

RESEARCH STUDY

English Version

OPEN ACCESS

Adequate Iron Consumption during Pregnancy to Prevent Babies Born with *Stunting*

Konsumsi Zat Besi yang Adekuat selama Hamil untuk Cegah Bayi Lahir dengan *Stunting*

Dessy Hermawan^{1*}, Erna Listyaningsih², Gunawan Irianto³, Lolita Sary¹, Fonda Octarianingsih Shariff⁴, Devi Kurnisari¹, Christina Kusuma Reni⁴

¹Faculty of Health Sciences, Malahayati University, Lampung, Indonesia

²Faculty of Economic and Manajement, Malahayati University, Lampung, Indonesia

³Faculty of Health Sciences, Muhammadiyah Pringsewu University, Lampung, Indonesia

⁴Faculty of Medicine, Malahayati University, Lampung, Indonesia

ARTICLE INFO

Received: 08-07-2024

Accepted: 08-05-2025

Published online: 12-09-2025

*Correspondent:

Dessy Hermawan

hermawan.dessy@gmail.com



DOI:

10.20473/amnt.v9i3.2025.479-485

Available online at:

<https://e-journal.unair.ac.id/AMNT>

Keywords:

Stunting, Food Taboo, Iron Consumption, Teenage Pregnancy, Cigarette Smoke

ABSTRACT

Background: The incidence of *stunting* remained high until 2024, namely 21.6%, making it a national problem. *Stunting* can be predicted early by using the length of the birth body. However, many people do not care about the length of the baby's body at birth. Many factors affect the length of the baby's body at birth, including genetic and external factors. Anemia in pregnant women is one of the determining factors for *stunting*, so giving iron tablets is very important to prevent *stunting*.

Objectives: The purpose of this study was to analyze the relationship between iron tablet consumption and the baby's length at birth.

Methods: This study was an analytical survey that examines the characteristics of mothers who have live-born babies with mature in 2019 to 2023 in Tugurejo Village. Data were collected from records in the Mother and Child Health/MCH book and direct interviews with research subjects. The number of samples was 108 babies and their mothers. The collected data were analyzed using chi square & logistic regression tests.

Results: There was a significant relationship between taboo from consuming one source of protein (p-value=0.034), consumption of iron tablets during pregnancy (p-value=0.043), maternal age during pregnancy (p-value=0.001), and exposure to cigarette smoke during pregnancy (p-value=0.050) with baby's birth length. Meanwhile, the mother's height and the habit of drinking milk during pregnancy were not significantly related to the baby's birth length.

Conclusions: The dominant variables related to the length of the baby's birth are the completeness of iron tablet consumption and the mother's age during pregnancy.

INTRODUCTION

Until early 2024, *stunting* is still a national problem in Indonesia; this can be seen from the results of the latest Indonesian Nutrition Status Survey/Survey Status Gizi Indonesia), which shows that the national *stunting* rate is 21.6%¹. The *stunting* incidence rate still needs to reach the national target, namely below 14%, which must be achieved by the end of 2024². *Stunting* in Indonesia occurs almost evenly in all provinces, including Lampung Province. Even though *stunting* in Lampung has decreased, data for 2022 shows that the incidence of *stunting* in Lampung Province still reaches 15.8%³.

Children who experience *stunting* tend to get sick easily and have low intellectual abilities, which will affect the nation's competitiveness in the future. *Stunting* has not only short-term impacts but also long-term effects that are very detrimental to the child's future⁴. Children

with *stunting* will tend to grow short and get sick quickly, and what is most worrying is that *stunting* can also have an impact on children's cognitive development⁵. his condition is why *stunting* must be addressed immediately; it is closely related to the future of children and the future of the Indonesian nation.

The Government of the Republic of Indonesia has taken many actions, either by preventing or accelerating the reduction of *stunting*. Prevention is carried out not only for pregnant women and toddlers but also for young women by providing iron tablets. Even though it continues to decline, the incidence of *stunting* in children under five in Indonesia is still being reported.

Several things are thought to contribute to the occurrence of *stunting* in Indonesia, due to the still high rate of anemia in pregnant women⁶ and the occurrence of pregnancies at risky ages (less than 20 years or more

than 35 years). Even in 2022, Lampung Province will be ranked 10th in the province with the lowest average age at marriage in Indonesia, namely with an average age at which women marry 20.6 years⁷. From the average age at marriage, indeed, there are still many women in Lampung who marry and become pregnant at a risky age (less than 20 years). Even though the age is too young when getting married and pregnant means that the reproductive organs are not ready for the development of the baby, especially with the high incidence of anemia in pregnant women⁶. This is what is believed to cause many health problems for pregnant women and mothers giving birth in Indonesia, including giving birth to babies with short body length/stunting.

