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Early Breastfeeding Practices, Energy and Protein Intake, Risk of Stunting in Coastal Areas of Sampang Regency, East Java Province: A Cross-Sectional Study

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ABSTRACT

Stunting remains a significant public health issue in Indonesia, particularly in coastal areas with limited access to nutrition and healthcare services. This study aims to identify early risk factors for stunting in children aged 12–59 months in the coastal areas of Sampang Regency, East Java. The study design employed a cross-sectional approach with a sample size of 250 children, selected randomly in proportion to the population. Data were collected through anthropometric measurements, structured questionnaires, and 24-hour food recalls. Analysis was performed using the chi-square test and simple logistic regression. The results showed a prevalence of stunting of 25,2%. Not getting breast milk in the first two days postpartum (OR=2,447), not getting exclusive breastfeeding for <6 months (OR=2,766), insufficient energy intake (OR=27,695), and insufficient protein intake, which showed the highest risk (OR=192,85), were associated with stunting (p<0,05). In contrast, early initiation of breastfeeding and continued breastfeeding at 12–23 months of age were not significantly associated with stunting. These findings underscore the importance of early nutritional practices and adequate intake of macronutrients, particularly protein, in efforts to prevent stunting. Focused nutritional interventions during the first 1,000 days of life need to be prioritized, including improving maternal education and the quality of children's food intake.

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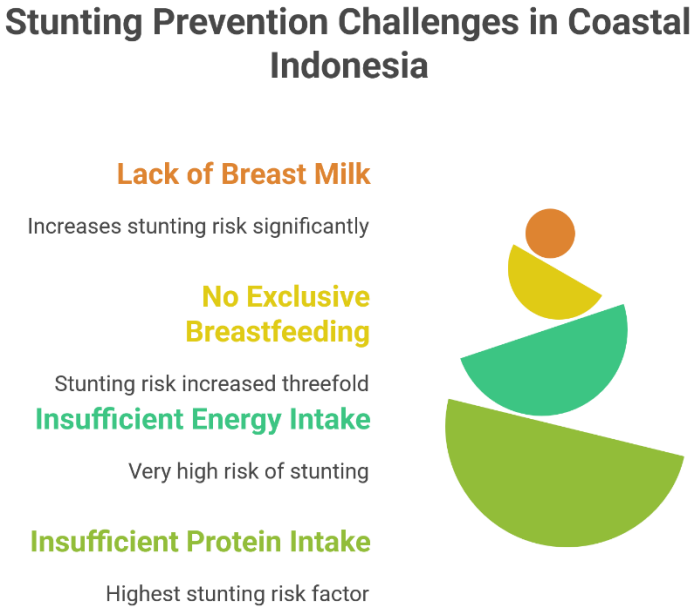
Key Messages:

- Early nutritional practices, especially during the first days and months of life, play a crucial role in preventing stunting.
- Inadequate protein intake is the strongest predictor of stunting among coastal children.
- Nutrition education and food security programs should prioritize maternal behavior and diet quality during the first 1,000 days.

GRAPHICAL ABSTRACT



INTRODUCTION

Stunting is a chronic public health problem that has a long-term impact on the quality of human resources (1). This condition is characterized by height for age (TB/A), which is below -2 standard deviations based on the World Health Organization (WHO) curve (2). Stunting is often caused by chronic malnutrition that occurs from pregnancy to the age of two years (3). Toddlers who experience stunting generally show stunted physical and cognitive development. Stunting measurements in toddlers use anthropometry with height or length and age measuring instruments. The standards used refer to WHO Child Growth Standards and Indonesian Minister of Health Regulation Number 2 of 2020 (2).

Basic Health Research (Riskesdas) data shows that the prevalence of toddlers with short and very short conditions decreased from 37,2% in 2013 (4) to 30,8% in 2018 (5). Stunting data in Indonesia based on the 2022 Indonesian Nutritional Status Survey (SSGI) was 21,6% (6). According to the results of the 2023 Indonesian Health Survey (SKI), the prevalence of stunting at the national level showed a figure of 15,8% short and 5,7% very short (7) a total of 21,5%; this figure has decreased by 0,1% compared to 2022. The target reduction in 2024 is still far from the realization of the reduction, which should be 14%.

