

IGSCPS SPECIAL EDITION

RESEARCH ARTICLE

Identification of factors causing stunting in Lamper Tengah primary healthcare centre, Semarang City

Firdha Fauzia¹, Gusti Noorrizka Veronika Achmad² , Ana Yuda² 

¹ Faculty of Pharmacy, Universitas Airlangga, Surabaya, Indonesia

² Department of Pharmacy Practice, Faculty of Pharmacy, Universitas Airlangga, Surabaya, Indonesia

Keywords

Causal
Children
Environment
Factor
Maternal
Stunting

Correspondence

Gusti Noorrizka Veronika Achmad
Department of Pharmacy Practice
Faculty of Pharmacy
Universitas Airlangga
Surabaya
Indonesia
Gusti-n-v-a@ff.unair.ac.id

Abstract

Background: Stunting is a form of growth failure due to the accumulation of nutritional deficiencies characterised by height-for-age below the applicable standard. The prevalence of stunting in Indonesia in 2021 is 24.4%. In Semarang, the prevalence of stunting fluctuates. 2015, it was 14.4% and increased to 21% in 2017. Until 2021, the stunting rate in Semarang is 21.3%. The Semarang government has made various efforts, but the stunting rate has remained unchanged. **Objective:** This study aims to discover more about the factors that cause stunting in Semarang. **Method:** This research is qualitative research with a phenomenological approach. The data obtained in this study was from observation and interviews with mothers who have stunted children. **Result:** A total of 15 informants were selected using purposive sampling techniques. The analysis method used is a descriptive method with inductive analysis. **Conclusion:** The result showed maternal factors were inadequate nutrition intake, genetic factors, stress during pregnancy, and poverty. In comparison, the factors in children are low birth weight, repeated infections, children's difficulty eating, and micronutrient deficiency. The environmental factors are the home environment polluted with cigarette smoke and unhealthy home conditions, poor sanitation, and limited access to clean water, leading to repeated infections.

Introduction

Stunting is a disorder of child growth and development caused by poor nutrition, repeated infections, and inadequate psychosocial stimulation. Moreover, stunting has adverse short-term and long-term effects (WHO, 2018). In low and middle-income countries, such as Indonesia, stunting is a severe problem with high prevalence (Ssetongo *et al.*, 2021). The prevalence of stunting in children aged five years and under five years in Indonesia in 2021 is 24.4% (UNICEF-WHO, 2019). In Central Java, the stunting rate in toddlers is 20.9%, while in Semarang, the figure reaches 21.3% (Republic of Indonesia Health Research and Development Agency, 2021).

Moreover, according to Nutritional Status Monitoring (PSG) data on toddlers, the number of stunted toddlers in Semarang increases yearly. Initially, in 2015, it was 14.4%; in 2016, the percentage increased to 16.5%; in

2017, the prevalence of stunting under five in Semarang increased to 21%. Until 2021, the stunting rate in Semarang is 21.3% (Republic of Indonesia Health Research and Development Agency, 2021). The Semarang City government has tried to overcome stunting, including intervention in the First 1000 Days of Life and providing additional food for recovery for toddlers who experience stunting (Semarang City Government, 2021).

The Indonesian government has a target of an average annual reduction in stunting rate of 2.7% per year so that by 2024, the prevalence of stunting will only be 14% (Republic of Indonesia Health Research and Development Agency, 2021). However, the stunting rate in Semarang has stayed the same, not as expected by the Indonesian government. Therefore, this research aimed to discover more about the factors that cause stunting in toddlers in Semarang City, especially at the Central Lamper Community Health Centre.

Methods

A qualitative research design using a phenomenological approach was used to provide an in-depth understanding of "what" is experienced and "how" some mothers experience having stunted children. This research protocol received ethical approval from the Health Research Ethics Committee, Faculty of Pharmacy, Airlangga University, with certificate No.20/LE/2023. The case selection criteria used were as follows:

- 1) Mothers who have stunting toddlers at the Lamper Tengah Health Centre in Semarang City
- 2) The informant's identity data is listed in the parent data of stunting toddlers at the Lamper Tengah Health Centre in Semarang City in 2023.
- 3) Must be able to read and write in Indonesian
- 4) Informants are willing to conduct interviews and can communicate well.

