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Relationship between diarrhea history, exclusive breastfeeding, and feeding patterns with stunting incidence in toddlers aged 24-59 months

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ABSTRACT

Background and purpose: Stunting remains a major public health issue globally, including in Jember District. Despite the significant stunting reduction in the region—from 21.4% in 2020 to 6.6% in 2024—Rambipuji Public Health Center (PHC) reports a comparatively high prevalence of 19.94%, indicating a persistent public health concern. This study aimed to analyze the association between diarrheal history, exclusive breastfeeding, and feeding patterns with the incidence of stunting among children aged 24–59 months.

Methods: An analytical observational study with a case-control design was conducted among 114 children aged 24–59 months (57 cases and 57 controls) selected by simple random sampling in the Rambipuji PHC area based on growth monitoring data from May 2025. Data which include stunting status, children characteristics and maternal characteristics were collected through structured interviews and observations, and analyzed using chi-square tests (α=0.05) with SPSS.

Results: The results indicated significant associations between maternal education (OR=11.25; 95%CI: 1.354-93.504; p=0.026), exclusive breastfeeding (OR=3.352; 95%CI: 1.377-8.159; p=0.006), and feeding patterns (OR=10.5; 95%CI: 2.336-47.201; p=0.005) with stunting incidence. However, a history of diarrhea was not significantly associated with stunting.

Conclusion: Maternal education, exclusive breastfeeding, and feeding patterns are associated with stunting among children. Strengthening maternal nutrition and feeding education, as well as optimizing services at integrated health posts (Posyandu) and public health centers (Puskesmas), are essential to reduce stunting prevalence.

Keywords: Stunting, exclusive breastfeeding, feeding patterns, maternal education, diarrhea

INTRODUCTION

Malnutrition in children is one of the leading causes of under-five mortality and represents a major public health concern globally.[1,2] Stunting, as a form of chronic malnutrition, affects approximately 149 million children under the age of five worldwide.[3] This condition has garnered international attention due to its far-reaching consequences—not only short-term effects but also serious long-term impacts such as impaired physical and cognitive development.[4] Stunting is generally irreversible after a child reaches the age of two and increases the risk of metabolic disorders and cardiovascular diseases later in life.[5,6] Consequently, reducing the prevalence of stunting by 50% by the year 2030 has been established as one of the key targets of the Sustainable Development Goals (SDGs).[7]

In Indonesia, the prevalence of stunting based on the 2023 Indonesian Health Survey was 21.5%, a figure that still falls short of the national target of reducing stunting to 14% by 2024, as outlined in the 2020–2024 National Medium-Term Development Plan.[8] In East Java Province, the stunting prevalence was recorded at 17.7%. Jember District is among the regions that successfully reduced its stunting rate from 21.4% in 2020 to 6.6% as of August 2024. However, several public health centers (PHC/*puskesmas*) have yet to meet the national target, including Rambipuji PHC, which reported the highest stunting prevalence in the district at 19.94%.[9]

Stunting is a chronic form of undernutrition that commonly begins during the prenatal period and continues after birth, with physical manifestations often becoming evident after the age of two years.[10] It is influenced by multiple interrelated factors, including inadequate dietary intake, recurrent infections, inappropriate caregiving practices, limited access to healthcare services, and poor environmental sanitation.[11] Nutritional deficits reflect a mismatch between dietary intake and physiological requirements in both quality and quantity.[12] Although several studies have reported a significant association between child feeding patterns and stunting, other studies have found no statistically significant relationship.[13-15]

Beyond feeding patterns, infectious diseases such as diarrhea significantly increase the risk of stunting, particularly in children who have not completed routine immunization.[16,17] Recurrent or prolonged episodes of diarrhea impair growth through intestinal mucosal damage and reduced nutrient absorption.[18] Exclusive breastfeeding remains a critical determinant in preventing stunting, promoting linear growth and providing essential immunological protection.[19-23]

According to the World Health Organization (WHO), the underlying causes of stunting are at the macro level, including education, poverty, socio-cultural factors, and government and political policies. These fundamental determinants influence feeding practices, food insecurity, health services, and the environment, which constitute indirect causes of stunting. Meanwhile, the direct causes of stunting are inadequate dietary intake and infectious diseases, both of which are interrelated. Previous studies in the Rambipuji PHC region have focused predominantly on maternal nutritional status during pregnancy. This study therefore aims to assess the associations between diarrheal history, exclusive breastfeeding, and feeding patterns with stunting among children aged 24–59 months in the Rambipuji PHC service area, Jember District.

