Original Research Article

Analysis of Stunting Risk Factors: Immunization, Exclusive Breastfeeding, and Duration of Breastfeeding in a Cross-Sectional Study

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ABSTRACT

Stunting remains a major public health challenge in Indonesia, particularly in West Nusa Tenggara and North Lombok Regency. It is influenced by a combination of biological and environmental factors, with immunization history, exclusive breastfeeding (EBF), and breastfeeding duration being key modifiable determinants. This cross-sectional observational study examined the association between these factors and stunting among children aged 0–59 months. A total of 83 children were included in the analysis, with bivariate analysis conducted using the Chi-square test at a 95% confidence level (α = 0.05). Results showed that most children were male (59%), did not experience stunting (54.2%), received full immunization (67.5%), practiced EBF (83.15%), and were breastfed for less than 2 years (59.4%). No statistically significant association was found between immunization history (p=0.592) or EBF practices (p=0.219) and stunting. However, a significant relationship was identified between shorter breastfeeding duration (less than 2 years) and higher stunting risk (p=0.009, PR=2.62, 95% CI: 1.225–5.593). In conclusion, there was no significant relationship between the history of immunization and the history of exclusive breastfeeding with the incidence of stunting. However, there was a significant relationship between the duration of breastfeeding and the incidence of stunting.

Keywords: Stunting, Immunization, Breastfeeding, Toddler health, *Nutrition*

INTRODUCTION

Stunting is a serious condition with long-term impacts on child growth and development. Stunting results from chronic malnutrition and affects both physical growth and cognitive development. According to the World Health Organization (WHO), stunting can be identified by a value less than -2 standard deviations (SD) based on the growth curve.[1] Stunting is characterized by impaired physical growth and brain development resulting from long-term nutritional deficiencies. This condition results in shorter stature of children compared to their peers, low cognitive ability, and cognitive development. Stunting cases remain high in Indonesia, with a prevalence of 12.9% according to Indonesian health survey in 2023,[2] placing Indonesia as the country with the sixth-highest number of stunting cases in Southeast Asia.[3] In West Nusa Tenggara, stunting remains a major public health issue.

According to data from the Indonesian Nutritional Status Survey (SSGI) in 2024, the province is one of the regions with a stunting prevalence which exceeds the national average,

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at 29.8%.[4] More specifically, data from the NTB Provincial Health Office in 2023 as cited in a study by Lubis (2025) indicate that the prevalence of stunting in North Lombok Regency remains relatively high at 19.5%.[5] Stunting is caused by various factors, including poor quality and inadequacy of toddler nutrition; the presence of infectious diseases; the mother's low nutritional status before and during pregnancy and breastfeeding; hereditary factors; insufficient exclusive breastfeeding practices; incomplete immunization; limited food availability; poor socioeconomic conditions; low maternal education level; limited maternal nutritional knowledge; and adverse environmental conditions.[6]

Immunization is a preventive intervention aimed at inducing immunity or resistance against specific infectious diseases[7]. Immunization aims to protect toddlers from various diseases such as diphtheria, pertussis, measles, and hepatitis, thereby reducing infant mortality. In the context of stunting, immunization in infants and young children is primarily implemented to prevent infectious diseases that can compromise nutrient absorption.

Studies have shown that children with a history of recurrent infections have a significantly increased risk of stunting, with diarrheal diseases and acute respiratory infections (ARI) being the most influential infections associated with stunting incidence.[8] According to the Indonesian Health Profile report in 2025, 64 out of 100 children aged 12-23 months have received complete immunizations.[9] This highlights low immunization coverage and its vital contribution to the increase of stunting cases in Indonesia. This finding is also supported by previous literature studies, which reveal a correlation between inadequate immunization among toddlers and higher stunting rates in Indonesia.[10]

In addition to inadequate immunization, the lack of exclusive breastfeeding also contributes to stunting. This is supported by the Indonesian Health Survey in 2023, which report that only 68.6% of infants aged 0-5 months and 55.5% of toddlers aged 6-23 months in Indonesia receive exclusive breastfeeding.[2] Breast milk is a critical source of nutrition for newborns, particularly during the first six months of life (exclusive breastfeeding). It naturally contains secretory immunoglobulin A (sIgA) and lactoferrin, which play essential roles in protecting infants against infectious diseases such as acute respiratory infections (ARI).[11] Furthermore, research indicates that exclusive breastfeeding positively influences microbial diversity in the gut and the upper respiratory tract, both of which are crucial for the development of a robust immune system. This effect is associated with increased concentrations of key cytokines, including IFN-α, IFN-γ, and IL-17A, which are integral to both innate and adaptive immune responses.[12]