The body length of a baby at birth is influenced by many factors that occur before and during the pregnancy process⁸, but the mother's nutritional factors during pregnancy are thought to play the most role⁹. Therefore, providing various nutrients during pregnancy is very important, such as giving additional iron (Fe) and calcium tablets to pregnant women. Providing additional Fe and calcium tablets during pregnancy has long been programmed by the Government of the Republic of Indonesia. However, there are still many pregnant women who experience anemia⁶, as well as mothers giving birth to babies born with a body length in the short category (less than 48 cm).

Stunting can be recognized from the time the baby is born, namely by using the indicator of the baby's birth length¹⁰. Babies born short, namely less than 48 cm¹¹ are at risk of experiencing *stunting*; research results even report that babies born short have three times the risk of experiencing *stunting* compared to babies born with regular body length¹². Many studies have reported that the length of a baby's birth predicts *stunting*^{10,13}, but few have studied the risk factors that cause short babies to be born more deeply. Although many studies have examined the risk factors for short babies to be born, those that link them to an increased risk of *stunting* are still rare. This condition is exacerbated by the fact that many parents do not understand that short babies are an early warning of *stunting* during their child's development. This condition is what attracted the author to analyze the risk factors associated with short birth length in TugurejoTanggamus village, Lampung Province, Indonesia. Tugurejo Village was chosen as the research location because it contributed to many *stunting* incidents in Tanggamus Regency in 2021. Meanwhile, Tanggamus Regency was the first district with the highest number of *stunting* incidents in Lampung Province in 2021¹⁴. This research aims to find out the factors associated with short-birth babies, with the hope that once they are known, they can be prevented immediately while the baby is still in the womb so that when the baby is born, he or she will not experience *stunting*.

METHODS

Design and Sample

This study's design is an analytical observational study with a cross-sectional approach that attempts to analyze the risk factors for short birth length in Pekon Tugurejo, Semaka District, Tanggamus, Lampung Province. Primary and secondary data used come from

medical records of live births at the Health Center and Village Midwives. The data needed in this study uses secondary data sourced from the MCH book and direct interviews with the baby's mother. This research has received approval from the Health Research Ethics Commission at Malahayati University Bandar Lampung, with number 4039/EC/KEP-UNMAL/2023 dated April 21, 2023.

Research Subjects

Data was collected from live birth records between 2019 and 2023 in Tugurejo Village. The total number of live births over the last five years (2019-2023) was 108 live birth data, and all of them were used as samples in this study (total population). Meanwhile, primary data is obtained by direct interviews with research subjects to complete the data if the secondary data recorded in the birth record still needs to be completed. The data that was asked directly from the research subjects was data about whether there was abstinence from protein foods during pregnancy, whether there was exposure to cigarettes in the house during pregnancy, and the mother's milk drinking habits during pregnancy. Meanwhile, other data, such as the body length of the baby at birth, the mother's age during pregnancy, and completeness of iron tablet consumption, were obtained from KIA book records/maternal and child health (MCH) book records.

This research was conducted in Tugurejo Village, Tanggamus Regency. This study was conducted from July to September 2023. Data was collected from the KIA book, while data that was not in the KIA book was collected by conducting direct interviews with the baby's mother.

The baby's birth body length will be categorized as short if it is <48 cm and will be categorized as average body length if it is more than 48 cm^{15,16}. In this study, researchers categorized the presence or absence of behaviour of abstaining from animal protein sources by directly asking mothers of infants and toddlers whether they abstained from one source of protein (milk, eggs, fish and meat) during pregnancy. If the answer is yes, it is categorized as abstaining from one source of animal protein. Conversely, if the answer is no, then it is categorized as not abstaining from eating protein. This study did not measure the amount of protein consumed by the research subjects during pregnancy. The variable for complete consumption of iron tablets can be seen from the records in the MCH book; if 90 tablets are consumed during pregnancy, then it is categorized as complete, and if less than 90 tablets, then it is categorized as incomplete/deficient. Meanwhile, initial data for the mother's age when pregnant and height were obtained from the MCH book and reconfirmed during direct interviews with research subjects. The variables of the habit of consuming milk during pregnancy and whether there was exposure to cigarette smoke in the house during pregnancy were asked directly to the research subjects. To obtain data on the regularity of milk consumption during pregnancy, mothers of infants and toddlers were asked about their milk consumption habits. If the mother always and often consumes milk every day during pregnancy, then she is categorized as consuming

milk regularly, and vice versa. If she does not or rarely consumes milk during pregnancy, then she is categorized as not consuming milk regularly during pregnancy. In this study, the researcher used a research instrument to develop a list of questions to collect data that was not recorded or obtained in the KIA book.