Before collecting data, prospective informants were given an informed consent sheet and signed it as a form of agreement as respondents in this study. The data of this study was obtained from overt observations and interviews.

Results

Researchers interviewed 15 mothers who had stunted toddlers as informants. The characteristics of the informants can be seen in Table I. Based on Table I, the educational levels of the informants vary from those who haven't attended school to those who had graduated with a bachelor's degree. Meanwhile, regarding the respondents' height, nine out of fifteen mothers had heights < 155 cm. Most of the informants had enough money to deliver a baby.

Most informants (13 out of 15) could not mention the number of "Upper Arm Circumference." Several reasons informants gave included never measuring, not recording, and missing maternal and child health record cards. Five mothers had insufficient food during pregnancy, and based on the interviews with informants, ten informants did not consume fortified milk for pregnant mothers. However, all the informants always took the vitamins given by the doctor.

Table I: Informants' characteristics

No	Initial	Age (years)	Level of education	Mothers' height (cm)	Stress during pregnancy	Time of birth	Birth method	Age of stunted toddler (month)	Toddler's birth weight (kg)	Toddler's birth length (cm)
1	MS	28	Senior high school	164	No	Full term	Caesar	26	3.40	49
2	FK	40	Junior high school	150	Yes	Premature	Caesar	31	3.30	49
3	SN	19	Junior high school	160	No	Full term	Caesar	28	3.30	49
4	IW	43	Senior high school	158	No	Full term	Caesar	54	3.50	50
5	DWS	33	Junior high school	138	Yes	Full term	Caesar	36	3.00	49
6	DM	40	Bachelor	150	No	Full term	Normal	29	3.30	49
7	HM	39	Bachelor	153	No	Full term	Caesar	43	2.90	48
8	DWI	41	Senior high school	158	Yes	Full term	Normal	27	3.20	50
9	DS	28	Unschooling	154	No	Premature	Caesar	41	2.10	47
10	ENM	30	Senior high school	170	Yes	Full term	Normal	35	3.50	50
11	UNF	32	Senior high school	150	No	Full term	Caesar	45	3.35	50
12	KSM	38	Senior high school	154	No	Full term	Caesar	53	3.60	68
13	S	49	Senior high school	158	No	Premature	Caesar	34	3.20	48
14	AP	41	Elementary school	150	Yes	Premature	Caesar	47	2.29	45
15	FH	25	Senior high school	150	Yes	Premature	Caesar	42	3.30	70

Based on the results of interviews with the informants, most informants felt that there was psychosocial pressure on themselves during pregnancy (stress). There were several reasons why informants felt stressed, including not being able to eat while pregnant, old age, economic factors, first pregnancy, feeling embarrassed about being so young, feeling pain in the body, and thinking about sick parents.

Fourteen informants stated they had provided exclusive breastfeeding for six months. However, one informant only breastfed her baby for three months. Furthermore, eight informants began introducing complementary foods to breast milk when the baby reached six months of age. Meanwhile, ten out of the fifteen children had difficulty in eating.

Based on the recording of baby weights at birth at the Lamper Tengah Community Health Centre, Semarang City, thirteen out of fifteen stunted toddlers had an average birth weight that was in the range of 2.5-3.9 kg (Ministry of Health, 2020), and only two babies had birth weights below 2.5 kg UNICEF standard (UNICEF-WHO, 2019), namely 2.1 kg and 2.29 kg (LBW) respectively.

Four informants said their child did not take micronutrient supplements because the child did not want to or could not afford them; mothers thought that just eating was enough and getting advice from a doctor who explained that vitamins are an unnatural doping. The results of in-depth interviews with respondents revealed that most toddlers had received complete immunisations, while two had incomplete immunisations. Apart from that, the informants admitted that their child had recurrent infections. The history of infectious diseases from toddlers included one child suffering from pulmonary tuberculosis and 14 other children having a history of coughs, colds, fever, and diarrhoea.

Table II shows that the economic condition of all informants, viewed from work, income and expenditure, is included in the lower middle economic group and categorised as poor. Meanwhile, household size varies from small (two to four family members) to medium (four to six family members) to high household size (seven to eleven family members). The location of all the informants' houses was on the edge of a river, which was quite dirty. Furthermore, the results of direct observation of informants' houses found unsanitary housing conditions with humid and minimal sunlight exposure. Most informants stated that some of their families were active smokers.