The prevalence of stunting in East Java Province is 14,4% short and 3,8% very short. Sampang Regency has a stunting rate of 14,1%. Sampang City Regency is a coastal area and stunting locus in East Java Province. In coastal areas, the prevalence of stunting is often higher than in non-coastal areas due to limited access to nutrition and health services. Sampang Regency is one of the coastal areas with a fairly high prevalence of stunting. Stunting affects not only children's physical growth but also brain development and productivity in the future. Stunting children are at risk of experiencing cognitive impairment, learning difficulties, and low academic performance when entering school age. If left untreated, stunting can reduce the quality of human resources in the long term (8). The risk of stunting also contributes to increased child morbidity and mortality (9). In adulthood, individuals who experience stunting as children have a higher risk of degenerative diseases such as hypertension, diabetes mellitus, and heart disease (10).

Risk factors for stunting are very complex and involve various aspects, one of which is the practice of breastfeeding since birth(11). Early Initiation of Breastfeeding (IMD) is one of the important interventions in preventing stunting, which is carried out within the first hour after delivery. IMD plays an important role in providing colostrum, which is rich in antibodies, and stimulating subsequent breast milk production (12). Research by Sunartiningsih et al., (2021), showed that the incidence of stunting was almost entirely found in toddlers who did not have IMD, namely 16 toddlers (80%) (13). In coastal areas, the implementation of IMD is still low due to a lack of education and limited health facilities. Local cultural and belief factors can also influence a mother's decision to carry out IMD. Exclusive breastfeeding in the

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first two days after birth is also very important as a form of providing early nutritional intake and protection against infection. However, this practice is often neglected due to medical intervention or separation of infants and mothers after delivery. This is a concern in the context of stunting, especially in areas with limited neonatal health services.

Continued breastfeeding after six months to two years of age is still needed to support children's nutritional needs. The 12-23 month period is an important period in the transition of food from breast milk to family food. Suboptimal continued breastfeeding can cause energy and protein deficiencies that impact child growth. In coastal areas, the practice of continued breastfeeding is often stopped before the age of two due to the mother's economic demands. In addition, community perceptions of sufficient family food can influence early cessation of breastfeeding. In fact, at that age, children still need nutritional intake from breast milk to support growth. Education about the importance of continued breastfeeding is crucial in nutritional interventions. Therefore, this study also considers the relationship between the duration of continued breastfeeding and stunting status. These data are expected to provide a comprehensive picture of stunting risk factors.

Energy intake is one of the main factors determining the nutritional status of toddlers. Children with insufficient energy intake will experience chronic energy deficits that impact growth (14). Research by Tanzil & Hafriani (2021) shows that in stunted toddlers, the majority receive insufficient energy intake, namely 16 (80%), increasing the risk of stunting by 9,33 times (p = 0,03, CI = 2,180- 39,962) (14). In coastal areas, limited access to nutritious food is a challenge in meeting children's energy needs. Consumption of staple foods such as rice is not always accompanied by adequate animal or vegetable side dishes. The lack of food variety causes children not to get energy in the appropriate amount and quality. In addition, family diets often do not pay attention to children's portions and meal frequency.

In addition to energy, protein is a macronutrient that plays an important role in the formation of body tissue. Lack of protein intake in toddlers has a direct impact on stunted growth in height. Protein also functions in the immune system, which protects children from infections that worsen their nutritional status. In coastal areas, consumption of animal protein such as fish, eggs, and meat is still low due to economic factors and eating habits. Research byTanzil & Hafriani, (2021), shows that insufficient protein intake is the majority in the stunting group (52,5%); insufficient protein is 7 times more at risk of stunting than sufficient protein intake (p=0,006, CI=1,739-28,174) (14). Therefore, this study identified no early initiation of breastfeeding (IMD), no exclusive breastfeeding for 2 days after birth, no exclusive breastfeeding <6 months, no continuation of breastfeeding at the age of 12-23 months, low energy intake, low protein intake as risk factors for stunting that are rarely the main focus and the coastal areas of Sampang Regency have also not been widely studied.

METHODS

The design of this research study is Cross-sectional. The study was conducted in the Coastal Area of Sampang Regency, East Java. The time of the study was conducted in in January to February 2025. The population in this study were all toddlers aged 12-59 months in the Coastal area of Sampang Regency, East Java, namely two selected coastal health centers included in the Stunting locus according to the Sampang Regent's Decree number 188 / KEP / 434.012 / 2024. The sampling technique for this study was Proportional random sampling. Sampling with eligibility criteria, namely, toddlers aged 12-59 months whose data were recorded at the Pulau Mandangin Health Center and the Pangarengan Health Center, respondents were on-site during the study, willing to be respondents in this study so that the number of samples needed was 230 toddlers.

