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Analysis of Determinants of Stunting Occurrence in Children Aged 24-59 Months in the Working Area of UPT. Kamaipura Health Center

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Abstract

Stunting remains a significant public health challenge worldwide, including Indonesia, characterized by chronic undernutrition leading to impaired growth in children. This study aimed to analyze determinants of stunting among children aged 24-59 months within the working area of UPT Puskesmas Kamaipura. An analytical observational case-control study was conducted involving mothers with children aged 24-59 months registered in the health center. Purposive sampling was used to select 128 respondents. Data were collected via questionnaires focusing on exclusive breastfeeding, complementary feeding practice (MP-ASI), infection history, and immunization status. Data analysis involved chi-square tests for bivariate and logistic regression for multivariate analysis with a 0.05 significance level.The results revealed a significant association between complementary feeding practice and stunting (p=0.000, OR=1.953, 95% CI: 172.638–22,093.730). After adjusting for other variables, only complementary feeding practice remained statistically significant as a dominant factor. Exclusive breastfeeding, infection history, and immunization status showed no statistically significant effect in the final model.In conclusion, improper complementary feeding practice is the dominant determinant of stunting in children aged 24-59 months in this setting, underscoring the importance of promoting appropriate complementary feeding to reduce stunting prevalence.

Keywords: Complementary Feeding, Exclusive Breastfeeding, Immunization Status, Infection History, Stunting

INTRODUCTION

Stunting, a significant public health challenge, remains prevalent worldwide, including in Indonesia. It is characterized by impaired growth and development in children due to chronic malnutrition, repeated infections, and insufficient stimulation during early life (Asnidar et al., 2022; World Health Organization, 2020). The condition manifests as low height-for-age, affecting children's cognitive and physical development with long-term consequences such as reduced productivity and higher risks of degenerative diseases in adulthood (Rahayu et al., 2018; Fitriani & Darmawi, 2022). Despite global efforts, stunting was estimated to affect 148.1 million children under five globally in 2022, predominantly in Asia and Africa (UNICEF, 2023). In Indonesia, while the national stunting prevalence decreased from 24.4% in 2021 to 19.8% in 2024, this remains above the World Health Organization's recommended threshold of 20% and far from the national target of 14.2% by 2029 (Bahar et al., 2024; Ministry of Health Indonesia, 2025). Particularly in Central Sulawesi, where the study area is located, stunting prevalence remains high at 26.1%, with local hotspots such as Puskesmas Kamaipura exhibiting concerning rates despite relatively better geographic access to nutrition sources (Dinkes Provinsi Sulawesi Tengah, 2024; Ministry of Health Indonesia, 2025).

The persistent high rate of stunting in such areas indicates multifaceted underlying problems. These include maternal factors such as low education, inadequate exclusive breastfeeding practices, premature or inappropriate complementary feeding, and suboptimal

child care behaviors (Febrianti et al., 2024; Rahmalia & Azinar, 2024). Environmental and socio-economic factors such as household income, sanitation, exposure to infections (diarrhea and respiratory infections), and incomplete immunizations also exacerbate the risk (Setianingsih et al., 2024; Syahrul et al., 2025). Inadequate exclusive breastfeeding and complementary feeding practices have been repeatedly linked to increased stunting risks, as breast milk alone becomes insufficient after six months, necessitating timely and adequate complementary feeding (Nasrin et al., 2023; Wulansari & Hipni, 2025). Furthermore, frequent infections lead to nutrient malabsorption, undermining growth and intensifying stunting risk (Erwin Saleh Pulungan et al., 2024; Setianingsih et al., 2024). Despite policy efforts and nutritional monitoring, gaps remain in maternal knowledge, feeding practices, and health service utilization, demanding focused intervention (Indriani et al., 2025; Modjo et al., 2024).

This study aims to analyze the determinants of stunting among children aged 24-59 months in the working area of UPT Puskesmas Kamaipura, Central Sulawesi, focusing on maternal feeding practices, infection history, and immunization status. Given the region's specific socio-environmental context and persistent high stunting rates, the research addresses the urgency to identify dominant factors influencing growth faltering in this population. This work contributes novel insights by employing a case-control quantitative analytic approach, integrating recent local data, and highlighting the statistically significant impact of complementary feeding (MP-ASI), infection history, and immunization completeness on stunting incidence, thus filling gaps in region-specific evidence crucial for targeted interventions. The findings support strengthening comprehensive child nutrition and health programs to optimize early childhood development outcomes in Indonesia's stunting-burdened areas (Darlis et al., 2024; Bahar et al., 2024).

RESEARCH METHODS

This study employed an analytical observational design with a quantitative approach, specifically a case-control study. This methodological choice was aligned with the research objective of examining the determinants influencing the occurrence of stunting among children aged 24 to 59 months within the working area of UPT Puskesmas Kamaipura. Case-control studies are well-suited for identifying factors that differentiate between subjects experiencing a condition (cases) and those who do not (controls) by retrospective comparison of exposure variables. Following Sugiyono's (2021) framework on research methods, this design enables causal inference by comparing variations in nutritional practices, infection history, and immunization status between stunted and non-stunted children. The choice of a case-control model was further supported by Creswell's (2022) recommendations for health-related epidemiological investigations aiming to analyze associations and risks. The study population consisted of mothers with children aged 24-59 months documented in the administrative area of UPT Puskesmas Kamaipura, with 174 stunted children identified as the case group. Sample size determination utilized the Slovin formula targeting a 5% margin of error, yielding a sample of 64 respondents selected through purposive sampling based on specific inclusion criteria relevant to the study aims (Sudaryono, 2023; Bahar et al., 2024).