METHOD

This analytical observational study with a case–control design was conducted in May 2025 in the Rambipuji PHC area, Jember District. The case population consisted of 415 stunted children aged 24–59 months recorded in the May 2025 growth monitoring data, while the control population comprised 1,540 non-stunted children of the same age group recorded in the same dataset. If two eligible children lived in the same household, only one was selected, and only those whose primary caregiver was the mother were included. Children with a history of genetic disorders or congenital abnormalities (such as Down syndrome, hemophilia, or heart disease) were excluded.

Based on the sample size calculation, a total of 114 children were included in the study—57 stunted (cases) and 57 non-stunted (controls)—selected through simple random sampling. Data were collected through interviews and observations using a structured questionnaire. The dependent variable was stunting status, while the independent variables included child characteristics (age, sex, and birth order), maternal characteristics (maternal age at pregnancy, education level, employment status, number of children, birth interval, and family income), diarrheal history, exclusive breastfeeding, and feeding practices.

Data were analyzed using univariate and bivariate methods. The association between independent and dependent variables was tested using Chi-square tests with an interpretation of the p-value or 95% confidence intervals (α=0.05) in SPSS. The study was approved by the Research Ethics Committee of the Faculty of Dentistry, University of Jember No. 3029/UN25.8/KEPK/DL/2025.

RESULT

Based on the findings presented in Table 1, children aged 36–47 months had the highest proportion of stunting (40.4%). Stunting was slightly more common in boys (50.9%) than girls (49.1%), whereas non-stunted children were predominantly female (57.9%). Firstborn children had the highest stunting prevalence (35.1%).

Most stunted children were born to mothers whose pregnancies were not considered high-risk (78.9%). The majority of mothers had only primary-level education (70.2%) and were not employed (82.5%). Stunting was most common among children of mothers with only one child (38.6%). More than half of stunted children (56.8%) were born following suboptimal birth spacing. Stunting prevalence was 70.2% among children from households earning below the district minimum wage, the same as in the non-stunted group.

Table 2 shows that most children—both stunted and non-stunted—had not experienced diarrhea in the previous six months. Among stunted children, 71.9% had no diarrheal episodes, while 28.1% had infrequent episodes. Most cases involved short-duration diarrhea (26.3%).

A total of 61.4% of stunted children received exclusive breastfeeding during the first six months, while 38.6% did not. Most stunted children (66.7%) had adequate feeding patterns, 26.35% had poor practices, and 7% had good practices.

Table 1. Distribution of child and maternal characteristics

Characteristics	Stunting		Non-Stunting	
	n	%	n	%
Child characteristics				
Age (months)				
24–35	19	33.3	24	42.1
36–47	23	40.4	14	24.6
48–59	15	26.3	19	33.3
Sex				
Male	29	50.9	24	42.1
Female	28	49.1	33	57.9
Birth order				
>2	18	31.6	14	24.6
2	19	33.3	23	40.4
1	20	35.1	20	35.1
Maternal characteristics				
Age during pregnancy				
At risk	12	21.1	7	12.3
Not at risk	45	78.9	50	87.7
Education				
Primary education	40	70.2	32	56.1
Secondary education	16	28.1	16	28.1
Higher education	1	1.8	9	15.8
Employment				
Employed	10	17.5	8	14
Unemployed	47	82.5	49	86
Number of children				
>2	16	28.1	15	26.3
2	19	33.3	22	38.6
1	22	38.6	20	35.1
Birth spacing				
Not ideal	21	56.8	20	52.6
Ideal	16	43.2	18	47.4
Household income				
< regional minimum wage	40	70.2	40	70.2
≥ regional minimum wage	17	29.8	17	29.8
Total	57	100.0	57	100.0

Table 2. Distribution of diarrhea history, exclusive breastfeeding, and feeding patterns

Variables	Stunting		Non-Stunting	
	n	%	n	%
Diarrhea frequency				
Frequent	0	0.0	0	0.0
Infrequent	16	28.1	13	22.8
Never	41	71.9	44	77.2
Diarrhea duration				
Long	1	1.8	3	5.3
Not long	15	26.3	10	17.5
Never	41	71.9	44	77.2
Exclusive breastfeeding				
No	22	38.6	9	15.8
Yes	35	61.4	48	84.2
Feeding patterns				
Poor	15	26.3	5	8.8
Adequate	38	66.7	38	66.7
Good	4	7.0	14	24.6
Total	57	100.0	57	100.0

Table 3 shows that child's age (p=0.198), sex (p=0.348), and birth order (p=0.644) were not significantly associated with stunting. Maternal age during pregnancy (p=0.209), employment status (p=0.607), parity (p=0.841), birth spacing (p=0.738), and household income (p=1.000) also showed no significant associations.