The dependent variable is the incidence of stunting, measured using a stadiometer to obtain a height index according to age (TB/A) with a threshold of Z score ≥ -2 SD for the non-stunting category and Z score < -2 SD for the stunting category (15). The independent variable is the history of Early Initiation of Breastfeeding (IMD), which is placing the baby face down on the mother's chest or stomach so that the baby's skin is attached to the mother's skin within 1 hour after birth, the measurement uses a questionnaire with the question "Was [NAME] immediately placed on the mother's chest/stomach with the mother's skin attached to the baby's skin immediately after birth?". The measurement result is yes IMD if the answer is

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"yes the baby was placed on the mother's chest for 1 hour after birth". No IMD if the answer is "the baby was not placed on the mother's chest after giving birth."

Exclusive breastfeeding variable for 2 days after birth, measurement using a questionnaire with the question "In the last 48 hours, was [NAME] given drinks (fluids) and/or food other than breast milk?". The measurement result is yes if the answer is from 0-2 days and no if the answer is <2 days. The exclusive breastfeeding variable <6 months is the provision of breast milk only without the addition of other fluids, be it formula milk, water, orange juice, honey, and/or other additional foods until the baby reaches the age of 6 months. The measurement used a questionnaire with the question, "Before being breastfed for the first time, was [NAME] ever given drinks (fluids) or food other than breast milk?". The measurement result is yes exclusive breastfeeding if the answer is yes breast milk starting from the age of 0-6 months, no exclusive breastfeeding if the answer is consumption <6 months. The variable continuing breastfeeding at the age of 12-23 months is the provision of continued breastfeeding after exclusive breastfeeding; the measurement result is yes if the answer is still given breast milk until the age of 23 months, no if the answer is not given or stops being given breast milk. Energy and protein intake variables measure the amount of energy and protein intake of toddlers for 24 hours using a 24-hour food recall form then the weight of the ingredients in grams will be translated using Nutrisurvey software to get kcal for energy intake and grams for protein intake, then energy and protein intake are divided by the Energy Adequacy Rate (AKG) for ages 12-59 months multiplied by 100, getting the results of measuring more intake if > 110% AKG, good intake if 80% - 110% AKG, insufficient intake if < 80% AKG (16).

Data analysis using SPSS software version 27 for univariate analysis aims to explain or describe the characteristics of each research variable. Crosstab analysis (cross-tabulation) with chi-square test and simple logistic regression analysis is used to predict binary dependent variables (dichotomy) based on one or more independent variables. Multivariate analysis using multiple logistic regression test. The 95% confidence level to see whether or not there is a relationship between the independent variable and the dependent variable at the significance limit $\alpha = 0.05$ with the understanding that if the p-value ≤0.05, there is a relationship, while if the p-value> 0.05 then there is no statistical relationship.

CODE OF HEALTH ETHICS

This research has submitted a research ethics application to the Health Research Ethics Committee (KEPK) of the Faculty of Medicine, Universitas Sebelas Maret, with the number 25/UN27.06.11/KEP/EC/2025.

RESULTS

Based on the results of the frequency distribution in Table 1, the incidence of stunting in the coastal areas of Sampang Regency is still quite high, which is 25,2% of a total of 250 toddlers. The majority of toddlers are aged 12–23 months (30%), with male gender dominating (56,8%). Most mothers have low to junior high school education, and all of them are unemployed. Although the coverage of Early Breastfeeding Initiation (IMD) is high (95,6%), only 16,4% of toddlers receive exclusive breastfeeding <6 months, and only 50% receive continued breastfeeding at 12–23 months. In addition, most toddlers experience a lack of energy intake (47,2%) and protein (24%), which shows that the risk of stunting is not only influenced by breastfeeding behavior but also by the adequacy of macronutrients, especially energy and protein.