According to previous studies, children with insufficient exclusive breastfeeding were found to have a 1.23-times higher risk of stunting compared to those who received exclusive breastfeeding.[13] This is also supported by the low maternal education level regarding stunting prevention; only 44.8% and 36% of mothers acknowledge the role of exclusive breastfeeding and immunization, respectively to prevent stunting.[2] Based on background described above, further research is needed to analyze the factors contributing the high incidence of stunting cases in Indonesia, particularly those related to immunization, exclusive breastfeeding, and breastfeeding duration.

METHOD

This study was an observational cross-sectional study conducted from January to March 2025 at the Pemenang Community Health Center (Puskesmas) in North Lombok Regency, West Nusa Tenggara Province. The study aimed to analyze the relationship between immunization history, exclusive breastfeeding history, and breastfeeding duration with the incidence of stunting in children within the Pemenang Community Health Center.

The study population included all children aged 59 months and younger (toddlers), and purposive sampling was used, applying inclusion and exclusion criteria aligned with the research objectives. Stunting status was determined using z-scores from weight-for-age (WFA) measurements, compared against the WHO growth standards.

This research has received ethical clearance from the Medical and Health Research Ethics Committee, Faculty of

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Medicine, Al-Azhar Islamic University. A questionnaire was used as data collection instrument to record the descriptive variables in this study, such as: 1) stunting status in children; 2) history of immunization; history of exclusive breastfeeding; and 3) duration of breastfeeding in children. The data in this study were analyzed using univariate and bivariate analyses.

Univariate analysis was conducted to determine the overall characteristics of the respondents, whereas bivariate analysis was conducted to determine the relationship between various independent variables (immunization history, exclusive breastfeeding, and duration of breastfeeding) and the incidence of stunting. Bivariate testing was conducted using the Chi-Square test with a confidence level (CI) of 95% and a significance level (α) of 5%. The entire data analysis process was carried out using the IBM SPSS program version 23.

RESULT AND DISCUSSION

The results of the univariate analysis of all respondents are presented in Table 1. The mean age of the respondents (n=83) was 33.69 months, with the youngest being 7 months and the oldest 57 months. The analysis showed that 38 children (45.8%) experienced stunting, while 45 children (54.2%) did not. Most children (67.5%) had received complete immunizations, while 32.5% had not. Most children (83.1%) received exclusive breastfeeding, and only 16.9% did not. There were greater number of male children (59.0%) than female children (41.0%).

Table 1. Frequency distribution of sex, stunting incidence, history of immunization, history of exclusive breastfeeding and duration of breastfeeding in children

Sex	**Frequency**	**Percentage (%)**
Male	49	59.0
Female	34	41.0
Stunting	**Frequency**	**Percentage (%)**
Yes	38	45.8
No	45	54.2
History of immunization	**Frequency**	**Percentage (%)**
Incomplete / never	27	32.5
Complete immunization	56	67.5
Exclusive breastfeeding	**Frequency**	**Percentage (%)**
No	14	16.9
Yes	69	83.1
Duration of breastfeeding	**Frequency**	**Percentage (%)**
< 2 years	41	59.42
≥ 2 years	28	40.58

The results of the chi-square test between immunization history, exclusive breastfeeding and the incidence of stunting are presented in Table 2. In general, there was no significant association between immunization history (n=83) and the incidence of stunting, and between the history of exclusive breastfeeding (n=83) and the incidence of stunting with p values of 0.592 and 0.219, respectively.

