

HISTORY OF DIARRHEA AND AGE ARE DETERMINANT FACTORS OF STUNTING INCIDENCE : ANALYSIS OF SSGI DATA 2022, EAST TANJUNG JABUNG DISTRICT, JAMBI PROVINCE

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ABSTRACT

Background: Stunting is a serious condition characterized by a child's height being below the normal limit for his age. Recurring infectious diseases, especially in the first two years of a toddler's life, can worsen stunting because they further disrupt nutritional absorption and growth. This study aimed to determine the relationship between acute respiratory infections (ARI) and diarrhea on the incidence of stunting in toddlers aged 0-59 month.

Method: This research is a cross-sectional study that applies two-stage stratified sampling using secondary data obtained from the 2022 Indonesian Nutrition Status Survey in East Tanjung Jabung Regency, Jambi Province. A total of 552 toddlers were included the sample analysis. Data were analyzed univariately, bivariately and multivariately using logistic regression.

Results: The results of the multivariate analysis showed that there was a relationship between a history of diarrhea ($p=0.002$), age 12-23 months ($p=0.034$) and age 24-59 months ($p=0.041$) with the incidence of stunting while there was no association between a history of ARI and the incidence of stunting in toddlers. ($p=0.836$).

Conclusion: The incidence of stunting in children aged 0-59 months is related to a history of diarrheal disease and the age of the toddler. There is no relationship between ARI and stunting. There is a need for further coordination in implementing sensitive interventions to reduce the incidence of stunting among children under five through the provision of clean water and proper sanitation

Keywords: ARI, diarrhea, Infectious diseases, stunting

INTRODUCTION

Stunting refers to a condition where a child's height is shorter than normal for his age. Stunting can affect a child's growth and development from the beginning of conception to the third or fourth year of life, where maternal and child nutrition is an important determinant of growth (Soliman et al., 2021; Junita et al., 2023). Apart from being caused by nutritional deficiencies, repeated attacks of infectious diseases during the first 1000 days of a child's life can worsen the condition.

The incidence of stunting in developing countries is still a large health problem that

requires a comprehensive solution. According to estimates of UNICEF, more than one in five children under five in the world, or the equivalent of 148.1 million people, will experience stunting in 2022. Meanwhile, Asia has the highest number of children under the age of five that are stunted, namely 76.6 million people, followed by Africa with 63.1 million people, or equivalent to 30% of total global stunting cases (UNICEF et al., 2023).

Based on the result of the 2022 Indonesian Nutrition Status Survey (SSGI), the prevalence of stunting in Indonesia is 21.6%. East Tanjung Jabung Regency is one of the areas with a fairly large prevalence of stunting. Based on 2023 Indonesian Health

Survey (SKI) data, the prevalence of stunting in East Tanjung Jabung

Regency is 23.7%. This figure has decreased significantly compared to 2018, with the prevalence of stunting at that time amounting to 40.9% (Riskseddas, 2018).

Diarrhea and Acute Respiratory Infections (ARI) are diseases that often attack children under five. Diarrhea ranks as the second leading cause of mortality among children under the age of five in Indonesia. Based on the 2021 Indonesian Health Profile, around 8 out of 100 Indonesians experienced diarrhea in 2020 with a prevalence of 8.68%. Meanwhile, ISPA cases rank first in the cause of infant mortality with a prevalence of ISPA in children under five of 22.8%. According to data from East Tanjung Jabung District Health Service, 2019, the prevalence of diarrhea cases in the area was 7.82% or there were 3,266 cases or 19.0 per 1000 population and the prevalence of ISPA cases was 4.44%.

One of the risk factors for stunting is infection disease. The study's findings indicate a correlation between the prevalence of stunting and an infectious disease history. The likelihood of stunting in toddlers with a history of infectious disease is 12 times higher (Pibriyanti et al., 2019). Recurrent infectious diseases in children disrupt and reduce the body's ability to absorb important nutrients from food (Fatimah & Wirjatmadi, 2018).

ARI illness leads to a decline in the nutritional status of children, which is associated with stunting. Research shows that children who have had an ARI in the past are three times more likely than children who have never had an ARI to have stunted growth (Himawati & Fitria, 2020). In addition to a previous occurrence of acute respiratory infection (ARI), diarrheal disease is also strongly associated with stunting in young children. It is one of the contributing factors to infectious diseases that result in infant mortality worldwide (Ilma et al., 2019). Both ARI and diarrhea will cause metabolic disorders in the body and require more energy

and nutrients due to the inflammation that occurs (DeBoer et al., 2017).