Table II: Informants' socioeconomic conditions

Initial	Income (IDR)	Householder's job	Family members
MS	3.000.000	Motorbike-taxi Rider	10
FK	3.000.000	Labour	5
SN	4.500.000	Driver	3
IW	3.000.000	Hawker	3
DWS	3.060.348	Labour	4
DM	5.000.000	Nurse	4
HM	3.060.348	Security	4
DWI	No regular income	Odd jobs	9
DS	900.000	Buskers	5
ENM	2.500.000	Entrepreneur	5
UNF	2.000.000	Labour	4
KSM	2.800.000	Technician	4
S	2.500.000	Odd jobs	5
FH	1.500.000	Buskers	3
AP	2.000.000	Bricklayer	5

Discussion

The present study divided the stunting factor into maternal, child, environmental, and health services factors.

Maternal factors

Many studies have found that the mother's education level is a factor that influences the incidence of stunting (Hizni *et al.*, 2010; Sarma *et al.*, 2017; Fatima *et al.*, 2020). With higher education, the mother's knowledge regarding nutrition, recognising health problems and seeking medical help is also good (Berhe *et al.*, 2019). However, this study found that stunting incidents can affect toddlers with mothers of all levels of education. Several other studies also find similar findings that mothers at various levels of education can experience stunting; however, the lower the level of education, the higher the risk of having a stunted toddler (Mzumara *et al.*, 2018; Li *et al.*, 2020; Laksono *et al.*, 2022). Moreover, maternal education does not directly affect stunting, but maternal education is more related to the mother's opportunity to get a job and increase family wealth so that it can provide a sufficient supply of nutritious food (Abuya *et al.*, 2012; Leroy *et al.*, 2014)

Table I shows nine out of the fifteen mothers were < 155 cm tall. Mothers with a height < 155 cm tend to give birth to children with low birth weights, which will impact malnutrition and generate stunting (WHO, 2018). Mothers' height is a genetic factor affecting children's physical growth (Zhang *et al.*, 2015; Wu *et al.*, 2015). Short mothers with a height below 145 cm have a two times greater risk of having stunted children and

a three times greater risk of having severely stunted children than tall mothers with a body height of 155 cm and above (Khatun *et al.*, 2019). Furthermore, a study in Malaysia found that the mother's height is a factor that directly influences stunted children (Lee *et al.*, 2022).

Six out of fifteen informants felt stressed during pregnancy. Informants conveyed the causes of stress they experienced, including difficulty eating during pregnancy, old age, economic factors, vomiting with high frequency, fear of giving birth due to their first pregnancy, embarrassment because they were pregnant at a very young age, and sadness due to family problems. Table I shows that informants who experience stress tend to give birth prematurely and to babies with low birth weights. These results are in agreement with previous research conducted by Liou and colleagues in 2016, which proved that mental stress experienced by pregnant women could cause premature birth or a baby with low birth weight.

The nutritional status of pregnant women is related to the incidence of stunting—the health development of mothers and children during pregnancy, childbirth and breastfeeding. For pregnant women, nutrition is essential to maintain and meet the mother's and foetus's nutritional needs in the womb (Ministry of Health, 2019). Several studies have found that milk consumption during pregnancy has an impact on foetal growth, although the role of the ingredients in milk needs further investigation (Achón *et al.*, 2019; Huang *et al.*, 2022; Yang *et al.*, 2022; Rohmawati *et al.*, 2023).

Child factors

Based on stunting toddler research data from the Lamper Tengah Healthcare Centre in Semarang City, two stunted toddlers in this study had low birth weights of 2.1 kg and 2.20 kg, respectively. Low body weight is a child factor closely related to the mother's risk of stunting. Several factors that cause low birth weight are pregnant women with poor nutrition, mothers giving birth prematurely, the age of pregnant women, the stress in pregnant women, and socioeconomic factors (Kaur *et al.*, 2019; UNICEF-WHO, 2019).

One informant introduced early complementary food to her baby. Starting complementary food feeding at the right time will be very beneficial for meeting babies' nutritional needs and growth and development (IDAI, 2015). Introducing complementary foods at least four months old is not recommended because the baby's digestive tract is still developing.

