a key factor in intrauterine growth restriction and low birth weight, both of which are predictors of mortality and growth failure in early life. Maternal short stature, reflecting generational influences, is strongly linked to stunting. The relationship between maternal height and a child's linear growth arises from a combination of genetic and environmental factors. Shorter mothers tended to have lower protein and energy reserves, smaller reproductive organs, and less space for foetal growth, which impacts foetal development through the placenta and infant growth via breast milk quantity and quality. This situation can lead to intrauterine growth restriction, contributing to short stature in children.[22] This current study showed a significant association between the maternal height and the stunting in toddlers. This finding aligns with a cross-sectional study in 2021 which demonstrated that mothers with short stature during pregnancy had a higher risk of having stunted children than mothers with average height.[21] Genetic transmission from parents to children through chromosomes carrying genes for shorter stature can influence a child's physical traits. Conditions such as maternal growth hormone deficiency, coupled with insufficient high-quality nutrition, may lead to stunting in children.[21,2]

Antenatal care (ANC) allows for the monitoring of health issues in both the mother and child during pregnancy, aimed at achieving optimal health. The ANC includes assessing maternal and foetal nutrition, monitoring foetal growth, preventing and managing diseases during pregnancy, and promoting health education.[5] The WHO recommends that pregnant women attend at least eight ANC visits: once in the first trimester (0–12 weeks), twice in the second trimester (20 and 26 weeks), and five times in the third trimester (at 30, 34, 36, 38, and 40 weeks).[23] Indonesia adapts this recommendation, advising a minimum of six ANC visits: twice in the first trimester (0–12 weeks), once in the second (>12–24 weeks), and three times in the third trimester (>24 weeks to birth).[24] According to this current study, the frequency of ANC visits did not show a significant relationship with the incidence of stunting in toddlers, as supported by previous study.[25] ANC effectiveness depends on both quantity (frequency of visits) and quality

(use of examination tools and healthcare standards). Inadequate ANC quantity or quality may affect outcomes, while ANC provided by skilled professionals can reduce the risk of complications like stillbirth, intrauterine growth retardation, preterm birth, low birth weight, foetal abnormalities, and other issues by facilitating health promotion, disease prevention, screening, and treatment, ultimately supporting maternal and newborn health. ANC can help ensure healthy pregnancy outcomes.[24,26]

A limitation of this study is that the researchers focused only on the quantity of ANC rather than the quality of antenatal care received. Additionally, the use of non-probability sampling techniques means that the findings may not have fully represented whole condition of Guntur II Primary Health Care. However, the results of this study can assist local authorities in Guntur district in their efforts to prevent stunting. This study also can help policy makers design interventions aimed at improving the health outcomes of pregnant women.

CONCLUSION

Maternal hemoglobin levels, maternal CED status, and maternal height were significantly associated with the incidence of stunting in toddlers aged 0-23 months in the working area of Guntur II Primary Health Care, Demak Regency. However, the behaviour of iron tablet consumption and the frequency of ANC did not show a significant relationship in this study. The most influential prenatal risk factor for the stunting in toddlers aged 0-23 months was maternal CED status during pregnancy, followed by the frequency of ANC.

CONFLICT OF INTEREST

All authors declare that there is no conflict of interest in this study.

ACKNOWLEDGEMENT

The authors would like to thank the participants in this study and Guntur II Primary Health Care, Demak Regency, for allowing and helping this study.

LIST OF ABBREVIATIONS

ANC: ante natal care; Hb: hemoglobin; CED: chronic energy deficiency; MUAC: mid-upper arm circumference.

REFERENCES

1. Arianti LIP. Faktor-faktor resiko penyebab terjadinya stunting pada balita usia 23-59 bulan. Oksitosin: J Ilm Kebidanan. 2019;4(1):28–37. DOI:10.35316/oksitosin.v6i1.341
2. Santosa A, Arif EN, Ghoni DA. Effect of maternal and child factors on stunting: Partial least squares structural equation modeling. Clin Exp Pediatr. 2022;65(2):90–7. DOI:10.3345/cep.2021.00094
3. Hegazy AAM. A look at early human embryonic development and the importance of darkness for embryogenesis. Int J Cadaveric Stud Anat Var. 2022;18–20. DOI:10.61797/ijcsav.v3i1.154
4. Jain D. Different stages of prenatal development and prenatal tests that relate to prenatal development. Matern Pediatr Nutr. 2021;6:143. DOI:10.35248/2472-1182.21.6.143
5. World Health Organization. Global nutrition targets 2025 low birth weight policy brief. WHO/NMH/NHD/145. 2022;8. DOI:10.1001/jama.287.2.270
6. Kementerian Kesehatan Republik Indonesia. Buku saku hasil studi status gizi Indonesia (SSGI) tahun 2022. Kemenkes RI. 2022;1–14. Available from: https://www.litbang.kemkes.go.id/buku-saku-hasil-studi-status-gizi-indonesia-ssgi-tahun-2021/
7. Perpres. Peraturan Presiden No. 28. Republik Indones. 2020;(1):23. Available from: https://peraturan.bpk.go.id/Details/174964/perpres-no-72-tahun-2021
8. Kementerian PPN/Bappenas. Keputusan Menteri Perencanaan Pembangunan Nasional/Kepala Badan Perencanaan Pembangunan Nasional Nomor Kep. 101/M.Ppn/Hk/06/2022 tentang penetapan kabupaten/kota lokasi fokus intervensi