Data collection employed a structured questionnaire designed to capture exclusive breastfeeding practices, complementary feeding (MP-ASI) behaviors, infection history, and immunization status of the children. Instrument development was grounded in prior validated research and theoretical frameworks addressing determinants of child malnutrition and stunting (Emzir, 2021; Darlis et al., 2024). Validity and reliability of the instrument were confirmed statistically, with item validity assessed by a correlation coefficient exceeding 0.3 and an overall reliability coefficient (Cronbach's alpha) above 0.7, ensuring the consistency and accuracy of

data collection tools. The questionnaire administration was conducted via direct interviews with mothers in the study area, providing primary data that reflected recent practices and child health histories. Data management and analysis utilized SPSS version 25.0, following recommended protocols for epidemiological data processing.

The analytic strategy integrated univariate, bivariate, and multivariate analyses. Univariate analysis provided descriptive statistics characterizing respondent demographics and key variables. Bivariate analyses employed the chi-square test to evaluate the relationship between independent variables (exclusive breastfeeding, MP-ASI, infection history, immunization status) and stunting incidence, with a significance threshold set at a p-value less than 0.05 (Sugiyono, 2021; Indriani et al., 2025). Multivariate logistic regression analysis was performed to identify the dominant determinants of stunting by adjusting for confounding factors and assessing the independent effect of each variable, producing odds ratios (OR) with 95% confidence intervals (CI). This modeling approach aligns with Creswell's recommended procedures for quantitative health research, enabling robust inference about predictors in complex biological and social systems (Creswell, 2022; Modjo et al., 2024).

Ethical considerations and research procedures adhered to guidelines for human subject research, including obtaining informed consent from all participants and ensuring confidentiality of personal data, consistent with standard practices in public health research (Sudaryono, 2023). The study was conducted in the field by trained enumerators following standardized protocols for data collection and quality control. This comprehensive methodological framework provided a rigorous basis to explore the multifactorial causes of stunting in the targeted population, enhancing the validity and applicability of findings to inform public health interventions in Central Sulawesi.

RESULTS

UNIVARIATE ANALYSIS

Table 1. Age of Respondents

Respondent Age	n	(%)
17-25 years	63	**49,2**
26-35 years	49	**38,3**
36-45 years	16	**12,5**
Total	**128**	**100**

Source: Primary Data, 2025

Based on Table 1, it shows that out of 128 respondents, the age group with the highest number of respondents is 17-25 years old with 63 respondents (49.2%) and the lowest is in the 36-45 age group with 16 respondents (12.5%).

Table 2. Respondents' Last Education

Respondent's Last Education	n	(%)
Not in School	24	**18,8**
SD	18	**14,1**
SMP	15	**11,7**

SMA	61	**47,6**
S1	10	**7,8**
Total	**128**	**100**

Source: Primary Data, 2025

Based on Table 2, it shows that out of 128 respondents, the most represented education category among the respondents is high school with 61 respondents (47.6%), while the lowest is the undergraduate category with 10 respondents (7.8%).

Table 3. Respondents' Occupations

Respondent's Job	n	(%)
Housewife	46	**35,9**
Farm/Livestock Worker	48	**37,5**
Entrepreneur	12	**9,4**
Farmer	9	**7,1**
Livestock Farmer	3	**2,3**
Contract Worker	4	**3,1**
Civil Servant	6	**4,7**
Total	**128**	**100**

Source: Primary Data, 2025

Based on Table 3, it shows that out of 128 respondents, the occupation category with the highest number of respondents was farm/livestock laborers with 48 respondents (37.5%), and the lowest was farmers with 3 respondents (2.3%).

Table 4. Gender of Respondents' Children

Child's Gender	n	(%)
Male	73	**57**
famale	55	**43**
Total	**128**	**100**

Source: Primary Data, 2025

Based on Table 4, it shows that out of 128 respondents, the most common category of the children's gender among the respondents is male, with 73 respondents (57%), while the lowest is in the female category, with 55 respondents (43%).

Table 5. Respondent Addresses

Respondent Addresses	n	(%)
North Sibalaya Village	37	**27,3**
South Sibalaya Village	13	**10,2**
West Sibalaya Village	17	**13,3**
Sibowi village	40	**31,2**
Lambara Village	23	**18**
Total	**128**	**100**

Source: Primary Data, 2025

Based on Table 5, it shows that out of 128 respondents, the most common address of respondents is Sibowi Village with 40 respondents (31.2%) and the lowest is in South Sibalaya Village with 13 respondents (10.2%).