Based on the cross-tabulation results in Table 2, the incidence of stunting is higher in toddlers aged 12–23 months compared to other age groups. Female toddlers tend to experience more stunting (14,4%) than male toddlers (10,8%). Maternal education also has an influence, where the proportion of stunting is more common in children of mothers with low education. Poor breastfeeding practices contribute significantly to the incidence of stunting, especially in groups that do not exclusively breastfeed for <6 months (23,2%) and do not breastfeed for 2 days after birth (13,2%). Children who do not continue breastfeeding aged 12–23 months also show a higher tendency for stunting. In addition, lack of energy intake (19,6%) and protein (21,6%) are dominant factors that differentiate stunting and non-stunting groups. These findings confirm that breastfeeding and adequacy of macronutrients are very important in preventing stunting.

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Table 1. Frequency Distribution of Toddler Characteristics in the Coastal Area of Sampang Regency, East Java Province

Category	n=250	(%)
Stunting Incident		
Not Stunting	187	(74,8)
Stunting	63	(25,5)
Toddler Age		
12-23 Months	75	(30)
24-35 Months	47	(18,8)
36-47 Months	63	(25,2)
48-59 Months	65	(26)
Gender		
Male	142	(56,8)
Female	108	(43,2)
Mother's Education		
Primary School	104	(41,6)
Junior High School	109	(43,6)
Senior High School	37	(14,8)
Mother's Occupation		
Not Working	250	(100)
Early Initiation of Breastfeeding (IMD)		
Yes IMD	239	(95,6)
No IMD	11	(4,4)
Exclusive Breastfeeding for 2 Days After Birth		
Yes	159	(63,6)
No	91	(36,4)
Exclusive Breastfeeding <6 Months		
Yes Exclusive Breastfeeding	41	(16,4)
No Exclusive Breastfeeding	209	(83,6)
Continued Breastfeeding 12-23 Months		
Yes Continued Breastfeeding	125	(50)
Not Continued Breastfeeding	125	(50)
Energy Intake		
More	40	(16)
Better	92	(36,8)
Less	118	(47,2)
Protein Intake		
More	157	(62,8)
Better	33	(13,2)
Less	60	(24)

Table 2. Frequency Distribution of Toddler Characteristics Based on Stunting Incidents in the Coastal Area of Sampang Regency, East Java Province

Category	Stunting Incident			
	Not Stunting		Stunting	
	n=187	(%)	n=63	(%)
Toddler Age				
12-23 Months	44	(17,6)	31	(12,4)
24-35 Months	36	(14,4)	11	(4,4)
36-47 Months	51	(20,4)	12	(4,8)
48-59 Months	56	(22,4)	9	(3,6)
Gender				
Male	115	(46)	27	(10,8)
Female	72	(28,8)	36	(14,4)
Mother's Education				
Primary School	77	(30,8)	27	(10,8)
Junior High School	81	(32,4)	28	(11,2)
Senior High School	29	(11,6)	8	(3,2)

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Category	Stunting Incident			
	Not Stunting		Stunting	
	n=187	(%)	n=63	(%)
Mother's Occupation				
Not Working	187	(74,8)	63	(25,2)
Working	0	(0)	0	(0)
Early Initiation of Breastfeeding (IMD)				
Yes IMD	178	(71,2)	61	(24,4)
No IMD	9	(3,6)	2	(0,8)
Exclusive Breastfeeding for 2 Days After Birth				
Yes	129	(51,6)	30	(12)
No	58	(23,2)	33	(13,2)
Exclusive Breastfeeding <6 Months				
Yes Exclusive Breastfeeding	36	(14,4)	5	(2)
No Exclusive Breastfeeding	151	(60,4)	58	(23,2)
Continued Breastfeeding 12-23 Months				
Yes Continued Breastfeeding	93	(37,2)	32	(12,8)
Not Continued Breastfeeding	94	(37,6)	31	(12,4)
Energy Intake				
More	39	(15,6)	1	(0,4)
Better	79	(31,6)	13	(5,2)
Less	69	(27,6)	49	(19,6)
Protein Intake				
More	150	(60)	7	(2,8)
Better	31	(12,4)	2	(0,8)
Less	6	(2,4)	54	(21,6)

Based on the results of the simple logistic regression test Table 3, four factors are significantly related to the incidence of stunting in toddlers. Not being given exclusive breastfeeding for the first two days after birth increases the risk of stunting by 2,4 times (p = 0,003). Toddlers who do not receive exclusive breastfeeding for <6 months are also at 2,77 times higher risk of experiencing stunting (p = 0,043). The greatest risk comes from insufficient protein intake, which increases stunting by 15 times (p = 0,001), followed by insufficient energy intake by 4.6 times (p = 0,001). Meanwhile, the variables of not doing IMD and not continuing breastfeeding at the age of 12–23 months did not show a significant relationship to the incidence of stunting (p > 0,05). These findings emphasize the importance of fulfilling macronutrients (energy and protein) and proper breastfeeding practices from birth in preventing stunting. Nutrition interventions should be focused on the early period of a child's life, especially in the first 6 months.