Based on these problems, researchers want to conduct research which aims to determine the relationship between acute respiratory tract infections (ARI) and diarrhea on the incidence of stunting in toddlers aged 0-59 months in East Tanjung Jabung Regency, Jambi Province.

METHOD

This study used secondary data obtained from the 2022 Indonesian Nutrition Status Survey conducted in East Tanjung Jabung Regency, Jambi Province, with a cross-sectional design. The population in this study was all households with toddlers based on census blocks consisting of 56 census blocks (BS). The samples were toddlers aged 0-59 months in East Tanjung Jabung Regency, Jambi Province.

The sample selection framework is based on the Master Frame from the block list of regular population census results (SP 2020), which is then updated the list of households in each selected census block by the Community Health Center's Nutrition Implementing Staff. The sampling design used was stratified two-stage sampling (Indonesian Ministry of Health, 2022a). In the first stage, block samples were systematically selected with an implicit process of stratification based on urban and rural areas. The second stage, selecting 10 households under five in each census block was selected using systematic random sampling.

In this study the instruments used were the Household Questionnaire (SSGI-2022-RT) and the Toddler Individual Questionnaire (SSGI-2022-IND_BLT) (Indonesian Ministry of Health, 2022b). The use of questionnaires is adjusted to the research variables. The secondary data that has been obtained is then checked and checked for completeness of the data, including the presence of missing or lost data. Based on the

results of checking the data, the number of samples processed was 552 toddlers. The data is continued with the data processing stage for further analysis.

The statistical package SPSS was utilized to perform the analysis of the data, which included univariate, bivariate, and multivariate analyses. The general distribution of the variables used is determined through univariate analysis. Bivariate analysis was applied to examine the correlation between the variables of gender, age, history of ARI, and history of diarrhea with the incidence of stunting. Meanwhile, multivariate analysis was conducted using a multivariable logistic regression test to determine the most dominant variables related to the occurrence of stunting. This research has received ethical approval from the Health Research Ethics Committee of RSUD Dr. Moewardi Surakarta Number: 428/II/HREC/2024 dated 19 February 2024.

RESULTS AND DISCUSSION

This research utilized a sample size of 552 children under the age of five from the 2022 SSGI data. The outcomes of the univariate analysis are displayed in the subsequent table:

Table 1. Sample Characteristics

Variable	N	%
Stunting		
Yes	124	22.5
No	428	77.5
ISPA history		
Yes	183	33.2
No	369	66.8
History of Diarrhea		
Yes	68	12.3
No	484	87.7
Gender		
Man	287	52
Woman	265	48
Age		
0-5 months	53	9.6
6-11 months	49	8.9
12-23 months	101	18.3
24-59 months	349	63.2

Table 1 shows the distribution of stunting incidence, history of ARI and diarrhea, gender and age. Most of the toddlers in the sample were male as many as 287 people

(52%) and were in the age range of 25-59 months, namely 349 people (63.2%). Meanwhile, from the frequency distribution of history of ARI, and history of diarrhea, and stunting, more than half of toddlers have never experienced ARI and diarrhea, respectively 369 people (66.8%) and 484 people (87.7%). There were 428 (77.5%) toddlers who were not stunted and 124 (22.5%) other toddlers who were stunted.

Table 2. Results of Bivariate Analysis of Stunting Risk Factors

Variable	Stunting				p	OR
	Yes n	Yes %	No n	No %		
ISPA history						
-Yes						
-No	46	25.1	137	74.9	0.341	1.25
	78	21.1	291	78.9		(0.83-1.90)
History of Diarrhea						
-Yes	25	36.8	43	63.2	0.004*	2.26
-No	99	20.5	385	79.5		(1.32-3.88)
Gender						
-Man	66	23.0	221	77.0	0.834	1.066
-Woman	58	21.9	207	78.1		(0.71-1.59)
Age						
-0-5 months	6	11.3	47	88.7		Ref
-6-11 months						1.53
-12-23 months	8	16.3	41	83.7	0.467	(0.49-4.78)
-24-59 months	26	25.7	75	74.3	0.041*	2.72
						(1.04-7.09)
						2.48
	84	24.1	265	75.9	0.044*	(1.03-6.01)