Data Analysis

This research used descriptive analysis to describe the frequency distribution of categorical variable data. Meanwhile, data on the baby's body length at birth and the mother's characteristics were also analyzed bivariate using the chi-square test and a multivariate test using a logistic regression test with the help of a computer program. Data testing was conducted

at the Public Health Study Program at Malahayati University. The significance value used is $p\text{-value} \leq 0.05$.

RESULTS AND DISCUSSIONS

The results of the primary and secondary data collected were then tabulated in several tables. Table 1 shows that the average length of live babies born in Tugurejo between 2019-2023 was 48.3 cm, with the shortest value being 46 cm and the longest being 52 cm. Meanwhile, the average height of the mother was 155.7 cm, with the lowest value being 145 cm and the highest being 172 cm. The average age of the mother during pregnancy was 21.9 years, with the youngest age being 15 years and the oldest age of the mother during pregnancy being 30 years.

Table 1. Frequency distribution of birth length of babies born in Tugurejo in 2019-2023

Variable	Min	Maks	Average
Baby's Body Length at Birth (cm)	46	52	48.3
Mother's Height (cm)	145	172	155.7
Mother's age when pregnant (years old)	15	30	21.9

*cm: centimeters

Table 2. The relationship between maternal characteristics during pregnancy and the length of the baby's birth

Variable	Baby's Body Length at Birth		Total	%	p-value	OR (CI 95%)
	Stunted	Not Stunted				
Abstain from consuming protein during pregnancy						
Yes	5 (4.6%)	4 (3.7%)	9	8.3	0.034*	4.13 (1.02-16.6)
No	23 (21.3%)	76 (70.4%)	99	91.7		
Consuming iron during pregnancy						
Incomplete (less than 90 tablets)	11 (10.2%)	16 (14.8%)	27	25	0.043*	2.58 (1.01-6.59)
complete (90 tablets)	17 (15.7%)	64 (59.3%)	81	75		
Mother's Height						
Short (≤ 150 cm)	7 (6.5%)	9 (8.3%)	16	14.8	0.078	2.63 (0.87-7.91)
Normal (> 150 cm)	21 (19.5%)	71 (65.7%)	92	85.2		
Mother's age when pregnant						
High risk (less than 20 years or more than 35 years)	13 (12.1%)	9 (8.3%)	22	20.4	0.001*	6.83 (2.47-18.8)
Low risk (20-35 years)	15 (13.9%)	71 (65.7%)	86	79.6		
Regularly consume milk during pregnancy						
No (Rarely and never drink milk during pregnancy)	9 (8.3%)	13 (12.1%)	22	20.4	0.072	2.44 (0.91-6.57)
Yes (Often or always drink milk during pregnancy)	19 (17.6%)	67 (62%)	86	79.6		
Exposure to cigarette smoke during pregnancy at home						
Exposed	24 (22.2%)	53 (49.1%)	77	71.3	0.050*	3.05 (0.96-9.70)
Not exposed	4 (3.7%)	27 (25%)	31	28.7		

* p-value ≤ 0.05 , the difference was statistically significant; p-value: Probability Value; OR: Odds Ratio; 95% CI: 95% Confidence Interval; %: Percentage of Respondents Total; >: Less than; More than; $\leq$: Less than or equal to; $\geq$: More than or equal to

The results of the primary and secondary data collected were then tabulated in several tables. Table 1 shows that the average length of a baby at birth is 48.3 cm, which is still slightly above the standard limit of 48 cm. There are still many: 28 babies (25.9%) who were born with short body length (< 48 cm). Table 2 shows that there are still 25% of mothers who do not consume enough iron tablets during their pregnancy, and there are still 20.4% who are pregnant at a risky age (too young or

too old). At the same time, the most worrying thing is that 71.7% of mothers were exposed to cigarette smoke pollution at home during their pregnancy.