Table 3. Determinant Factors of Stunting Incidence in Toddlers in Coastal Areas of Sampang Regency, East Java Province

Category	*p-value*	Exp (B)	95% CI	
			Lower	*Upper*
No Early Initiation of Breastfeeding (IMD)	0,586	0,648	0,136	3,084
No Exclusive Breastfeeding for 2 Days After Birth	0,003*	2,447	1,365	4,385
No Exclusive Breastfeeding <6 Months	0,043*	2,766	1,035	7,392
Not Continuing Breastfeeding Age 12-23 Months	0,884	0,958	0,541	1,697
Good Energy Intake	0,078	6,417	0,809	50,849
Lack of Energy Intake	0,001*	27,695	3,679	208,44
Good Protein Intake	0,695	1,382	0,274	6,974
Lack of Protein Intake	0,000*	192,85	62,05	599,3
Toddler Age 24-35 Months	0,045*	0,434	0,192	0,982
Toddler Age 36-47 Months	0,006*	0,334	0,153	0,728
Toddler Age 48-59 Months	0,001*	0,228	0,098	0,529
Female	0,011*	2,130	1,193	3,801
Mother's Education Junior High School	0,964	0,986	0,534	1,821
Mother's Education Senior High School	0,600	0,787	0,321	1,929

Exp (B): exponent of B. 95% IC: Confidence Interval 95%, *Significant at p<0,05 level (Simple Logistic Regression Test)

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Table 4. Multivariate analysis was conducted after removing variables from the results in Table 3 that did not meet the p-value threshold of 0,05. The multivariate results explain that lack of protein intake is a strong and statistically significant predictor of stunting in toddlers (p = 0,000; OR = 328,2; 95% CI: 56,2–1916). This shows that toddlers with inadequate protein intake are 328 times more likely to experience stunting compared to those with good protein intake. Toddlers aged 24–35 months were found to have a significantly lower risk of stunting (p = 0,039; OR = 0,169; 95% CI: 0,031–0,915), indicating that this age group is less likely to experience stunting than the 12–23-month age group.

Table 4. Multivariate Analysis of Determinant Factors of Stunting Incidence in Toddlers in Coastal Areas of Sampang Regency, East Java Province

Category	*p-value*	Exp (B)	95% CI	
			Lower	*Upper*
No Exclusive Breastfeeding for 2 Days After Birth	0,344	1,744	0,552	5,513
No Exclusive Breastfeeding <6 Months	0,553	1,699	0,295	9,777
Good Energy Intake	0,581	1,871	0,202	17,342
Lack of Energy Intake	0,828	0,756	0,061	9,369
Good Protein Intake	0,606	1,633	0,254	10,51
Lack of Protein Intake	0,000*	328,2	56,2	1916
Toddler Age 24-35 Months	0,039*	0,169	0,031	0,915
Toddler Age 36-47 Months	0,119	0,291	0,062	1,373
Toddler Age 48-59 Months	0,209	3,77	0,082	1,726
Female	0,715*	1,226	0,140	3,661

DISCUSSION

Based on the results of the study Table 1, the prevalence of stunting in toddlers in the coastal areas of Sampang Regency reached 25,2%. This means that around one in four children experience chronic growth disorders. Most toddlers (74,8%) did not experience stunting, which indicates the potential for success of previous interventions. However, the remaining stunting rate remains a public health problem (17). his stunting incident needs serious attention, considering its impact on children's growth and development in the long term. Stunting has an impact on intelligence, productivity, and the risk of non-communicable diseases in adulthood (8).

The composition of toddlers' ages in the study was quite even, with ages 12–23 months dominating at (30%). The age groups 36–47 months and 48–59 months contributed almost equal proportions, respectively (25,2%) and (26%). Meanwhile, ages 24–35 months were recorded at (18,8%). This age variation shows that the toddler group studied covers an important phase in the First 1000 Days of Life. In terms of gender, the majority of toddlers were male at (56,8%), while females were (43,2%).