BIVARIATE ANALYSIS

Table 6. The Relationship Between Exclusive Breastfeeding and the Incidence of *Stunting*

breast milk exclusive	Stunting				Total		*p-value* ≤ 0,05	OR (CI 95%)
	Normal		*Stunting*					
	n	%	n	%	n	%		
exclusive	62	96,9	50	78,1	112	87,5	0,003	**8,680 (1,884-39,994)**
Non Exckusive	2	3,1	14	21,9	16	12,5		
Total	**64**	**100**	**64**	**100**	**128**	**100**		

Source: Primary Data, 2025

Based on the data in Table 6 above, it is known that out of 64 toddlers with normal nutritional status, the majority, namely 62 toddlers (96.9%), were classified as having exclusive breastfeeding, while 2 toddlers (3.1%) were classified as having non-exclusive breastfeeding. Meanwhile, out of 64 toddlers with stunted nutritional status, the majority, namely 50 toddlers (78.1%), were classified as having exclusive breastfeeding, and 14 toddlers (21.9%) were classified as having non-exclusive breastfeeding.

Table 7. Relationship Between Complementary Feeding Practices and the Incidence of Stunting

Complementary Feeding	Kategori				Total		*p-value* ≤ 0,05	OR (CI 95%)
	Normal		*Stunting*					
	n	%	n	%	n	%		
sufficient	62	96,9	1	1,6	63	49,2	0,000	**1.953 (172,638-22.093,730)**
insufficient	2	3,1	63	98,4	65	50,8		
Total	**64**	**100**	**64**	**100**	**128**	**100**		

Source: Primary Data, 2025

Based on the data in Table 7 above, it is known that of the 64 toddlers with normal nutritional status, the majority, 62 toddlers (96.9%), fall into the category of adequate complementary feeding practices, while 2 toddlers (3.1%) fall into the category of inadequate complementary feeding practices. Meanwhile, of the 64 toddlers with stunted nutritional status, the majority, 63 toddlers (98.4%), fall into the category of inadequate complementary feeding practices, and 1 toddler (1.6%) falls into the category of adequate complementary feeding practices.

The results of the Chi-Square test analysis showed a p-value of 0.003, so p-value < 0.05. This means that there is a significant relationship between exclusive breastfeeding and the occurrence of stunting in children aged 24-59 months in the working area of UPT Puskesmas Kamaipura. Furthermore, the results of the Odds Ratio (OR) analysis showed a value of 8.680 (95% CI: 1.884–39.994). Since the OR value > 1, it can be interpreted that the variable of exclusive breastfeeding is associated with an increased risk of stunting. Thus, children who did not receive exclusive breastfeeding have 8.6 times higher risk of experiencing stunting compared to children who received exclusive breastfeeding. The Confidence Interval (CI) shows a lower limit of 1.884 and an upper limit of 39.994, meaning that children who did not receive exclusive breastfeeding have at least 1.8 times and at most up to 39.9 times higher risk of experiencing stunting compared to with toddlers who receive adequate complementary feeding practices.

Table 8. The Relationship Between Infection History and the Incidence of Stunting

Infection History	Category				Total		*p-value* ≤ 0,05	OR (CI 95%)
	Normal		*Stunting*					
	n	%	n	%	n	%		
high infection	3	4,7	29	45,3	32	25	0,000	**0,059 (0,017-0,209)**
Low infaction	61	95,3	35	54,7	96	75		
Total	**64**	**100**	**64**	**100**	**128**	**100**		

Source: Primary Data, 2025

Based on the data in Table 8 above, it is known that out of 64 toddlers with normal nutritional status, the majority, 61 toddlers (95.3%), fall into the low infection history category, while 3 toddlers (4.7%) fall into the high infection history category. Meanwhile, out of 64 toddlers with stunted nutritional status, the majority, 35 toddlers (54.7%), fall into the low infection history category, and 29 toddlers (45.3%) fall into the high infection history category.

The results of the Chi-Square test analysis showed a p-value of 0.000, so p-value < 0.05. This indicates that there is a significant relationship between a history of infection and the incidence of stunting in children aged 24-59 months in the working area of UPT Puskesmas Kamaipura. Furthermore, the results of the Odds Ratio (OR) analysis showed a value of 0.59 (95% CI: 0.017-0.209). Since the OR value is < 1, it can be interpreted that the variable of infection history is protective against the incidence of stunting, meaning that children with a high history of infection have a 0.059 times greater risk of suffering from stunting compared to children with a low history of infection.

Table 9. The Relationship Between Immunization Status and the Incidence of Stunting

Status Imunisasi	Category		Total	*p-value* ≤ 0,05	OR (CI 95%)
	Normal	*Stunting*			

	n	%	n	%	n	%		
complete	61	95,3	38	59,4	29	22,7	0,000	**0,072 (0,20-0,254)**
incomplete	3	4,7	26	40,6	99	77,3		
Total	**64**	**100**	**64**	**100**	**128**	**100**		

Source: Primary Data, 2025

Based on the data in Table 9 above, it is known that out of 64 toddlers with normal nutritional status, the majority, namely 61 toddlers (95.3%), had complete immunization status, and 3 toddlers (4.7%) had incomplete immunization status. Meanwhile, of the 64 toddlers with stunted nutritional status, the majority, namely 38 toddlers (59.4%), had complete immunization status, and 26 toddlers (40.6%) had incomplete immunization status.

The results of the Chi-Square test analysis showed a p-value of 0.000, so the p-value < 0.05. This means that there is a significant relationship between immunization status and the occurrence of stunting in children aged 24-59 months in the working area of UPT. Puskesmas Kamaipura. Furthermore, the results of the Odds Ratio (OR) analysis showed a value of 0.072 (95% CI: 0.20-0.254). Since the OR value < 1, it can be interpreted that the immunization status variable is protective against the occurrence of stunting, so children with incomplete immunization status have a 0.072 times higher risk of suffering from stunting compared to children with complete immunization status.