In Table 2, it was found that several variables related to the length of the baby at birth were as follows, namely: the existence of restrictions on consuming one source of protein ($p\text{-value}=0.34$), the complete intake of iron tablets during pregnancy ($p\text{-value}=0.043$), the mother's age during pregnancy ($p\text{-value}=0.001$) and

exposure to cigarette smoke in the house during pregnancy (p -value=0.050). Meanwhile, the variables of maternal height and milk drinking habits during pregnancy were not significantly related to the body length of the baby born.

In Table 1, 25.9% of babies born in Tugurejo village from 2019 to 2023 still had short birth lengths (less than 48 cm). This condition illustrates that many babies born in the short category are at risk of stunting. This is in accordance with data showing that the incidence of *stunting* in the Tanggamus district until 2021 was still around 25¹⁴. In fact, a baby's body length at birth can be used as an initial indicator and an early warning of the possibility of *stunting* as a toddler^{10,17}.

From Table 2, it appears that the habit of abstaining from eating protein sources in pregnant women (eggs, fish, meat, and milk) is significantly related to the body length of the baby they give birth to (p -value=0.034) with an OR value of 4.31, which means that the mother who Abstaining from animal protein foods has the potential to have a baby with a short birth length of 4.31 times compared to mothers who do not abstain from eating protein. Animal protein sources are needed during pregnancy. Previous research has reported a relationship between adequate consumption of animal protein and the incidence of *stunting* in toddlers¹⁸. Protein is essential for pregnant women to meet their increasing protein needs during pregnancy. The need for protein will increase as the period increases after pregnancy¹⁹. Adequate protein intake during pregnancy is essential for embryo survival, growth, and development. Low maternal dietary protein intake can lead to miscarriage, intrauterine growth restriction, and suboptimal postnatal growth due to deficiencies of certain amino acids essential for metabolism and cell function²⁰.

In Table 2, it is also seen that there is a significant relationship between the completeness of consuming iron/Fe tablets during pregnancy and the body length of the newborn (p -value=0.043), with an OR value of 2.85, which means that mothers who consume completely (90 tablets) during pregnancy will have the potential to have a baby with an average body length of 2.85 times compared to mothers who do not consume iron tablets completely. Iron is essential to meet iron needs, which increase during pregnancy; if needs are not met, it can cause pregnancy anemia²¹. There are high cases of anemia in pregnant women in Indonesia, with almost half of them experiencing anemia²², so additional iron tablets are used as an alternative to meet iron needs in treating anemia. Anemia in both pregnant women and toddlers is thought to be closely related to *stunting*. The high number of cases of anemia in children and toddlers is exacerbated by the still high number of worm infections caused by poor hygiene behavior^{18,23}.

The mother's height was not significantly related to the body length of the baby she was born with (p -value=0.078). Although the baby's body length will be influenced by the height of the parents genetically, external environmental factors such as adequate nutrition during pregnancy seem to have a stronger influence on the baby's body length than genetic factors²⁴. This condition can explain why children can be

taller than their parents. Alternatively, vice versa, children who are shorter than their parents. Adequate nutritional factors during pregnancy, childhood, and growth play a far more significant role in determining a child's height than genetic factors, because nutritional factors can optimize genetic factors²⁵.

In Table 2, it is also found that the mother's age during pregnancy is also significantly related to the birth length of the baby (p -value=0.001) with a value of OR=6.83, which means that mothers who become pregnant at an at-risk age have the potential to give birth to babies with a short body length of 6.83 times, if compared with mothers who became pregnant at a non-risk age. The high age of marriage at a young age is thought to be the cause of the high number of pregnant women at risk ages, even though many studies report a relationship between early marriage age and the incidence of *stunting*²⁶. A pregnancy that is too young (less than 20 years) is precarious for the mother's health as well as the baby's health, including the risk of being born with a short body length. This is associated with the mother not being physically and psychologically ready to get pregnant and give birth, so many are found to have births with problems, for example, experiencing premature births²⁷ and many other health problems. On the other hand, mothers who are pregnant over the age of 35 are at risk of experiencing many disorders that can be dangerous for the mother and her baby. Various studies have reported that being pregnant over the age of 35 increases the risk of miscarriage, postpartum haemorrhage and premature birth²⁸.