Maternal education was significantly associated with stunting (p=0.026). Compared to higher education, children whose mothers had primary education were at increased risk of stunting (OR=11.25; 95%CI: 1.354–93.504), as were those whose mothers had secondary education (OR=9.00; 95%CI: 1.018–79.545).

Diarrheal frequency was not significantly associated with stunting, but diarrhea duration showed a significant association. Lack of exclusive breastfeeding was associated with higher risk of stunting (p=0.006; OR=3.352; 95%CI: 1.377–8.159). Feeding patterns were also significantly associated (p=0.005); children with poor feeding had a 10.5-fold increased risk (95%CI: 2.336–47.201), and those with adequate feeding had a 3.5-fold increased risk (95%CI: 2.336–47.201), compared with those with good feeding patterns.

Table 3. The association between child and maternal characteristics with stunting

Variables	Stunting Incidence				p	OR	95%CI
	Yes		No				
	n	%	n	%			
Child Characteristics							
Age (months)							
24–35	19	33.3	24	42.1	0.198	1.003	(0.405–2.481)
36–47	23	40.4	14	24.6		2.081	(0.806–5.373)
48–59	15	26.3	19	33.3			1
Sex							
Male	29	50.9	24	42.1	0.348	1.424	(0.680–2.982)
Female	28	49.1	33	57.9			1
Birth order							
>2	18	31.6	14	24.6	0.644	1.286	(0.505–3.271)
2	19	33.3	23	40.4		0.826	(0.347–1.968)
1	20	35.1	20	35.1			1
Maternal Characteristics							
Age during pregnancy							
At risk	12	21.1	7	12.3	0.209	1.905	(0.690–5.258)
Not at risk	45	78.9	50	87.7			
Education							
Primary education	40	70.2	32	56.1	0.026*	11.250	(1.354–93.504)
Secondary education	16	28.1	16	28.1		9.000	(1.018–79.545)
Higher education	1	1.8	9	15.8			1
Employment							
Employed	10	17.5	8	14	0.607	1.303	(0.474–3.586)
Unemployed	47	82.5	49	86			1
Number of children							
>2	16	28.1	15	26.3	0.841	0.970	(0.383–2.455)
2	19	33.3	22	38.6		0.785	(0.331–1.860)
1	22	38.6	20	35.1			1
Birth spacing							
Not ideal	21	56.8	20	52.6	0.720	1.181	(0.475–2.935)
Ideal	16	43.2	18	47.4			1
Household income							
< regional minimum wage	40	70.2	40	70.2	1	1	(0.448–2.231)

Variables	Stunting Incidence				p	OR	95%CI
	Yes		No				
	n	%	n	%			
>= regional minimum wage	17	29.8	17	29.8			1
Diarrhea frequency							
Frequent	0	0.0	0.0	0.0			
Infrequent	16	28.1	13	22.8	0.519	1.321	(0.567–3.080)
Never	41	71.9	44	77.2			1
Diarrhea duration							
Long	1	1.8	3	5.3	0.349	0.358	(0.036–3.578)
Not long	15	26.3	10	17.5		1.610	(0.650–3.984)
Never	41	71.9	44	77.2			1
Exclusive breastfeeding							
No	22	38.6	9	15.8	0.006*	3.352	(1.377–8.159)
Yes	35	61.4	48	84.2			
Feeding patterns							
Poor	15	26.3	5	8.8	0.005*	10.500	(2.336–47.201)
Adequate	38	66.7	38	66.7		3.500	(1.056–11.606)
Good	4	7	14	24.6			1

DISCUSSION

Stunting is defined as a chronic nutritional problem that persists over a long period, characterized by a child's height being below the standard for their age. This condition is generally caused by multiple factors, including unhealthy lifestyle practices, poverty, and inadequate nutrient intake over time. Children under five require sufficient nutrition to support optimal growth and development; deficiencies in nutrient intake, both quantitatively and qualitatively, can lead to impaired linear growth. Therefore, ensuring both the quality and quantity of food intake is essential to prevent chronic nutritional deficiencies.[12]

In this study, most stunted children were aged 36–47 months, though age was not significantly associated with stunting. This is consistent with some studies reporting an age–stunting relationship,[24] but contrasts with others, likely due to differences in socioeconomic settings and feeding patterns.[25] Children aged 24–47 months are vulnerable to growth faltering during the transition to complementary feeding, particularly when dietary intake is poorly managed.[26]

Sex was not significantly associated with stunting, suggesting relatively equal caregiving and nutritional access. Other studies have found sex differences, with boys more likely to be stunted.[25] Potentially due to environmental and cultural differences in childrearing. Boys are also biologically more vulnerable due to weaker immune function and higher metabolic needs.[27,28]