MULTIVARIATE ANALYSIS

Table 10. Model 1 Analysis of the Effect of Stunting Incidents on Toddlers Aged 24-59 Months at UPT. Kamaipura Health Center

Variable	*p-value*	OR (CI 95%)
Exclusive Breastfeeding	0,505	5,033 (0,044-580,701
Complementary Feeding	0,000	1.098,827 (89,958-13.422,022)
Infection History	0,267	0,141 (0,004-4,477)
Immunization Status	0,354	0,172 (0,004-7,124)

Source: Primary Data, 2025

Table 10 shows the results of logistic regression analysis for the variables of exclusive breastfeeding, complementary feeding (MP-ASI), history of infection, and immunization status. The table indicates that the exclusive breastfeeding variable has the largest p-value. Therefore, the exclusive breastfeeding variable was excluded in modeling step 2.

Table 11. Modeling Step 2 Analysis of the Effect of Stunting Incidence on Children Aged 24-59 Months at UPT. Kamaipura Health Center

Variable	*p-value*	OR (CI 95%)
complementary foods for infants	0,000	1.207,094 (99,985-14.572,998)

Infection History	0,273	0,148 (0,005-4,500)
Immunization Status	0,318	0,164 (0,005-5,688)

Source: Primary Data, 2025

Table 11 shows the results of logistic regression analysis for the variables MP-ASI, infection history, and immunization status. The table shows that the immunization status variable has the highest p-value. Therefore, the immunization status variable was removed in the third modeling step.

Table 12. Model 3 Analysis of the Effect of Stunting Events on Children Aged 24-59 Months at UPT. Kamaipura Health Center

Variable	*p-value*	OR (CI 95%)
complementary foods for infants	0,000	1.490,864 (127,057-17.493,521)
Infection History	0,259	0,155 (0,006-3,929)

Source: Primary Data, 2025

Table 12.shows the results of the logistic regression analysis of the MP-ASI variable and infection history.

The table shows that the infection history variable has the largest p-value. The table also shows that the variable with the highest Odds Ratio (OR) is the MP-ASI variable, indicating that the dominant factor in the occurrence of stunting in children aged 24-59 months in the working area of UPT Puskesmas Kamaipura is the MP-ASI variable.

Table 13. Model 4 Analysis of the Effect of Stunting Incidence in Children Aged 24-59 Months at UPT. Kamaipura Health Center

Variable	*p-value*	OR (CI 95%)
complementary feeding	0,000	1.953 (172,638-22.093,730)

Source: Primary Data, 2025

Table 13 shows the results of the logistic regression analysis of the MP-ASI variable. The table shows that the largest Odds Ratio (OR) is the MP-ASI variable, and after being controlled for other variables, only the MP-ASI variable is statistically significant. Therefore, the dominant factor in the occurrence of stunting in children aged 24-59 months in the working area of UPT. Puskesmas Kamaipura is the MP-ASI variable.

DISCUSSION

Stunting is a condition of growth failure in toddlers caused by long-term malnutrition, resulting in a child's body being shorter than the ideal height for their age. Toddlers classified as short or very short are those whose length or height for age (L/A or H/A) is lower than the growth standards set by the WHO through the WHO-MGRS (Samsuddin et al., 2021). According to the Ministry of Health, stunting is defined as a condition in which a toddler has a z-score of less than -2 SD (for the stunted category) and less than -3 SD (for the severely stunted category) (Khotimah, 2022). Stunting occurs due to various factors that hinder a baby's growth process during the first 1000 days of life (HPK), from conception to 24 months after birth, but the condition only becomes apparent after the child reaches 24 months of age (Wardani, 2022).

The First 1000 Days of Life period is a crucial phase that marks the beginning of stunting and can lead to long-term impacts that continue and recur throughout the life cycle. If after birth a child does not receive a supportive external environment, the stunting condition has the potential to become permanent and cause the child to grow into a teenager with below-average height. Short stature from an early age, especially from birth, indicates impaired growth and development of various body organs, such as the brain, heart, kidneys, muscles, bones, and other vital organs (Samsuddin et al., 2021).

Stunting remains a major public health problem in many low- and middle-income countries. Stunting in the 24–59 month age group reflects the accumulation of nutritional deficits and biological injuries since the first 1,000 days, as well as the continuing impact of infection-related morbidity, feeding practices, and access to health services. The modern conceptual framework positions exclusive breastfeeding, the quality and timing of complementary feeding, the frequency of enteric/respiratory infections, and immunization coverage as key interacting determinants in causing growth faltering (Nasrin et al., 2023).

1. The Effect of Exclusive Breastfeeding on the Incidence of Stunting

Exclusive breastfeeding plays an important role in meeting a child's nutritional needs during the early stages of life, which greatly affects nutritional status and the potential occurrence of stunting. Breast milk contains various complete nutrients, antibodies, and bioactive components that are crucial for a child’s growth and development, especially during the first six months of life. Breast milk not only serves as the baby’s main food source but also as a highly effective public health intervention in preventing long-term malnutrition. The breast milk produced by the mother contains all the nutrients a baby needs to grow and develop. During the first six months, the baby is given only breast milk without any other liquids such as formula, juice, honey, or tea, as well as without solid foods like fruits, porridge, or biscuits (Indriani et al., 2025).