The habit of consuming milk during pregnancy was not significantly related to the baby's birth length (p -value=0.072). This is certainly different from previous studies, which reported a relationship between milk consumption during pregnancy and an increase in the birth weight and length of the baby²⁹. However, several studies recommend not giving too much milk to pregnant women because it can cause an increase in maternal weight/obesity, thereby triggering various degenerative diseases in the future³⁰. There was no significant relationship between the habit of consuming milk during pregnancy and the baby's body length in this study. This is thought to be due to disruption of the nutrient absorption process in pregnant women, for example, due to worm infections³¹ or other absorption disorders due to competitive barriers³², so that the essential nutrients in milk cannot be absorbed optimally.

In Table 2, it was found that exposure to cigarette smoke in the house during pregnancy was significantly related to the birth length of the baby (p -value=0.050) with an OR=3.05. This shows that pregnant women who are exposed to cigarette smoke are at risk of having short-term babies when compared to mothers who are not exposed to cigarette smoke. The results of this study are in accordance with research that reports that exposure to cigarette smoke during pregnancy will reduce the body length and head circumference of the baby at birth³³. The more prolonged exposure to cigarette smoke experienced by pregnant women or toddlers (more than 3 hours/day) is also reported to increase the risk of *stunting* in toddlers ten times³⁴.

Table 3. Results of multivariate analysis between maternal characteristics and baby's length at birth

Variable	p-value	OR	CI (95%)
Consuming iron during pregnancy	0.050*	2.98	0.99-8.91
Mother's age when pregnant	0.001*	9.01	2.85-18.4
Mother's Height	0.111	2.69	0.79-9.08
Exposure to cigarette smoke at home	0.060	3.67	0.94-14.2

* p-value ≤ 0.05 , the difference was statistically significant; p-value: Probability Value; 95% CI: 95% Confidence Interval; OR: Odds Ratio

In Table 3, the most dominant variables related to the length of the baby at birth are the consumption of complete iron tablets (p-value=0.050) and the mother's age during pregnancy (p-value=0.001). The results of the multivariate analysis showed that the mother's age during pregnancy was the most dominant factor related to the incidence of short birth babies (p-value=0.001), with an OR value of 9.01, which means that mothers who become pregnant at an at-risk age will have the potential to give birth to babies with a short body length of 9.01 times. When compared with pregnant mothers at an age who are not at risk. The physical and psychological maturity of the mother during pregnancy seems to have a significant influence on the health and growth of the baby she is carrying. Various efforts can be made to prevent pregnancy at a very young age, for example, by delaying marriage at a young age and delaying pregnancy until the age of maturity (between 20-35 years). There also needs to be strong efforts from the family, especially parents, to ensure that their children do not marry at too young an age because Law No. 16 of 2019 concerning marriage in Indonesia provides permission for the marriage age to be limited to 19 years, of course, it is still relatively young from a health perspective.

Multivariate analysis also showed that the variable completeness of iron tablet consumption was significantly related to the birth length of the baby (p-value=0.050) with an OR of 2.98, which means that pregnant women who consumed incomplete or less than 90 iron tablets would have the potential to have a baby with a long body length—short birth when compared with mothers who consumed complete iron tablets during their pregnancy (table 3). Supplemental iron is used to prevent anemia during pregnancy. Pregnancy anemia has been reported to cause various health problems for both the mother and the unborn baby. Anemia is also reported to cause postnatal disorders, for example, an increase in the potential for postpartum hemorrhage³⁵ and *stunting* in toddlers³⁶. Discomfort when consuming iron tablets, such as constipation, bloating, and nausea/vomiting, have long been reported by many pregnant women³⁷, requires modification and prevention so that this complaint does not become an obstacle to consuming iron tablets during pregnancy. There needs to be education about the right time to consume iron so as not to increase nausea and vomiting, and education is needed to increase the consumption of fruit that contains lots of vitamin C³⁸ and contains lots of fiber so that it can increase the iron absorption process and prevent the occurrence of iron constipation³⁹. Food sources that naturally contain a lot of iron, such as meat, liver, and green vegetables, can also be used as additional alternatives to meet the increased iron needs during

pregnancy. In fact, *stunting* prevention should ideally be carried out during adolescence or before pregnancy⁴⁰.

The weakness of this study is that the researcher collected secondary data sourced from birth registration data at the village midwife and conducted direct interviews with research subjects. This activity is carried out if the secondary data in the birth registration is incomplete. However, there are weaknesses because what was asked of the research subjects was past data; some research subjects no longer remember or have forgotten, so they need to ask for help from other family members to remember the data asked. Some research subjects were also interviewed several times while waiting for their memories to be recalled.