Table 2. Chi-square test of relationship between history of immunization, history of exclusive breastfeeding, and duration of breastfeeding with the incidence of stunting among toddler respondents

Variable		Stunting incidence		Total n (%)	p-value*	PR**	CI 95% (lower-upper)
		Stunted (%)	Not stunted n (%)				
History of immunization	Incomplete/ Never	14 (51.9)	13 (48.1)	27 (100)	0.592	1.210	0.754 – 1.941
	Complete	24 (42.9)	32 (57.1)	56 (100)			
	TOTAL	**38 (45.8)**	**45 (54.2)**	**83 (100)**			
Exclusive breastfeeding	Yes	9 (64.3)	5 (35.7)	14 (100)	0.219	1.530	0.948 – 2.469
	No	29 (42.0)	40 (58.0)	69 (100)			
	TOTAL	**38 (45.8)**	**45 (54.2)**	**83 (100)**			
Duration of breastfeeding	< 2 years	23 (56.1)	18 (43.9)	41 (100)	0.009	2.62	1.225 – 5.593
	≥ 2 years	6 (21.4)	22 (78.6)	28 (100)			
	TOTAL	**29 (42.0)**	**40 (58.0)**	**69 (100)**			

* p-value <0.05 was considered statistically significant. ** PR: Prevalence Ratio (95% Confidence Interval)

This study also analyzed the relationship between the duration of breastfeeding in the group with a history of exclusive breastfeeding (n=69) and the incidence of stunting. Overall, of the 69 children who received exclusive breastfeeding, the majority (n=41, 59.4%) did not receive breast milk until the age of 2 years, while the remaining 28 children (40.6%) received breast milk until the age of 2 years or more. The chi-square test results indicated a significant relationship between the duration of breastfeeding and the incidence of stunting with a p value of 0.009 and a PR of 2.618 (95% CI: 1.225–5.593). This indicated an increased risk of stunting among children with a shorter duration of exclusive breastfeeding. Children who received exclusive breastfeeding for less than 2 years in this study were 2.62 times more likely to experience stunting compared to children who received exclusive breastfeeding for 2 years or longer.

The Relationship Between History of Immunization and Stunting Incidence

The results of the study showed no significant association between immunization history and the incidence of stunting in toddlers (p=0.59; n=83). These results were in line with a study by Sutriyawan (2020) in Bandung and Sari (2023) in Tangerang which also showed no significant relationship between immunization status and the incidence of stunting.[14,15] One possible explanation for this lack of association is the role of infection history, which may act as a confounding factor. Sutriyawan (2020) also found that the incidence of infectious diseases had a stronger relationship with stunting compared to its direct relationship with immunization.[15]

Biologically, immunization plays a crucial role in preventing severe infections which may increase the risk of malnutrition and other complications.[7] Infectious diseases which can be prevented by immunization, such as diarrhea or acute respiratory infections (ARI), can disrupt nutrient absorption and trigger an inflammatory response that can decrease IGF-1 hormone activity [16], thereby inhibiting bone growth.[17] However, if nutritional intake is inadequate, particularly protein and essential micronutrients such as zinc, iron, vitamin A, and vitamin D[18,19], optimal growth remains difficult to achieve even when the child is protected from certain infectious diseases, as adequate nutrition is a key determinant in preventing stunting among children.

Other studies have also found that although immunization has a significant protective effect against stunting, other important risk factors remain associated with

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stunting, such as child age, sex, place of residence, maternal age, economic status, parental education; family size; and environmental sanitation.[20] This further emphasizes that although immunization is a protective factor, stunting can still occur due to other contributing factors which were not examined or observed in this study.

The Relationship Between Exclusive Breastfeeding and the Incidence of Stunting

The study results showed no significant relationship between exclusive breastfeeding and stunting in toddlers (p=0.21; n=83). However, a large body of literature confirms the protective role of exclusive breastfeeding in preventing stunting. Exclusive breastfeeding during the first six months of life serves as a natural defense to prevent stunting. Breast milk provides all the essential nutrients for early physical and brain growth of baby in a balanced composition, such as protein, fat, vitamins, and minerals. These nutrients naturally help prevent malnutrition, a major risk factor of stunting.[21] Breast milk also acts as a natural “protective barrier" by providing antibodies which help safeguard babies from dangerous infections. By reducing the frequency and severity of infections, exclusive breastfeeding also strengthens the digestive system and improves the baby's general health.[22]

Although breastfeeding is a crucial factor in preventing stunting, other factors play a more dominant role which determines a child's linear growth after six months of age. One key factor is the quality and quantity of complementary foods (MP-ASI).[23] Due to significant increase of energy and protein needs after six months of age, breast milk alone is no longer sufficient. If MP-ASI has poor nutritional content, the risk of stunting increases despite exclusive breastfeeding. This is evidenced by a study conducted by Widyantari (2025), which found that inadequate complementary foods also increase the likelihood for stunting in toddlers.[24] This further strengthens the assumption that exclusive breastfeeding alone is not sufficient to prevent stunting; complementary foods which can meet the essential nutritional needs for child growth are one of other equally important factors. This may explain the lack of significant relationship between exclusive breastfeeding and the incidence of stunting. However, the complementary feeding was not the focus in this study.