Four informants said that their children did not consume micronutrient supplements. Reasons for not consuming include: children do not want to consume

micronutrients; informants cannot afford micronutrient supplements; the informant thought that eating alone was enough and received advice from a doctor who explained that vitamins were unnatural doping. However, supplementation and fortification interventions have successfully reduced the burden of micronutrient malnutrition in children (Tam *et al.*, 2020). A similar study also found that micronutrient powder supplementation is a cost-effective intervention to improve micronutrient status, haemoglobin levels, and growth parameters in children under five (Khan *et al.*, 2023).

Immunisation is the most powerful protection to prevent several dangerous diseases. The data showed that only two toddlers were incompletely immunised, while 13 others were fully immunised. The results of this study show that children under five who have been fully immunised are still likely to be stunted. This study's findings differ from several other studies, which found that toddlers whose immunisation was incomplete had a greater risk of stunting than those with complete immunisation (Mukhlis *et al.*, 2020; Solis-Soto *et al.*, 2020). Furthermore, immunised toddlers do not show signs of stunting. These findings differed from several other studies, which mentioned that toddlers whose immunisation was incomplete had a greater risk of stunting than those with complete immunisation. This shows that other factors caused stunting in our informants.

The main causes of death in children under five years are premature birth, lower respiratory tract infections, and infectious diarrhoea. Some diseases can even be prevented by vaccination, namely lower respiratory tract infections, meningitis and measles (Perin *et al.*, 2022). However, this research shows that even though most toddlers have received complete immunisation, they are still susceptible to disease.

Environment factors

Unsanitary housing conditions, such as humidity and minimal sunlight exposure, were found at the informant's house. The location of all the informants' houses was on the edge of a river, which was quite dirty and dirty. Aspects of sanitation and family hygiene behaviour affect the threat of infectious diseases and digestive disorders, ultimately affecting children's growth and development. Low sanitation and hygiene will trigger digestive disorders that impact nutrients for growth and become body resistance in the face of infection, causing stunting cases in toddlers (Schmidt *et al.*, 2014).

Most informants stated that some of their families were active smokers. Tobacco smoke contains over 7,000 chemicals, of which hundreds are toxic. Smokers

feel the impact of cigarette smoke themselves and the people around them, called passive smoke. Exposure to cigarette smoke can affect a child's nutritional status. The predictor of stunting in children under five years is father smoking. Exposure to smoking for more than three hours a day increases the risk of children being stunted (Muchlis *et al.*, 2023). This study data showed that three people smoked in her house, and the informant had two children exposed to pneumonia.

Research in several countries on the effect of second-hand smoke (SHS) and lower respiratory tract infections (LRI) shows that in 2019, globally, an estimated 6.94% (3.80–10.12%) of deaths due to LRI under five years were caused by SHS, with a mortality rate under five years of 7.02 per 100,000. Similarly, 6.95% (3.81–10.13%) of Disability Adjusted Live Years LRI was caused by SHS in children under five years, with an under-5 rate of 619.36 DALYs per 100,000 (Xiang *et al.*, 2023).

All the respondents belong to lower income groups, and research conducted by Wahyuni and Fitriyuna in 2020 confirms that the socioeconomic level affects the family's ability to meet the nutritional needs of toddlers; in addition, socioeconomic conditions also affect the selection of additional foods and feeding times and healthy living habits. This socioeconomic condition is very influential on the incidence of stunting toddlers. The size of the informant's household varies from the most minor, namely three, to the largest, namely ten family members. Toddlers living in crowded households risk experiencing stunting (Beal *et al.*, 2018).

Health service factors

Monitoring the nutritional status of pregnant women by measuring the circumference of the upper arms must be carried out periodically so that the condition of pregnant women who experience chronic energy deficiency can be identified and treated immediately (Kpewou *et al.*, 2020).

The statement of several informants that their upper arm circumference had never been measured is an essential thing that health workers need to pay attention to, especially at the Community Health Centre in the Maternal and Child Health Department. Moreover, almost half of the informants gave birth prematurely, and most of the informants gave birth via caesarean section. The condition of a malnourished mother makes the mother unhealthy and can experience various pregnancy complications such as preeclampsia and premature birth. It also increases the possibility of giving birth via caesarean section (Farias *et al.*, 2020; Young & Ramakrishnan, 2021).