A bivariate test was carried out in order to collect information regarding the factors that are associated with the prevalence of stunting (Table 2). According to the findings of the bivariate analysis conducted with the chi square test, the variables that were shown to be associated with stunting ($p < 0.05$) were the age of the toddlers and the history of diarrhea. The findings of the chi-square analysis indicate that there is a significant association between the history of diarrhea in toddlers and the incidence of stunting, with the value of $p = 0.004$ ($p < 0.05$). Meanwhile for the age variable, the results of bivariate analysis showed that there was a relationship between age 12-23 months ($p = 0.041$) and age 24-59 months ($p = 0.044$) with the incidence of stunting. Toddlers aged 12-23 months are at 2.72 times the risk of experiencing stunting compared to toddlers aged 0-5 months. Stunting is 2.48 times more likely to occur in

toddlers aged 24-59 months than in those aged 0-5 months. Regarding the relationship between history of ARI and stunting, the value of $p=0.341$ was obtained, which means that there is no relationship between history of ARI in toddlers and the incidence of stunting ($p>0.05$). The gender variable is also not related to the incidence of stunting ($p=0.834$).

The findings of the bivariate analysis conducted on toddlers in East Tanjung Jabung Regency revealed no correlation between the incidence of stunting and a child's history of ARI, with $p\text{-value}=0.341$ ($p\text{-value}>0.005$). Different from research results Yoselin & Pambudi (2020) which states that children with a history of respiratory tract disorders are at risk of experiencing stunting. The relationship between stunting and respiratory tract infections (ARI) in children is a complex and reciprocal relationship, meaning that each condition can influence each other.

The results of this study are consistent with prior research conducted by Efendi et al. (2015), which found that there is no association between stunting and the frequency of acute respiratory infections (correlation coefficient $0.411>\alpha=0.05$) in children aged 12-48 months in the working area of the Gilingan Surakarta Health Center. Furthermore, Halim et al. (2021) found no significant relationship between risk factors of ARI and the incidence of stunting in children aged 3-5 years in TK/PAUD Tuminting District. Generally, ARI attacks children in the form of mild symptoms such as fever accompanied by a cough and cold, in some cases it can also heal by itself in a short time. Research conducted in Uganda found that children under 24 months were at higher risk of experiencing ARI and pneumonia. In addition, children whose mothers have lower secondary education have a higher chance of contracting ARI compared to children whose mothers have higher education (Terfa et al., 2022).

Table 3. Results of Multivariate Analysis of Stunting Risk Factors

Variable	Sig.	OR	CI(95%)
History of Diarrhea	0.002	2.33	1.35 – 4.01
Toddler age			
- 0-5 months	0.106		
- 6-11 months	0.474	1.52	0.43 – 4.79
- 12-23 months	0.034	2.85	1.08 – 7.50
- 24-59 months	0.041	2.53	1.04 – 6.18

The variables linked to the incidence of stunting were a history of diarrhea ($p=0.002$), age 12-23 months compared to age 0-5 months ($p\text{-value}=0.034$), and age 24-59 months compared to age 0-5 months ($p=0.041$), according to the results of multivariate analysis using logistic regression. Age is the main factor influencing the prevalence of stunting. Toddlers aged 12-23 months have a 2.85 times risk of experiencing stunting compared to those aged 0-5 months after controlling for diarrhea variables ($OR=2.85$ 95% CI 1.08-7.50). Multivariate analysis was carried out by conducting a logistic regression test on four variables on the incidence of stunting. The final result of the multivariate analysis was obtained after removing the variables history of ARI and gender because the results in the full model were $p>0.05$. Based on the results of the cross tabulation between diarrhea and age, it is known that those who experienced a history of diarrhea were mostly in the toddler age range of 24-59 months and then those aged 12-23 months.