The Relationship Between the Duration of Breastfeeding and the Incidence of Stunting

In contrast to the other two variables, this study found that the duration of breastfeeding had a significant relationship with the incidence of stunting (p=0.003; PR=2.62; 95% CI: 1.225–5.593; n=69). Children who were breastfed for 2 years (24 months) or longer had a lower risk of stunting. This finding was in line with the findings by Azizah (2022) which reported a significant relationship between breastfeeding and a reduced risk of stunting; breastfed children had a 0.62 times lower risk of stunting compared to those who were not breastfed[25]. Other studies also found that children who were breastfed for more than 6 months had healthier weight-growth patterns than those who were breastfed for less than 6 months.[25,26]

Breast milk contains various essential components needed by children during their growth period, including complex nutrients, antibodies, and important bioactive components for growth and development. Research by Dewi (2021) states that every 100 mL of breast milk contains approximately 62 kcal of energy, with 1.5 grams of protein, 3.2 grams of fat, and 7.0 grams of carbohydrates, along with essential vitamins and minerals such as calcium and iron.

Breast milk also contains long-chain unsaturated fatty acids, such as DHA and arachidonic acid, which are crucial for brain development and cognitive function in infants.[27] Breastfeeding has also been found to reduce the risk of infection in children[28], thus preventing stunted growth and development, which can reduce the risk of stunting. Moreover, the World Health Organization (WHO) and the American Academy of Pediatrics (AAP) also recommend the introduction of appropriate complementary foods while continuing breastfeeding. This period, known as the complementary feeding period, lasts up to two years or more.[29]

Although this study found a relationship between the duration of breastfeeding and the incidence of stunting, several other studies have reported different results. Research conducted in Pakistan showed that children breastfed until the age of 2–3 years had a higher risk of stunting.[30] Another study also revealed that children who were breastfed until two years old had a 2.9 times higher likelihood of experiencing stunting, while those breastfed until three years

old had a 5.45 times greater risk.[31] These differing results may be due to another factor, namely the provision of complementary feeding. Complementary foods are an important factor also found to be closely related to the occurrence of stunting and malnutrition in children.[32] Even if a child is breastfed beyond 2 years, without adequate complementary feeding, the amount of nutrients needed for optimal growth will not be met. This is because the nutrient content in breast milk alone is insufficient to meet the nutritional needs of the child, although Astuti (2024) found that breastfeeding could complement the nutritional deficiencies present in complementary foods.[33,34] In this study, observation of the amount and suitability of complementary feeding given to children was not conducted, which is a limitation of this research.

Socioeconomic factors are also estimated to be associated with the occurrence of stunting. A prolonged duration of breastfeeding by itself is not the primary determinant of stunting; rather, it is the interaction between breastfeeding duration and the family's economic status. Children breastfed for more than 12 months in low-income families have the highest risk of stunting, whereas children in more affluent families are less likely to experience stunting regardless of the length of their breastfeeding period.[35] This is likely related to the family's ability to provide nutritious complementary foods. However, in this study, the socioeconomic conditions of the families were not observed, which is one of the limitations of the research.

The relationship between the duration of breastfeeding and the incidence of stunting is complex and involves various factors. Although this study found that children who were breastfed for more than two years had a lower risk of stunting, other crucial factors that also support the child's nutritional intake were not observed. This indicates the need for further research to strengthen the findings of this study.

CONCLUSION

Based on the results of the study, it was concluded that there was no significant relationship between the history of immunization and the history of exclusive breastfeeding with the incidence of stunting. However, there was a significant relationship between the duration of breastfeeding and the incidence of stunting; children who were breastfed for less than 2 years had a higher risk of stunting.

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