Conclusion

The causes of maternal infections are inadequate nutrition intake during pregnancy, genetic factors, stress during pregnancy, and poverty. Child factors are low birth weights, repeated infections, children's difficulty eating, and micronutrient deficiency. Also, the environmental factors are the home environment polluted with cigarette smoke, unhealthy home conditions, and poor sanitation, which leads to repeated infections.

Acknowledgement

Completing this research project would not have been possible without the contributions and support of many individuals. We want to extend our sincere thanks to all the participants in our study, who generously shared their time, experiences, and insights with us. Their willingness to engage with our research was essential to the success of this project.

Source of funding

This research received a Project Budget from the Faculty of Pharmacy Universitas Airlangga.

References

- Abuya, B. A., Ciera, J., & Kimani-Murage, E. (2012). Effect of mother's education on child's nutritional status in the slums of Nairobi. *BMC paediatrics*, *12*, 80. <https://doi.org/10.1186/1471-2431-12-80>
- Achón, M., Úbeda, N., García-González, Á., Partearroyo, T., & Varela-Moreiras, G. (2019). Effects of milk and dairy product consumption on pregnancy and lactation outcomes: A systematic review. *Advances in nutrition (Bethesda, Md.)*, *10*(2), S74–S87. <https://doi.org/10.1093/advances/nmz009>
- Beal, T., Tumilowicz, A., Sutrisna, A., Izwardy, D., & Neufeld, L. M. (2018). A review of child stunting determinants in Indonesia. *Maternal & child nutrition*, *14*(4), e12617. <https://doi.org/10.1111/mcn.12617>
- Berhe, K., Seid, O., Gebremariam, Y., Berhe, A., & Etsay, N. (2019). Risk factors of stunting (chronic undernutrition) of children aged 6 to 24 months in Mekelle City, Tigray Region, North Ethiopia: An unmatched case-control study. *PLoS one*, *14*(6), e0217736. <https://doi.org/10.1371/journal.pone.0217736>
- Fatima, S., Manzoor, I., Joya, A. M., Arif, S., & Qayyum, S. (2020). Stunting and associated factors in children of less than five years: A hospital-based study. *Pakistan journal of medical sciences*, *36*(3), 581–585. <https://doi.org/10.12669/pjms.36.3.1370>