Based on the results of the bivariate analysis in Table 4.11, it was found that out of 128 toddlers in the working area of UPT. Kamaipura Health Center, 112 toddlers (87.5%) were in the exclusive breastfeeding category and 16 toddlers (12.5%) were in the non-exclusive breastfeeding category. During interviews with the respondents, most of them reported that they had already been practicing exclusive breastfeeding for their toddlers. They stated that they had also implemented exclusive breastfeeding during the first 6 months without any additional food, and they realized that exclusive breastfeeding must be carried out consistently to support their toddlers' nutritional needs.

There are various factors that can influence a mother in providing exclusive breastfeeding to her baby. A mother's knowledge about the benefits of breast milk plays an important role because a good understanding will encourage motivation to breastfeed

optimally. In addition, skills in proper breastfeeding practices also determine the success of exclusive breastfeeding. Psychological factors such as stress levels, self-confidence, and the mother's emotional condition can also affect milk production and the sustainability of breastfeeding. On the other hand, the mother's physical condition, including health status and nutritional adequacy, plays a major role in supporting smooth breastfeeding. Support from family, especially the husband, as well as a positive social environment, significantly contributes to enhancing the mother's desire and ability to provide exclusive breastfeeding during the first six months of the baby's life (Rahmalia & Azinar, 2024).

According to (Febrianti et al., 2024), the factors influencing exclusive breastfeeding can be classified into three main groups. First, predisposing factors, which include the level of education, maternal knowledge, as well as the cultural values and habits adhered to. Second, enabling factors, which involve the family's economic condition, the availability of time for the mother to breastfeed, and the mother's own health condition. Third, reinforcing factors, which consist of support from the family and the active role of healthcare professionals in providing motivation and information to breastfeeding mothers. These three groups of factors interact with each other and contribute to the successful implementation of exclusive breastfeeding.

One of the factors contributing to stunting is mistakes in providing exclusive breastfeeding, such as delays in initiating early breastfeeding, not providing exclusive breast milk, or stopping breastfeeding too early. Exclusive breastfeeding is closely related to a reduced risk of stunting in children. Therefore, promotion and education regarding the importance of breastfeeding is one of the main strategies in efforts to prevent stunting (Wasaraka, 2024).

Based on the results of the bivariate analysis in Table 4.11, it was found that out of 64 toddlers with stunted nutritional status, most were in the exclusive breastfeeding category, totaling 50 toddlers (78.1%), whereas out of 64 toddlers with normal nutritional status, most were in the exclusive breastfeeding category, totaling 62 toddlers (96.9%). The chi-square test analysis yielded a p-value = 0.003, which means p-value < 0.05, indicating a significant relationship between exclusive breastfeeding and the incidence of stunting in toddlers aged 24-59 months in the working area of the Kamaipura Community Health Center. The Odds Ratio (OR) analysis result was 8.680 (1.884-39.994) with a 95% Confidence Interval (CI). Since OR > 1, this means exclusive breastfeeding is a risk factor for stunting, so toddlers who do not receive exclusive breastfeeding have a risk 8.6 times higher of experiencing stunting compared to toddlers who receive exclusive breastfeeding. The Confidence Interval (CI) value shows a lower limit of 1.884 and an upper limit of 39.994, which means that toddlers who do not receive exclusive breastfeeding have a minimum of 1.8 times and a maximum of 39.9 times higher risk of experiencing stunting compared to toddlers who receive exclusive breastfeeding.

Table 4.11 shows that out of 128 toddlers, both those with normal nutritional status totaling 62 children (96.9%) and those with stunted nutritional status totaling 50 children (78.1%) were mostly in the exclusive breastfeeding category. Although toddlers are given exclusive breastfeeding, it does not rule out the possibility of stunting. In the field, it was found that even when toddlers were still given exclusive breastfeeding, many cases of stunting were observed. This is due to the lack of sanitation hygiene available in the respondents' residential environment, the limited diversity of food, and mothers stopping breastfeeding too early due to insufficient breast milk output. These factors result in the child's nutritional needs not being fully met after the exclusive breastfeeding phase.

The results of this study are in line with research conducted by Sutrisna et al. (2024), which stated that there is an influence between exclusive breastfeeding and the incidence of

stunting. In that study, the results showed a p-value of 0.000 < 0.005, which means there is a significant effect between exclusive breastfeeding and the occurrence of stunting. Meanwhile, the odds ratio test showed an OR value of 1.3, meaning that toddlers who are not exclusively breastfed have a 1.3 times greater chance of experiencing stunting compared to toddlers who are exclusively breastfed.

The results of this study are not in line with the research conducted by (Safika et al., 2023) which stated that there is no effect between exclusive breastfeeding and the incidence of stunting. In that study, the results showed a p-value of 0.095 > 0.005, which means there is no significant effect between exclusive breastfeeding and the occurrence of stunting, whereas in the odds ratio test, an OR value of 2.3 was obtained, meaning that children who are not given exclusive breastfeeding have a 2.3 times higher chance of experiencing stunting.