Stunting is a common form of malnutrition in children and is associated with adverse health problems (Makasi & Humphrey, 2020). A number of infectious illnesses, including diarrhea, are responsible for morbidity and mortality in children, particularly in countries with low and intermediate incomes (George et al., 2021). The research result in Table 3 shows that there is a relationship between a history of diarrhea in toddlers and the incidence of stunting with a value of $p=0.002$. Stunting is 2.3 times more likely to occur in toddlers who have had diarrhea in the past than in those who have not. This research aligns with earlier studies

that found a correlation between the incidence of diarrhea and the incidence of stunting ($p=0.007$) in toddlers in the Pecangaan Jepara Health Center working area (Lestari & Siwiendrayanti, 2021). Additional research found a link between the prevalence of diarrhea and stunting in infants in Sambas Regency, in addition to postnatal variables such as early delivery, low birth weight, and full coverage of basic immunization (Sartika et al., 2021). This research contradicts the findings of Purwanti and Ratnasari (2020), who determined that there is association between the incidence of diarrhea and stunting in young children in Kluwut Village, Bulakamba District, Brebes Regency. Similarly, Angraini et al. (2021) also found no correlation between the incidence of diarrhea and stunting, with $p = 0.237$ ($p\text{-value} > 0.05$) in the Mumpo Regulation Community Health Center Working Area, Central Bengkulu Regency.

Children living in families with inadequate sanitation and hygiene facilities, and inadequate potable water source are more susceptible to diarrhea (Terfa et al., 2022). According to Mulyaningsih et al. (2021), children residing in communities lacking access to sanitation, water, and hygiene are at an increased risk of stunting. Terfa et al. (2022) adding that stunting in children is more may occur in children from homes where there are inadequate drinking water sources. Children living in homes with poor flooring have a higher prevalence of diarrhea than in homes with better flooring materials (Kundu et al., 2022).

Sanitation and clean water are vital in reducing stunting rates. The quality and quantity of safe drinking water and available sanitation facilities correlates with the burden of diarrhea and gastrointestinal infections, and in turn with stunted growth in children (Das & Bhutta, 2016). Clean water is still a serious problem in East Tanjung Jabung Regency. Based on data of BPS Jambi Province in 2022 coverage of households with

clean water or households that have access to proper sanitation has only reached 69.75%. The source of drinking water consumption in the community is mostly rainwater in addition to refill water.

Infectious diseases, both diarrhea and ARI, both of which can cause loss of appetite in children, resulting in stunted growth (Arini et al., 2020). Toddlers with infectious disorders may experience both malabsorption and loss of nutrients if they are not treated right away and given a balanced diet (Fadilah et al., 2020). Nevertheless, this study concluded that there was no correlation observed between ARI and the prevalence of stunting in toddlers.

Children under the age of two, particularly those between 12 and 23 months old, have a notably higher occurrence of acute respiratory infections and diarrhea (Kundu et al., 2022). Consistent with the findings of this study, toddlers who suffer from diarrhea are susceptible to stunting. In addition, toddlers between the ages of 12 and 23 months face a 2.8 times higher risk of stunting than toddlers aged 0 to 5 months. These findings are consistent with the findings of Mengesh et al. (2021), who found that children in the age group between 0-6 months and 11 months have a decreased probability of having stunting compared to those aged over 24 months.

The chances of stunting in children vary greatly and are influenced by many factors, not only related to characteristics at the child level but also characteristics at the family and society level (Junita et al., 2023). Children who are raised in households that do not have access to water, sanitation, and hygiene are at a greater risk of stunting (Mulyaningsih et al., 2021). Lack of access to adequate sanitation can increase the risk of spreading infectious diseases and malnutrition.

CONCLUSION

Based on the research results, it can be concluded that there is a significant relationship between the history of diarrhea and age in toddlers and stunting in East Tanjung Jabung Regency, while the history of ARI and stunting is not significantly related. Further research needs to be done by taking into account the history of diseases that have not been included in this study as other factors that can affect the incidence of stunting in toddlers.

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CONFLICT OF INTEREST

There was no conflict of interest in this article.