- Hizni, A., Julia, M., & Gamayanti, I. (2010) Stunted status and its relationship with the development of children under five in the coastal area of North Beach, Lemahwungkuk District, Cirebon City. *Indonesian Journal of Clinical Nutrition*, **6**(3), 131–137. <https://doi.org/10.22146/ijcn.17721>
- Huang, D., Wu, Q., Xu, X., Ji, C., Xia, Y., Zhao, Z., Dai, H., Li, H., Gao, S., Chang, Q., & Zhao, Y. (2022). Maternal consumption of milk or dairy products during pregnancy and birth outcomes: A systematic review and dose-response meta-analysis. *Frontiers in nutrition*, **9**, 900529. <https://doi.org/10.3389/fnut.2022.900529>
- IDAI. (2015). *Recommendations for evidence-based feeding practices for infants and toddlers in Indonesia to prevent malnutrition*. Nutrition and Metabolic Disease Coordination Working Unit Indonesian Paediatrician Association.
- Kaur, S., Ng, C. M., Badon, S. E., Jalil, R. A., Maykanathan, D., Yim, H. S., & Jan Mohamed, H. J. (2019). Risk factors for low birth weight among rural and urban Malaysian women. *BMC Public Health*, **19**(4), 539. <https://doi.org/10.1186/s12889-019-6864-4>
- Khan, A., Ul-Haq, Z., Fatima, S., Ahmed, J., Alobaid, H. M., Fazid, S., Muhammad, N., Garzon, C., Ihtesham, Y., Habib, I., Tanimoune, M., Iqbal, K., Arshad, M., & Safi, S. Z. (2023). Long-term impact of multiple micronutrient supplementation on micronutrient status, haemoglobin level, and growth in children 24 to 59 months of age: A non-randomised community-based trial from Pakistan. *Nutrients*, **15**(7), 1690. <https://doi.org/10.3390/nu15071690>
- Khatun, W., Rasheed, S., Alam, A., Huda, T. M., & Dibley, M. J. (2019). Assessing the intergenerational linkage between short maternal stature and under-five stunting and wasting in Bangladesh. *Nutrients*, **11**(8), 1818. <https://doi.org/10.3390/nu11081818>
- Kpewou, D. E., Poirot, E., Berger, J., Som, S. V., Lailou, A., Belayneh, S. N., & Wieringa, F. T. (2020). Maternal mid-upper arm circumference during pregnancy and linear growth among Cambodian infants during the first months of life. *Maternal & child nutrition*, **2**(2), e12951. <https://doi.org/10.1111/mcn.12951>
- Laksono, A. D., Wulandari, R. D., Amaliah, N., & Wisnuwardani, R. W. (2022). Stunting among children under two years in Indonesia: Does maternal education matter? *PloS one*, **17**(7), e0271509. <https://doi.org/10.1371/journal.pone.0271509>
- Lee, W. S., Jalaludin, M. Y., Khoh, K. M., Kok, J. L., Nadarajaw, T., Soosai, A. P., Mukhtar, F., Fadzil, Y. J., Anuar Zaini, A., Mohd-Taib, S. H., Rosly, R. M., Khoo, A. J., & Cheang, H. K. (2022). Prevalence of undernutrition and associated factors in young children in Malaysia: A nationwide survey. *Frontiers in paediatrics*, **10**, 913850. <https://doi.org/10.3389/fped.2022.913850>
- Leroy, J. L., Habicht, J. P., González de Cossío, T., & Ruel, M. T. (2014). Maternal education mitigates the negative effects of higher income on the double burden of child stunting and maternal overweight in rural Mexico. *The Journal of Nutrition*, **144**(5), 765–770. <https://doi.org/10.3945/jn.113.188474>
- Li, Z., Kim, R., Vollmer, S., & Subramanian, S. V. (2020). Factors associated with child stunting, wasting, and underweight in 35 low- and middle-income countries. *JAMA network open*, **3**(4), e203386. <https://doi.org/10.1001/jamanetworkopen.2020.3386>
- Liou, S. R., Wang, P., & Cheng, C. Y. (2016). Effects of prenatal maternal mental distress on birth outcomes. *Women and birth: Journal of the Australian College of Midwives*, **29**(4), 376–380. <https://doi.org/10.1016/j.wombi.2016.03.004>
- Ministry of Health. (2016). *Complete basic immunization*. <https://sehatnegeriku.kemkes.go.id/baca/daerah/>
- Ministry of Health. (2019). *Recommended nutritional adequacy rates* (M. et al. Indonesia (ed.)). http://hukor.kemkes.go.id/uploads/produk_hukum
- Ministry of Health. (2020). *Children's anthropometry standards*. <http://hukor.kemkes.go.id/uploads/>
- Muchlis, N., Yusuf, R. A., Rusydi, A. R., Mahmud, N. U., Hikmah, N., Qanitha, A., & Ahsan, A. (2023). Cigarette smoke exposure and stunting among under-five children in rural and poor families in Indonesia. *Environmental health insights*, **17**. <https://doi.org/10.1177/11786302231185210>
- Mukhlis, H., & Yanti, R. (2020). Factors associated with the incidence of stunting in toddlers aged 24 - 59 months. *Proceedings of pioneer health seminar*, **3**(1), 127. <https://jurnal.upertis.ac.id/index.php/PSKP/article/view/554>
- Mzumara, B., Bwembya, P., Halwiindi, H., Mugode, R., & Banda, J. (2018). Factors associated with stunting among children below five years of age in Zambia: Evidence from the 2014 Zambia demographic and health survey. *BMC Nutrition*, **4**, 51. <https://doi.org/10.1186/s40795-018-0260-9>
- Perin, J., Mulick, A., Yeung, D., Villavicencio, F., Lopez, G., Strong, K. L., Prieto-Merino, D., Cousens, S., Black, R. E., & Liu, L. (2022). Global, regional, and national causes of under-5 mortality in 2000-19: An updated systematic analysis with implications for the Sustainable Development Goals. *The Lancet. Child & adolescent health*, **6**(2), 106–115. [https://doi.org/10.1016/S2352-4642\(21\)00311-4](https://doi.org/10.1016/S2352-4642(21)00311-4)
- Republic of Indonesia Health Research and Development Agency. (2021). *Pocket book of Indonesian Nutritional Status Study Results (SSGI)*. Republic of Indonesia Health Research and Development Agency.
- Rohmawati, N., Akbar, A. A., & Nurfaradila, T. (2023). Food security and parenting as risk factors of stunting in toddlers aged 24 to 59 months. *Pharmacy Education*, **23**(4), 82–86. <https://doi.org/10.46542/pe.2023.234.8286>
- Sarma, H., Khan, J. R., Asaduzzaman, M., Uddin, F., Tarannum, S., Hasan, M. M., Rahman, A. S., & Ahmed, T. (2017). Factors influencing the prevalence of stunting among children aged below five years in Bangladesh. *Food and Nutrition Bulletin*, **38**(3), 291–301. <https://doi.org/10.1177/0379572117710103>
- Schmidt C. W. (2014). Beyond malnutrition: The role of sanitation in stunted growth. *Environmental health perspectives*, **122**(11), A298–A303. <https://doi.org/10.1289/ehp.122-A298>