CONCLUSIONS

The completeness of iron tablet consumption during pregnancy and the age at which the mother becomes pregnant is related to the length of the baby at birth. The less complete the mother's consumption of iron tablets and the younger the mother is when pregnant, the higher the potential for the mother to give birth to a baby with a short body length.

Serious efforts are needed to increase the amount of iron intake during pregnancy, whether obtained from taking iron tablets or from foods that naturally contain a lot of iron, so as to meet the increased iron needs during pregnancy. Efforts are also needed to prevent marriage and pregnancy at an early age, for example, by advocating for changes in regulations regarding the age of marriage.

ACKNOWLEDGEMENT

The author thanks the Indonesian Ministry of Education and Culture for funding this research through the PkM-PMM grant program in 2023 and also thanks the Head of Tugurejo Village for allowing us to collect data for this research.

CONFLICT OF INTEREST AND FUNDING DISCLOSURE

This research was funded by the Indonesian Ministry of Education and Culture through the 2023 PkM-PPM grant program, contract number 128/E.5/PG.02.00.PM/2023. All authors involved in this research declare that there is no conflict of interest.

AUTHOR CONTRIBUTIONS

DH: conceptualization, methodology, investigation, supervision, validation, writing—review and editing; EL: validation, formal analysis, resources; GI: licensing and data collection, project administration; LS: licensing and data collection; FO: formal analysis, resources, validation; DK & CKR: data collection.