REFERENCES

- Angraini, W., Amin, M., Bintang Agustina, P., Febriawati, H., & Yanuart, R. (2021). Maternal Knowledge, Access to Clean Water, and Diarrhea with Stunting at the Aturon Mumpo Health Center, Central Bengkulu. *Equator Public Health Journal*, 8(2), 92–102.
- Arini, D., Nursalam, N., Mahmudah, M., & Faradilah, I. (2020). The incidence of stunting, the frequency/duration of diarrhea and Acute Respiratory Infection in toddlers. *Journal of Public Health Research*, 9(2), 1816. <https://doi.org/10.4081/jphr.2020.1816>
- Jambi Central Statistics Agency (2022). Ownership of Access to Adequate Sanitation Report (Percent), 2020-2022. BPS Jambi Province.
- Das, J. K., & Bhutta, Z. A. (2016). Global challenges in acute diarrhea. *Current Opinion in Gastroenterology*, 32(1), 18–23. <https://doi.org/10.1097/MOG.0000000000000236>
- DeBoer, M.D., Scharf, R.J., Leite, A.M., Ferrer, A., Havt, A., Pinkerton, R., Lima, A.A., & Guerrant, R.L. (2017). Systemic inflammation, growth factors, and linear growth in the setting of infection and malnutrition. *Nutrition (Burbank, Los Angeles County, Calif.)*, 33, 248–253. <https://doi.org/10.1016/j.nut.2016.06.013>
- East Tanjung Jabung District Health Service. (2019). Health Profile of East Tanjung Jabung Regency 2019.
- Efendi, A., Mutalazimah, & Mustikaningrum, F. (2015). Correlation between the incidence of stunting and the frequency of acute respiratory infections and diarrhea in toddlers aged 12-48 months in the working area of the Gilingan Surakarta Community Health Center. Muhammadiyah Surakarta university. Available at: <https://eprints.ums.ac.id/38307/>.
- Fatimah, NSH, & Wirjatmadi, B. (2018). Adequacy Levels of Vitamin A, Zinc and Iron and Frequency of Infections in Stunting and Non-Stunting Toddlers. *Indonesian Nutrition Media*, 13(2), 168. <https://doi.org/10.20473/mgi.v13i2.168-175>
- George, CM, Monira, S., Zohura, F., Thomas, ED, Hasan, MT, Parvin, T., Hasan, K., Rashid, M.-U., Papri, N., Islam, A., Rahman, Z., Rafique, R., Islam Bhuyian, MS, Saxton, R., Labrique, A., Alland, K., Barman, I., Jubya, FT, Afroze, F., ... Alam, M. (2021). Effects of a Water, Sanitation, and Hygiene Mobile Health Program on Diarrhea and Child Growth in Bangladesh: A Cluster-randomized Controlled Trial of the Cholera Hospital-based Intervention for 7 Days (CHoBI7) Mobile Health Program. *Clinical Infectious Diseases : An Official Publication of the Infectious*