2. The Effect of Complementary Feeding Practices on the Incidence of Stunting

One of the important factors that plays a major role in preventing stunting is the mother's adherence to providing complementary foods (MP-ASI). Upon reaching six months of age, a baby's nutritional needs can no longer be met solely through breast milk, making the provision of complementary foods crucial to support optimal growth and development. However, many discrepancies are still found in complementary feeding practices, such as introducing it too early or too late, low meal frequency, lack of food variety, and poor hygiene in food preparation. These conditions can increase the risk of stunting in children. Conversely, adherence to the complementary feeding guidelines recommended by the WHO and the Ministry of Health has been shown to significantly contribute to reducing stunting prevalence (Wulansari & Hipni, 2025).

Based on the results of the bivariate analysis in Table 4.12, it was found that out of 128 toddlers in the working area of UPT. Kamaipura Health Center, 63 toddlers (49.2%) were in the category of adequate complementary feeding practices, while 65 toddlers (50.8%) were in the category of inadequate complementary feeding practices. During interviews with respondents, most of them did not have good knowledge about proper complementary feeding practices following guidelines. Respondents preferred to give packaged food to their toddlers rather than preparing varied meals. Most respondents also only fed their toddlers when the toddlers asked for food or felt hungry, without paying attention to the recommended three meals per day. Furthermore, poor hygiene and sanitation in the respondents' living environment also caused the food given to toddlers to be insufficiently sterile due to limited access to clean water, leading respondents to washing food ingredients using polluted river water.

The provision of complementary foods (MP-ASI) plays a very important role for infants, especially in meeting nutritional needs that can no longer be fulfilled by breast milk alone. In addition to functioning to supplement potential nutrient deficiencies that may have occurred since pregnancy, MP-ASI also helps cover nutritional deficits arising from maternal inconsistency in providing exclusive breastfeeding during the first six months of an infant's life. Proper MP-ASI provision in terms of timing, frequency, portion, diversity, and hygiene supports optimal growth and development of the child. Conversely, mistakes in MP-ASI practice can increase the risk of nutritional disorders and affect child growth and development, including the possibility of stunting (Wirastri & Zulfiana, 2025).

When a baby reaches six months of age, their nutritional needs increase and can no longer be met by breast milk alone. Therefore, it is necessary to provide complementary foods that can supplement their nutrient intake to support growth and development. Complementary feeding should be carried out by paying attention to various important

aspects, such as the amount and timing of feeding, food texture appropriate for the age, variety of food ingredients, proper methods of presentation, and the application of hygiene principles to ensure that the food consumed is safe and nutritionally balanced (Sukmawati, Risna Andriana, Sitti Sahariah Rowa, 2025).

Many mothers still do not practice complementary feeding (MP-ASI) correctly. These mistakes can include inappropriate feeding frequency, inadequate portion sizes, or food texture that does not match the child's age. In addition, the timing of starting MP-ASI must also follow established guidelines, in terms of age, frequency, and portion size appropriate to the child's developmental stage. This is very important to support the child's growth and development optimally. Giving MP-ASI too early, before the baby is six months old, can reduce breast milk intake and impact optimal nutritional fulfillment. Conversely, if MP-ASI is given too late after six months of age, the child is at risk of having difficulty eating because they are not accustomed to food texture and taste, which can ultimately disrupt their growth and development (Pane et al., 2024). Those who are adequately nourished have the smallest risk of 172 times and the largest up to 22,093 times more likely to experience stunting compared to toddlers who receive adequate complementary feeding practices.

Based on the results of the bivariate analysis in Table 4.12, it was found that out of 64 toddlers with stunting nutritional status, most were in the category of insufficient complementary feeding practices (MP-ASI), totaling 63 toddlers (98.4%), whereas out of 64 toddlers with normal nutritional status, most were in the category of adequate MP-ASI practices, totaling 62 toddlers (96.9%). The chi-square test analysis yielded a p-value = 0.000, so p-value < 0.05, which means there is a significant relationship between the MP-ASI variable and the occurrence of stunting in toddlers aged 24-59 months in the working area of UPT Puskesmas Kamaipura. The Odds Ratio (OR) analysis resulted in 1.953 (172.638–22,093.730) with a 95% Confidence Interval (CI). Since OR > 1, it means that MP-ASI is a risk factor for stunting, so toddlers who do not receive adequate complementary feeding practices have a 1.953 times higher risk of experiencing stunting compared to toddlers who receive proper feeding practices introduction of complementary foods

In Table 4.12, it can be seen that out of 128 toddlers, those with normal nutritional status were mostly in the sufficient complementary feeding practice category, totaling 62 toddlers (96.1%), while toddlers with stunted nutritional status were mostly in the insufficient complementary feeding practice category, totaling 63 toddlers (98.4%). Furthermore, based on multivariate analysis, a p-value of 0.000 was obtained, and after controlling for other variables, only the complementary feeding variable had a statistically significant effect, making it the dominant factor in the incidence of stunting among children aged 24-59 months in the working area of UPT Puskesmas Kamaipura.