REFERENCES

1. Ministry of Health of the Republic of Indonesia. *Results of the 2022 Indonesian Nutrition Status Survey/Hasil Survei Status Gizi Indonesia (SSGI) 2022*. (Kementerian Kesehatan Republik Indonesia, 2023).
2. Ministry of State Apparatus Empowerment & Bureaucratic Reform of the Republic of Indonesia. President: Target of a stunting prevalence rate below 14% by 2024 must be achieved (Presiden: Target Angka Prevalensi Stunting Di Bawah 14 Persen pada 2024 Harus Tercapai). *Ministry of State Apparatus Empowerment & Bureaucratic Reform of the Republic of Indonesia* (2022). Available at: <https://www.menpan.go.id/site/berita-terkini/dari-istana/presiden-target-angka-prevalensi-stunting-di-bawah-14-persen-pada-2024-harus-tercapai>. (Accessed: 25th March 2022).
3. Khoiriyah, S. Stunting Rate in Lampung 2022 Decreased to 15.8% (Angka Stunting di Lampung 2022 Turun Menjadi 15,8 %). *kupastuntang.co* (2022). Available at: <https://www.kupastuntas.co/2022/12/12/angka-stunting-di-lampung-2022-turun-menjadi-158-persen#:~:text=Kupastuntas.co%2C Bandar Lampung -,berada diangka 18%2C8 persen>.
4. Soliman, A. *et al.* Early and long-term consequences of nutritional stunting: From childhood to adulthood. *Acta Biomed* **92**, 1–12 (2021). <https://doi.org/10.23750/abm.v92i1.11346>.
5. Ekholuenetale, M., Barrow, A., Ekholuenetale, C. E. & Tudeme, G. Impact of stunting on early childhood cognitive development in Benin: evidence from Demographic and Health Survey. *Egypt. Pediatr. Assoc. Gaz* **68**, (2020). <https://doi.org/10.1186/s43054-020-00043-x>.
6. Kementrian Kesehatan Republik Indonesia. *Riskesdas 2018*. (Sekretariat Litbang Kesehatan Kemenkes, 2018).
7. Muhammad, N. 10 Provinsi dengan Rata-rata Usia Kawin Perempuan Terendah pada 2022. *Katadata Media Network* (2023). Available at: <https://databoks.katadata.co.id/datapublish/2023/08/16/10-provinsi-dengan-rata-rata-usia-kawin-perempuan-terendah-pada-2022>.
8. Jamshed, S. *et al.* Frequency of Normal Birth Length and Its Determinants: A Cross-Sectional Study in Newborns. *Cureus* **12**, (2020).DOI: 10.7759/cureus.10556.
9. Marshall, N. E. *et al.* The importance of nutrition in pregnancy and lactation: lifelong consequences. *Am. J. Obstet. Gynecol* **226**, 607–632 (2022). DOI: 10.1016/j.ajog.2021.12.035.
10. Judiono, J. *et al.* Determinant Factors of Short Birth Length Baby as a Risk Factor of Stunting in West Java. *Amerta Nutr.* **7**, 240–247 (2023). <https://doi.org/10.20473/amnt.v7i2.2023.240-247>.
11. Trihono *et al.* Pendek (Stunting) di Indonesia, *masalah dan solusinya*. (Lembaga Penerbit Balitbangkes, 2015).
12. Nurillah Amalia, Kencana Sari & Indri Yunita Suryaputri. Panjang Badan Lahir Pendek Sebagai Salah Satu Faktor Determinan Keterlambatan Tumbuh Kembang Anak Umur 6-23 Bulan di Kelurahan Jaticempaka, Kecamatan Pondok Gede, Kota Bekasi. *J. Ekol. Kesehat.* **3–9** (2016). DOI: 10.22435/jek.v15i1.4959.43-55.
13. Krebs, N. F. *et al.* Birth length is the strongest predictor of linear growth status and stunting in the first 2 years of life after a preconception maternal nutrition intervention: the children of the Women First trial. *Am. J. Clin. Nutr* **116**, 86–96 (2022). <https://doi.org/10.1093/ajcn/nqac051>.
14. Kusnandar, V. B. Daftar Kabupaten di Lampung dengan Prevalensi Balita Stunting Tertinggi 2021. *Katadata Media Network* (2022). Available at: <https://databoks.katadata.co.id/datapublish/2022/08/10/daftar-kabupaten-di-lampung-dengan-prevalensi-balita-stunting-tertinggi-2021>.
15. Sari, N. A. M. E. & Resiyanthi, N. K. A. Kejadian Stunting Berkaitan Dengan Perilaku Merokok Orang Tua. *J. Ilmu Keperawatan Anak* **3**, 24–30 (2020). <https://doi.org/10.30994/jnp.v7i2.466>.
16. Ministry Health of the Republic of Indonesia. *Basic Health Research 2013*. (2013).
17. Sari, K. & Sartika, R. A. D. The effect of the physical factors of parents and children on stunting at birth among newborns in Indonesia. *J. Prev. Med. Public Heal* **54**, 309–316 (2021). <https://doi.org/10.3961/jpmph.21.120>.
18. Hermawan, D., Kurniasari, D., Sandayanti, V., Sari, N. & Listyaningsih, E. Relationships of deworming drug consumption and animal protein intake with stunting. *Parasite Epidemiol. Control* **23**, e00326 (2023). <https://doi.org/10.1016/j.parepi.2023.e00326>.
19. Elango, R. & Ball, R. O. Protein and Amino Acid Requirements during Pregnancy. *Adv. Nutr* **7**, 839S-844S (2016). <https://doi.org/10.3945/an.115.011817>.
20. Herring, C. M., Bazer, F. W., Johnson, G. A. & Wu, G. Impacts of maternal dietary protein intake on fetal survival, growth, and development. *Exp. Biol. Med* **243**, 525–533 (2018). <https://doi.org/10.1177/1535370218758275>.
21. Ambarsari, N. D., Herlina, N., Dewanti, L. & Ernawati. Correlation Between Compliance With Iron Tablet Consumption and Iron Nutrition Intake With Pregnant Women'S Hemoglobine Consumption. *Indones. J. Public Heal* **18**, 72–81 (2023). <https://doi.org/10.20473/ijph.v18i1.2023.72-81>.
22. BPS-STATISTICS-INDONESIA. Prevalence of Anemia in Pregnant Women, 2013-2018. *Badan Pusat Statistik* (2021). Available at: <https://www.bps.go.id/en/statistics-table/2/MTMzMyMy/prevalence-of-anemia-in-pregnant-women.html>.