Birth order was not significantly associated with stunting. Although firstborns appeared more affected, the difference was not statistically significant. Lack of parental experience in early caregiving may explain this trend, particularly among mothers of first or second children.[29]

This study found no significant association between maternal age at pregnancy and child stunting. Similar findings have been reported elsewhere, though other studies suggest a potential link. [30,31] Maternal age may exert an indirect effect through factors such as education and feeding patterns. Both adolescent (<20 years) and older maternal age (>35 years) are associated with higher risks of pregnancy complications and fetal growth restriction.[32]

Maternal education was significantly associated with stunting. Children whose mothers had only primary education were at greater risk than those with higher maternal education.[33] However, some studies report inconsistent results, possibly due to differences in access to information or social support.[21] Lower maternal education is often linked to poor knowledge of child nutrition,[34] whereas higher education improves comprehension of health messages and adoption of hygienic and nutritional practices.[32,35]

Maternal employment was not significantly associated with stunting. Employment status alone may not determine child nutritional outcomes, with caregiving quality and time use being more relevant.[33] Employment is often linked to income and food access, but its impact is mediated by caregiving behaviors.[36]

No significant relationship was found between number of children and stunting. While stunted children were more often found among first-time mothers, this may reflect inexperience in feeding and care.[29] The findings suggest that parenting quality may be more influential than parity itself.

Birth interval was not significantly associated with stunting, consistent with prior findings.[30] Long intervals (>5 years) may increase the risk of preeclampsia and fetal growth restriction,[37] while short intervals may divert maternal attention and nutrition from the older child to the younger one.[38] he effects of birth spacing are likely moderated by factors such as antenatal care, breastfeeding, and feeding pattern.

Household income was not significantly associated with stunting. Both stunted and non-stunted children were largely from families earning below the regional minimum wage. Effective use of affordable, nutritious food can help low-income families meet children's nutritional needs, while higher income does not guarantee better outcomes when food spending is misdirected.[24]

There was no significant link between diarrhea (frequency or duration) and stunting. This aligns with studies suggesting that infrequent, short-duration episodes—if promptly treated—do not adversely affect growth.[19,39] However, extended diarrhea can impair nutrient absorption and contribute to stunting.[21,40]

Exclusive breastfeeding was significantly associated with stunting. Children not exclusively breastfed were 3.35 times more likely to be stunted. This finding supports prior research highlighting the protective role of exclusive breastfeeding.[23] Common barriers include low milk supply, maternal illness, and early introduction of complementary foods. Stopping breastfeeding before six months increases stunting risk.[41] Breastfed children also demonstrate better cognitive performance and school attendance in later years.[42]

Feeding patterns showed a strong association with stunting risk. Children with poor feeding had a 10.5-fold increased risk, while adequate feeding was associated with a 3.5-fold risk compared to optimal feeding. Maternal education influences feeding quality; mothers with lower education often focus on quantity rather than diet diversity and nutrient balance. While some studies report no significant relationship between feeding

patterns and stunting.[43] Evidence suggests that age-appropriate feeding—supported by diverse, attractive meals and consistent meal timing—improves nutritional outcomes. Children are ideally fed three main meals and two snacks per day.[24]

Continuous monitoring and evaluation are strategic measures for accelerating stunting reduction, particularly in the working area of Rambipuji PHC. Current programs include the provision of supplementary feeding (*pemberian makanan tambahan*/PMT) using locally sourced foods, monitoring of the "One Day One Egg" initiative, and the utilization of household yards to support community food security programs. Developing a follow-up action plan is essential to address various implementation challenges. The active participation of pregnant women, breastfeeding mothers, and children under five in nearby integrated health posts (*posyandu*) is crucial, as these serve as key platforms for monitoring nutritional status, growth, and development during the critical first 1,000 days of life. These efforts align with Indonesia's national strategy to accelerate stunting reduction, which emphasizes both nutrition-specific and nutrition-sensitive interventions delivered through primary health care services.

CONCLUSION

Child characteristics and maternal demographic factors were not significantly associated with stunting. However, maternal education, exclusive breastfeeding, and feeding patterns showed strong associations.

Targeted interventions are needed to enhance maternal knowledge on child nutrition and promote healthy feeding behaviors. Strengthening services at integrated health posts (*posyandu*) and public health centers (*puskesmas*) is critical. Early adoption of balanced, age-appropriate diets and consistent meal schedules should be prioritized to reduce stunting prevalence.

COMPETING INTEREST

The authors declare no conflicts of interest.

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AUTHOR'S CONTRIBUTION

JW designed and conducted the study, performed data analysis, drafted the initial manuscript, and revised the final version. CB and CAK contributed to the study design and conceptual framework, provided critical feedback, and participated in manuscript revision.

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