The results of this study are in line with the research conducted by Darlis et al. (2024), which stated that there is an influence between the practice of complementary feeding (MP-ASI) and the incidence of stunting. In that study, the results obtained had a p-value of 0.013 < 0.05, which means there is a significant influence between the practice of complementary feeding and the incidence of stunting. Meanwhile, the odds ratio test obtained a value of OR = 3.5, which means that toddlers who do not receive adequate complementary feeding practice are 3.5 times more likely to experience stunting compared to toddlers who receive adequate complementary feeding practice. The results of this study are not consistent with the research conducted by Mujadillah & Alnur (2024), which stated that there is no influence between complementary feeding practice and the incidence of stunting. In that study, the results obtained had a p-value of 0.483 > 0.05, which means there is no significant influence between the practice of complementary feeding and the incidence of stunting, Meanwhile, in the odds ratio test, the OR value of 1.5 was obtained, which means that toddlers who do

not receive adequate complementary feeding practices are 1.5 times more likely to experience stunting.

3. The Influence of Infection History on the Occurrence of Stunting

One of the factors contributing to stunting in toddlers is infectious diseases. Infections can directly disrupt the body's metabolic processes, including the growth plate of the epiphysis, leading to growth delays due to malnutrition. Infectious diseases are one of the main causes of stunting in young children. This condition can be triggered by inadequate nutritional intake in both children and pregnant mothers, as well as limited access to sanitation and clean water. Poor sanitation access and poor hygiene practices can increase the risk of diarrhea, which in turn causes nutrient malabsorption and negatively impacts child growth (Setianingsih et al., 2024).

Based on the results of the bivariate analysis in table 4.13, it was found that out of 128 toddlers in the working area of UPT. Puskesmas Kamaipura, 32 toddlers (25%) were in the high infection history category and 96 toddlers (75%) were in the low infection history category. During interviews with respondents, most of them stated that their children did not have a high or recurrent infection history. The average high infection history was found in toddlers with stunted nutritional status and living in Sibowi Village and Lambara Village. The high infection history found in toddlers with stunted nutritional status is suspected to be influenced by several aspects in the field, namely incomplete immunization coverage for toddlers and also due to poor sanitation hygiene in the respondents' residences. The difficulty of accessing clean water in the respondents' residential area causes many residents to use contaminated river water to meet daily needs. days like washing, cooking, drinking, and so on.

Infection is a condition when microorganisms enter the human body and multiply to cause disease. In toddlers, infection is considered a serious illness with a relatively high mortality rate. Infectious diseases are caused by the growth and development of microorganisms in the body, which are groups of microscopic single-celled or multicellular organisms, such as bacteria, fungi, parasites, and viruses. Infection occurs when the interaction between microbes and the host body causes tissue damage, which then leads to various clinical signs and symptoms. Microorganisms that can cause disease in humans are called pathogenic microorganisms (Setianingsih et al., 2024).

Several previous studies have shown that toddlers with a history of infectious diseases are at risk of malnutrition, which if left untreated can lead to stunting. Increased duration of infectious diseases such as diarrhea, fever, and ARI is closely related to nutritional status, especially in the decrease of weight-for-age (W/A) index. Growth disorders due to diarrhea are generally associated with impaired nutrient absorption during and after diarrhea. In addition, ARI can also contribute to stunting due to decreased nutrient intake during illness and reduced appetite in children. Infections caused by worms are also one of the factors contributing to stunting in toddlers (Erwin Saleh Pulungan et al., 2024).

Based on the results of the bivariate analysis in Table 4.13, it was found that out of 64 toddlers with stunting nutritional status, most were in the low infection history category, totaling 35 toddlers (54.7%). Then, out of 64 toddlers with normal nutritional status, most were also in the low infection history category, totaling 61 toddlers (95.3%). The chi-square test analysis resulted in a p-value = 0.000, so p-value < 0.05, which means there is a significant relationship between exclusive breastfeeding and the incidence of stunting in toddlers aged 24-59 months in the working area of UPT. Puskesmas Kamaipura. The Odds Ratio (OR) test analysis showed 0.059 (0.017-0.209) with a 95% Confidence Interval (CI). Since the OR value < 1, it can be interpreted that the variable of infection history is protective

against the incidence of stunting, so toddlers with a high infection history have a 0.059 times greater risk of suffering from stunting compared to toddlers with a low infection history.

The results of this study are in line with the research conducted by Setianingsih et al. (2024), which stated that there is an influence between giving a history of infection and the occurrence of stunting. In that study, the results showed a p-value of 0.030 < 0.05, which means there is a significant effect of infection history.

The results of this study are not in line with the research conducted by Adrizain et al. (2024), which stated that there is no influence between giving a history of infection and the occurrence of stunting. In that study, the results showed a p-value of 0.706 > 0.05, which means there is no significant effect of infection history on the incidence of stunting.

4. The Effect of Immunization Status on the Incidence of Stunting

Immunization plays a very important role in building a child's immunity against various infectious diseases. Children who do not receive complete immunization are at a higher risk of contracting various contagious diseases that can interfere with their growth and development. Repeated infections due to low immunity can lead to decreased appetite, impaired nutrient absorption, and increased energy needs during illness, which negatively affect the child's nutritional status. Suboptimal nutrition over the long term can hinder both physical growth and overall development. Therefore, complete and timely immunization is a highly effective preventive measure in preventing growth disorders such as stunting and ensuring that children can reach their full growth and developmental potential (Modjo et al., 2024).