23. Yulyani, V., Febriani, C. A., Shaharudin, M. S. & Hermawan, D. Patterns and determinants of open defecation among urban people. *Kesmas* **16**, 45–50 (2021). <https://doi.org/10.21109/kesmas.v16i1.3295>.
24. Yokoyama, Y. *et al.* Genetic and environmental factors affecting birth size variation: A pooled individual-based analysis of secular trends and global geographical differences using 26 twin cohorts. *Int. J. Epidemiol* **47**, 1195–1206 (2018). <https://doi.org/10.1093/ije/dyy081>.
25. Grasgruber, P., Cacek, J., Kalina, T. & Sebera, M. The role of nutrition and genetics as key determinants of the positive height trend. *Econ Hum Biol* **15**, (2014). <https://doi.org/10.1016/j.ehb.2014.07.002>.
26. Restiana, R. P. & Fadilah, T. F. Relationship Between Early Marriage and Incidence of Stunting in Children Aged 24-59 Months. *Proc. 3rd Borobudur Int. Symp. Humanit. Soc. Sci. 2021 (BIS-HSS 2021)* 924–929 (2023). DOI: 10.2991/978-2-494069-49-7_156.10.2991/978-2-494069-49-7_156
27. Diabelková, J. *et al.* Adolescent Pregnancy Outcomes and Risk Factors. *Int. J. Environ. Res. Public Health* **20**, 0–9 (2023). <https://doi.org/10.3390/ijerph20054113>
28. Jolly, M., Sebire, N., Harris, J., Robinson, S. & L Regan. The risks associated with pregnancy in women aged 35 years or older. *Hum. Reprod* **15**, (2000). <https://doi.org/10.1093/humrep/15.11.2433>.
29. Achón, M., Úbeda, N., García-González, Á., Partearroyo, T. & Varela-Moreiras, G. Effects of Milk and Dairy Product Consumption on Pregnancy and Lactation Outcomes: A Systematic Review. *Adv. Nutr* **10**, S74–S87 (2019). <https://doi.org/10.1093/advances/nmz009>.
30. Melnik, B. C., John, S. M. & Schmitz, G. Milk consumption during pregnancy increases birth weight, A risk factor for the development of diseases of civilization. *J. Transl. Med* **13**, 1–11 (2015). <https://doi.org/10.1186/s12967-014-0377-9>.
31. Fauziah, N., Aviani, J. K., Agrianfanny, Y. N. & Fatimah, S. N. Intestinal Parasitic Infection and Nutritional Status in Children under Five Years Old: A Systematic Review. *Trop. Med. Infect. Dis.* **7**, (2022). <https://doi.org/10.3390/tropicalmed7110371>.
32. Piskin, E., Cianciosi, D., Gulec, S., Tomas, M. & Capanoglu, E. Iron Absorption: Factors, Limitations, and Improvement Methods. *ACS Omega* **7**, 20441–20456 (2022). <https://doi.org/10.1021/acsomega.2c01833>.
33. Quelhas, D. *et al.* The association between active tobacco use during pregnancy and growth outcomes of children under five years of age: A systematic review and meta-analysis. *BMC Public Health* **18**, 1–17 (2018). <https://doi.org/10.1186/s12889-018-6137-7>.
34. Astuti, D. D., Handayani, T. W. & Astuti, D. P. Cigarette smoke exposure and increased risks of stunting among under-five children. *Clin. Epidemiol. Glob. Heal.* **8**, 943–948 (2020). <https://doi.org/10.1016/j.cegh.2020.02.029>.
35. Mansukhani, R. *et al.* Maternal anaemia and the risk of postpartum haemorrhage: a cohort analysis of data from the WOMAN-2 trial. *Lancet Glob. Heal.* **11**, e1249–e1259 (2023). DOI: 10.1016/S2214-109X(23)00245-0.
36. Amaliah, R., Nasution, A. & Khairunnisa. Analysis of Pharmacist Intervention in Anaemic Pregnant Women in Stunting Prevention. *Int. J. Sci. Technol. Manag.* **4**, 674–680 (2023). <https://doi.org/10.46729/ijstm.v4i3.835>.
37. Tolkien, Z., Stecher, L., Mander, A. P., Pereira, D. I. A. & Powell, J. J. Ferrous sulfate supplementation causes significant gastrointestinal side-effects in adults: A systematic review and meta-analysis. *PLoS One* **10**, 1–20 (2015). <https://doi.org/10.1371/journal.pone.0117383>.
38. Skolmowska, D. & Głabska, D. Effectiveness of Dietary Intervention with Iron and Vitamin C Administered Separately in Improving Iron Status in Young Women. *Int. J. Environ. Res. Public Health* **19**, 1–19 (2022). <https://doi.org/10.3390/ijerph191911877>.
39. Huo, J., Wu, L., Lv, J., Cao, H. & Gao, Q. Effect of fruit intake on functional constipation: A systematic review and meta-analysis of randomized and crossover studies. *Front. Nutr.* **9**, 1–13 (2022). <https://doi.org/10.3389/fnut.2022.1018502>.
40. Renyoet, B. S., Dary, D. & Nugroho, C. V. R. Literature Review: Intervention on Adolescent Girls in 8000 First Days of Life (HPK) as Stunting Prevention. *Amerta Nutr.* **7**, 295–306 (2023). <https://doi.org/10.20473/amnt.v7i2.2023.295-306>.