- Semarang City Government. (2021). Semarang City Government realise the Indonesia emas program to prevent stunting. <https://semarangkota.go.id/p/2306>
- Solis-Soto, M. T., Paudel, D., & Nicoli, F. (2020). Relationship between vaccination and nutritional status in children: Analysis of recent Demographic and Health Surveys. *Demographic Research*, **42**, 1–14. <https://www.jstor.org/stable/26936781>
- Ssentongo, P., Ssentongo, A. E., Ba, D. M., Ericson, J. E., Na, M., Gao, X., Fronterre, C., Chinchilli, V. M., & Schiff, S. J. (2021). Global, regional and national epidemiology and prevalence of child stunting, wasting and underweight in low- and middle-income countries, 2006-2018. *Scientific Reports*, **11**(1), 5204. <https://www.doi.org/10.1038/s41598-021-84302-w>.
- Tam, E., Keats, E. C., Rind, F., Das, J. K., & Bhutta, A. Z. A. (2020). Micronutrient supplementation and fortification interventions on health and development outcomes among children under-five in low- and middle-income countries: A systematic review and meta-analysis. *Nutrients*, **12**(2), 289. <https://doi.org/10.3390/nu12020289>
- UNICEF-WHO. (2019). Levels and trends in child malnutrition. UNICEF-WHO Low birthweight estimates: Levels and trends 2000–2015. Geneva: World Health Organization. <https://cdn.who.int/media/docs/default-source/>
- Wahyuni, D & Fitrayuna, R. (2020). Socioeconomic influences on the incidence of stunting in Kulau Mining Kampar village. *Prepotif: Journal of Public Health*, **4**(1), 20–26. <https://doi.org/10.31004/prepotif.v4i1.539>
- WHO., (2018). Global nutrition targets 2025: Stunting policy brief.
- Wu, H., Ma, C., Yang, L., & Xi, B. (2021). Association of parental height with offspring stunting in 14 Low- and middle-income countries. *Frontiers in nutrition*, **8**, 650976. <https://doi.org/10.3389/fnut.2021.650976>
- Xiang, S., Chen, Z., Dai, Z., & Wang, F. (2023). Global burden of lower respiratory infections attributable to second-hand smoke among children under 5 years of age, 2010-2019: A systematic analysis of the global burden of disease study 2019. *BMC Public Health*, **23**(1), 1920. <https://doi.org/10.1186/s12889-023-16848-5>
- Yang, W., Han, N., Jiao, M., Chang, X., Liu, J., Zhou, Q., & Wang, H. J. (2022). Maternal diet quality during pregnancy and its influence on low birth weight and small for gestational age: A birth cohort in Beijing, China. *The British Journal of Nutrition*, 1–10. <https://doi.org/10.1017/S0007114522000708>
- Young, M. F., & Ramakrishnan, U. (2021). Maternal undernutrition before and during pregnancy and offspring health and development. *Annals of Nutrition & Metabolism*, 1–13. <https://doi.org/10.1159/000510595>
- Zhang, G., Bacelis, J., Lengyel, C., Teramo, K., Hallman, M., Helgeland, Ø., Johansson, S., Myhre, R., Sengpiel, V., Njølstad, P. R., Jacobsson, B., & Muglia, L. (2015). Assessing the causal relationship of maternal height on birth size and gestational age at birth: A mendelian randomization analysis. *PLoS medicine*, **12**(8), e1001865. <https://doi.org/10.1371/journal.pmed.1001865>