- Diseases Society of America, 73(9), e2560–e2568.
<https://doi.org/10.1093/cid/ciaa754>
- Halim, L.A, Warouw, SM, Ch Manoppo, JI, & Child Health, Faculty of Medicine, Sam Ratulangi University, I. (2021). The Relationship between Risk Factors and Stunting in Children Aged 3-5 Years in Kindergarten/Paud, Tuminting District. *Journal of Medicine and Rehabilitation*, 1(2), 1–8.
- Himawati, EH, & Fitria, L. (2020). Relationship between Upper Respiratory Tract Infections and Stunting in Children Under 5 Years in Sampang. *Indonesian Journal of Public Health*, 15(1), 1. <https://doi.org/10.26714/jkmi.15.1.2020.1-5>
- Ilma, NN, Salimo, H., & Pamungkasari, EP (2019). Prevalence and Path Analysis on the Effects of Diarrhea and Life Course Determinants on Stunting in Children Under Two Years of Age in Kupang, East Nusa Tenggara. *Journal of Maternal and Child Health*, 4(4), 230–241.
<https://doi.org/10.26911/thejmch.2019.04.04.02>
- Indonesian Ministry of Health. (2022a). Indonesian Nutritional Status Survey (SSGI) 2022. Indonesian Ministry of Health, 1–14.
<https://www.litbang.kemkes.go.id/buku-saku-hasil-studi-status-gizi-indonesia-ssgi-tahun-2021/>
- Indonesian Ministry of Health. (2022a). Indonesian Ministry of Health. Available from: <https://jasadata.kemkes.go.id/katalog-data/ssgi/ketersediaan-data/ssgi-2022>[Accessed 21st September 2023]
- Junita, J., Rusmimpong, R., Triana, W., & Putra, E. S. (2023). Simpatik Education Model for Knowledge and Diversity of Food Intake for Stunting Toddlers in Kerinci Regency. In *Proceeding International Conference Health Polytechnic of Jambi* (Vol. 2, pp. 1-8).
- Junita, J., Rusmimpong, R., Triana, W., & Putra, E. S. (2023b). SIMPATIK website nutrition education on mother's knowledge and diversity of toddler consumption in Jambi City. *AcTion: Aceh Nutrition Journal*, 8(2), 270-277.
- Kundu, S., Kundu, S., Banna, M.H. Al, Ahinkorah, B.O., Seidu, A.-A., & Okyere, J. (2022). Prevalence of and factors associated with childhood diarrheal disease and acute respiratory infection in Bangladesh: an analysis of a nationwide cross-sectional survey. *BMJ Open*, 12(4), e051744. <https://doi.org/10.1136/bmjopen-2021-051744>
- Lestari, MEP, & Siwiendrayanti, A. (2021). Contribution of Physical Conditions of the Home Environment to Diarrhea Incidents and Their Relationship to Stunting Incidents Article Info. *Indonesian Journal of Public Health and Nutrition*, 1(3), 355–361.
- Makasi, R.R., & Humphrey, J.H. (2020). Summarizing the Child Growth and Diarrhea Findings of the Water, Sanitation, and Hygiene Benefits and Sanitation Hygiene Infant Nutrition Efficacy Trials. *Nestle Nutrition Institute Workshop Series*, 93, 153–166.
<https://doi.org/10.1159/000503350>
- Mengesha, A., Hailu, S., Birhane, M., & Belay, M. M. (2021). The prevalence of stunting and associated factors among children under five years of age in southern Ethiopia: Community based cross-sectional study. *Annals of Global Health*, 87(1), 1–14.
<https://doi.org/10.5334/aogh.3432>
- Mulyaningsih, T., Mohanty, I., Widyaningsih, V., Gebremedhin, TA, Miranti, R., & Wiyono, VH (2021). Beyond personal factors: Multilevel determinants of childhood stunting in Indonesia. *PloS One*, 16(11), e0260265.
<https://doi.org/10.1371/journal.pone.0260265>
- Pibriyanti, K., Suryono, S., & Luthfi, C. (2019). Factors associated with the incidence of stunting in toddlers in the

- working area of the Slogohimo Health Center, Wonogiri Regency. *Darussalam Nutrition Journal*, 3(2), 1. <https://doi.org/10.21111/dnj.v3i2.3398>
- Purwanti, DY, & Ratnasari, D. (2020). The Relationship Between Diarrhea, Exclusive Breastfeeding, and Stunting in Toddlers. *Scientific Journal of Health Nutrition*, 1(02), 15–23.
- Risikesdas. (2018). Results of Basic Health Research 2018. In Ministry of Health of the Republic of Indonesia (Vol. 53, Issue 9).
- Sartika, AN, Khoirunnisa, M., Meiyetrian, E., Ermayani, E., Pramesthi, IL, & Nur Ananda, AJ (2021). Prenatal and postnatal determinants of stunting at age 0-11 months: A cross-sectional study in Indonesia. *PloS One*, 16(7), e0254662. <https://doi.org/10.1371/journal.pone.0254662>
- Soliman, A., De Sanctis, V., Alaaraj, N., Ahmed, S., Alyafei, F., Hamed, N., & Soliman, N. (2021). Early and long-term consequences of nutritional stunting: From childhood to adulthood. *Acta Biomedica*, 92(1), 1–12. <https://doi.org/10.23750/abm.v92i1.11346>
- Terfa, Z.G., Ahmed, S., Khan, J., Niessen, L.W., & Consortium, OBOTI (2022). Household Microenvironment and Under-Fives Health Outcomes in Uganda: Focusing on Multidimensional Energy Poverty and Women Empowerment Indices. *International Journal of Environmental Research and Public Health*, 19(11). <https://doi.org/10.3390/ijerph19116684>
- UNICEF / WHO / World Bank Group. (2023). Levels and trends in child malnutrition Joint Child Malnutrition Estimates.
- UNICEF, WHO, & WORLD BANK. (2023). Levels and trends in child malnutrition. World Health Organization, 4. <https://www.who.int/publications/i/item/9789240073791>
- Yoselin, M., & Pambudi, W. (2020). The relationship between airway disorders and stunting. *Tarumanagara Medical Journal*, 2(2), 366–371.