percepatan penurunan stunting terintegrasi tahun 2023. 2023; p. 149–200. Available from: https://jdih.bappenas.go.id/peraturan/detailperaturan/2957
9. Peraturan Bupati Demak. Peraturan Bupati Demak Nomor 29 Tahun 2019 tentang rencana aksi daerah penanggulangan stunting di Kabupaten Demak Tahun 2019-2021. 2019; Available from: https://peraturan.bpk.go.id/Details/185981/perbup-kab-demak-no-29-tahun-2019
10. Ernawati F, Briawan D. Indeks massa tubuh rendah pada awal kehamilan dan defisiensi vitamin a pada trimester kedua sebagai faktor risiko gangguan pertumbuhan linier pada bayi lahir. J Gizi Pangan. 2016;11:1–10. DOI: 10.25182/jgp.2016.11.3.%25p
11. Dewi R, Evrianasari N, Yuviska IA. Kadar Hb, LILA dan berat badan ibu saat hamil berisiko terhadap kejadian stunting pada anak usia 1-3 tahun. J Kebidanan Malahayati. 2020;6(1):57–64. DOI:10.33024/jkm.v6i1.1769
12. Fentiana N, Tambunan F, Ginting D. Stunting, pemeriksaan kehamilan dan konsumsi tablet tambah darah ibu hamil di Indonesia: Analisis data Riskesdas 2013. J Keperawatan Suaka Insa. 2022;7(2):133–8. DOI:10.51143/jksi.v7i2.351
13. Fatimah N, Utama BI, Sastri S. Hubungan antenatal care dengan kejadian bayi berat lahir rendah pada ibu aterm di RSUP Dr. M. Djamil Padang. J Kesehat Andalas. 2018;6(3):615. DOI:10.25077/jka.v6i3.747
14. Kumar A, Sharma E, Marley A, Samaan MA, Brookes MJ. Iron deficiency anaemia: Pathophysiology, assessment, practical management. BMJ Open Gastroenterol. 2022;9(1):1–9. DOI:10.1136/bmjgast-2021-000759
15. Ocktariyana O, Rohmah UN, Yulia S, Rosnani R, Mediarti D, Setyowati S, et al. Antenatal care in Indonesia: A nationwide study. Br J Midwifery. 2023;31(10):558–66. DOI:10.12968/bjom.2023.31.10.558
16. Noptriani S, Simbolon D. Probability of non-compliance to the consumption of iron tablets in pregnant women in Indonesia. J Prev Med Hyg. 2022;63(3):E456–63. DOI:10.15167/2421-4248/jpmh2022.63.3.2340
17. Sugianti E. Hubungan konsumsi tablet Fe, kunjungan antenatal, dan keikutsertaan kelas hamil dengan kejadian stunting pada balita. J Ris Gizi. 2021;9(2):114–9. Available from: https://ejournal.poltekkes-smg.ac.id/ojs/index.php/jrg/article/view/7689/3267
18. Kemenkes RI. Pencegahan dan penanggulangan anemia pada remaja putri dan wanita usia subur. NewsGe. 2018;4(1). Available from: https://promkes.kemkes.go.id/download/fpcl/files99778
19. Mulyasari I, Jatiningrum A, Setyani AP, Kurnia RRSS. Faktor risiko stunting pada 1000 hari pertama kehidupan. Amerta Nutr. 2022;6(1SP):177–83. DOI:10.20473/amnt.v6i1sp.2022.177-183
20. Mustafa H, Nurjana MA, Widjaja J, Wdayati AN. Faktor risiko dominan mempengaruhi kurang energi kronis (KEK) pada ibu hamil di Indonesia Tahun 2018. Bul Penelit Kesehat. 2021;49(2):105–12. DOI:10.22435/bpk.v49i2.4773
21. Sari K, Sartika RAD. The effect of the physical factors of parents and children on stunting at birth among newborns in Indonesia. J Prev Med Public Heal. 2021;54(5):309–16. DOI:10.3961/jpmph.21.120
22. Manggala AK, Kenwa KWM, Kenwa MML, Sakti AAGDPJ, Sawitri AAS. Risk factors of stunting in children aged 24-59 months. Paediatr Indones. 2018;58(5):205–12. DOI:10.14238/pi58.5.2018.205-12
23. WHO. Nutritional intervention: A secondary analysis of its effect on malnourished colombian pre-schoolers. In: Antenatal care for a positive pregnancy experience. 2016. p. 145–72. DOI:10.1177/016327878100400203
24. Sarker BK, Rahman M, Rahman T, Rahman T, Khalil JJ, Hasan M, et al. Status of the WHO recommended timing and frequency of antenatal care visits in Northern Bangladesh. PLoS One. 2020;15(11):1–21. DOI:10.1371/journal.pone.0241185
25. Ramadhini N, Sulastri D, Irfandi D. Hubungan antenatal care terhadap kejadian stunting pada balita usia 0-24 bulan di wilayah kerja Puskesmas Seberang Padang tahun 2019. J Ilmu

Kesehat Indones. 2021;1(3):246–53. DOI:10.25077/jikesi.v1i3.62
26. Dharmayanti I, Azhar K, Tjandrarini DH, Hidayangsih PS. Pelayanan pemeriksaan kehamilan berkualitas yang dimanfaatkan ibu hamil untuk persiapan persalinan di Indonesia. J Ekol Kesehat. 2019;18(1):60–9. DOI:10.22435/jek.18.1.1777.60-69