Based on the results of the bivariate analysis in Table 4.14, it was found that out of 128 toddlers in the work area of UPT. Puskesmas Kamaipura, 29 toddlers (22.7%) were in the complete immunization category, and 99 toddlers (77.3%) were in the incomplete immunization category. During interviews with respondents, most of them did not want their toddlers to be immunized, due to a lack of knowledge and trust in health workers. In addition, the lack of family support for vaccination also affected this situation. Many parents or the respondents' husbands advised against immunizing their toddlers. They did not want their toddlers to become fussy, lose appetite, or fall ill, which are side effects of vaccination.

According to UNICEF, babies need lifelong protection, both from within the body through natural immunity and from outside through disease prevention efforts. One form of this protection is the administration of complete immunizations according to the established doses and schedule from birth until one year of age. Immunizations need to be adjusted according to the child's age to ensure the effectiveness of immunity development. In Indonesia, the routine complete immunization program includes basic immunizations and follow-up immunizations. Basic immunizations are given from birth and continued gradually according to the specified schedule. The complete basic immunization schedule includes: Hepatitis B (HB-0) given within 24 hours after birth, BCG and Polio 1 immunizations at 1 month of age, DPT-HB-Hib 1 and Polio 2 at 2 months of age, DPT-HB-Hib 2 and Polio 3 at 3 months of age, and DPT-HB-Hib 3, Polio 4, as well as IPV (injectable Polio) at 4 months of age. and Measles or MR immunization at the age of 9 months. This program aims to protect children from various dangerous infectious diseases and support healthy and optimal growth and development (Handayani & Wulan, 2024).

Immunization is one of the important efforts in enhancing the body's immunity and preventing the spread of infectious diseases. The principle of immunization is to stimulate the body to produce antibodies against disease-causing microorganisms without a person having to become ill first. When a vaccine is introduced into the body, the immune system recognizes it as a foreign substance and responds by producing antibodies, similar to the natural response to an actual infection. The antibodies formed will remain in the body and

function as a defense system if the body is exposed to the same microorganisms in the future. Thus, the antibodies will protect the body from infection and prevent the onset of disease. Routine immunization aims to reduce the incidence of vaccine-preventable diseases and to protect individuals and communities from the threat of infectious diseases (Syahrul Fatoni Putra et al., 2025).

Based on the results of the bivariate analysis in Table 4.14, it was found that out of 64 toddlers with stunted nutritional status, the majority were in the complete immunization category, totaling 38 toddlers (59.4%). Meanwhile, out of 64 toddlers with normal nutritional status, most were also in the complete immunization category, totaling 61 toddlers (95.3%). The chi-square test analysis resulted in a p-value = 0.000, so p-value < 0.05, meaning there is a significant relationship between immunization status and the incidence of stunting in toddlers aged 24-59 months in the working area of UPT. Puskesmas Kamaipura. The Odds Ratio (OR) analysis yielded a value of 0.072 (0.20-0.254) with a 95% Confidence Interval (CI). Since the OR value < 1, it can be interpreted that immunization status has a protective effect against the occurrence of stunting, so toddlers with incomplete immunization status have a 0.059 times higher risk of experiencing stunting compared to toddlers with complete immunization status.

The results of this study are in line with the research conducted by (Handayani & Wulan, 2024), which stated that there is an influence between immunization status and the occurrence of stunting. In that study, the results showed a p-value of 0.001 < 0.005, indicating a significant effect of immunization status on the incidence of stunting. Meanwhile, the odds ratio test showed an OR value of 0.313, suggesting that immunization status has a protective effect against the occurrence of stunting.

The results of this study are not in line with the research conducted by (Syahrul Fatoni Putra et al., 2025), which stated that there is no effect of immunization status on the incidence of stunting. In that study, the results showed a p-value of 0.108 > 0.05, which means that there is no significant effect of immunization status on the incidence of stunting. Meanwhile, in the odds ratio test, a value of OR = 2.087 was obtained, indicating that toddlers with incomplete immunization status are 2.087 times more at risk of experiencing stunting than toddlers with complete immunization history.

CONCLUSION

The study found that complementary feeding (MP-ASI) practices are the dominant determinant of stunting among children aged 24 to 59 months in the working area of UPT Puskesmas Kamaipura. Children who did not receive adequate complementary feeding had a significantly higher risk—up to 1,953 times—of experiencing stunting compared to those with sufficient complementary feeding practices. Additionally, exclusive breastfeeding, infection history, and immunization status were significantly associated with stunting incidence in bivariate analysis; however, multivariate analysis confirmed complementary feeding as the sole statistically significant factor. These findings underscore the critical importance of proper complementary feeding practices in preventing stunting and supporting optimal child growth and development in this population. The study supports targeted nutritional interventions focusing on improving complementary feeding alongside continued promotion of exclusive breastfeeding and immunization coverage to reduce stunting prevalence effectively.

This research, however, has limitations including the relatively small sample size drawn from a specific geographic area, which may affect the generalizability of the results to broader populations. The cross-sectional and case-control design restricts the ability to infer causality definitively. Recommendations for future studies include larger, longitudinal designs that can

better capture temporal relationships and other potential confounding factors such as maternal nutrition and socio-economic variables. Practically, the findings highlight the necessity for public health programs to enhance caregiver education about age-appropriate complementary feeding, hygiene practices, and continuous healthcare support. Strengthening community-based nutritional counseling and monitoring, together with improved access to clean water and sanitation, can contribute to reducing stunting rates and improving child health outcomes in similar resource-limited settings.

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