Most mothers of toddlers have low to secondary education. Elementary school education dominates (41,6%), followed by junior high school (43,6%), and only (14,8%) have high school education. The level of maternal education has a major influence on knowledge and practices of feeding children. Mothers with higher education tend to have a better understanding of child nutrition. All mothers in this study did not have formal jobs or were recorded as unemployed (100%). This shows that mothers act as the primary caregivers of children. Although they have time to care for children, low education and access to information are obstacles to optimal nutritional practices. Therefore, nutritional education interventions need to be adjusted to the educational background of mothers (18).

Early breastfeeding practices are quite good, with (95,6%) mothers carrying out Early Initiation of Breastfeeding (IMD). However, only (63,6%) provide exclusive breastfeeding for the first two days after birth. The coverage of exclusive breastfeeding for less than 6 months is very low, only (16,4%). This means that the majority of toddlers (83,6%) do not receive exclusive breastfeeding as recommended by WHO. In addition, only half of respondents continued breastfeeding until the age of 12–23 months. This low practice of continued breastfeeding can increase the risk of chronic malnutrition in children. These results indicate a gap between high breastfeeding initiation and low sustainability of breastfeeding practices. Therefore, there needs to be a strengthening of education about the importance of exclusive and continued breastfeeding during the first two years of a child's life.

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Data shows that children's energy intake is still a major problem. As many as (47,2%) of toddlers experience energy deficiency, while only (16%) have energy intake that exceeds needs. Chronic energy deficiency contributes directly to the risk of stunting because the body lacks fuel to grow. Meanwhile, protein intake is also not optimal, with (24%) of children recorded as lacking protein. Protein is very important for the growth of body tissue, the brain, and the immune system (19). Only (13,2%) of children have good protein intake, and (62,8%) are categorized as sufficient. These findings emphasize that nutritional interventions must target improving children's diets, especially on quality sources of energy and protein (20). Efforts to improve family food security are also needed to address this chronic nutritional problem sustainably.

Early Initiation of Breastfeeding

Early Initiation of Breastfeeding (IMD) is a breastfeeding process carried out within the first hour after the baby is born. This process aims to provide colostrum, which is the first breast milk that is very rich in antibodies and important nutrients. WHO and the Ministry of Health of the Republic of Indonesia emphasize the importance of IMD as part of a strategy to improve the nutritional status of children. IMD also plays a role in forming an emotional bond between mother and baby from an early age. In addition, IMD can stimulate the baby's sucking reflex and stimulate the mother's breast milk production. Consistent IMD practices have been shown to support the success of exclusive breastfeeding in the following months (21).

Based on the results of a study on 250 toddlers in the coastal area of Sampang Regency, it was found that the implementation of IMD was quite high, which was 95,6%. However, the results of the logistic regression analysis showed that there was no significant relationship between the IMD variable and the incidence of stunting (p = 0,586). This means that toddlers who do not receive IMD do not have a significantly different risk of stunting compared to those who receive IMD. From these data, only 11 children did not receive IMD, and of that number, only 2 (0,8%) experienced stunting. Meanwhile, most toddlers who experienced stunting were included in the group that had received IMD. This finding indicates that even though IMD is carried out well, it does not immediately reduce the prevalence of stunting. This shows that other factors, such as the quality of nutritional intake after birth, greatly affect the growth status of children (19).

This finding is inconsistent with the results of a study by Noviasty et al., (2023) which stated that not carrying out IMD increased the risk of stunting by 12.6 times (p = 0,001) (22). Another study by Sunartiningsih et al., (2021) also showed a significant relationship between IMD and the incidence of stunting (13). he characteristics of the respondents influence this difference, the quality of intervention after IMD, and other unmeasured factors such as infectious diseases and food access (23). In contrast, a study in Ogan Ilir by Rahayu et al. (2024) supports the results of this study, which concluded that IMD had no significant relationship to stunting. This shows that the role of IMD in preventing stunting is highly dependent on the social context and continued nutrition after delivery. In addition, the effectiveness of IMD can be reduced if it is not followed by good breastfeeding practices, such as exclusive breastfeeding and adequate complementary food intake (24). Therefore, IMD should be viewed as part of a comprehensive strategy, not the only intervention.

In Table 2 of the crosstab results, it is known that the majority of toddlers who experienced stunting had received IMD (61 out of 63 stunted toddlers), and only two stunted toddlers did not undergo IMD, which shows a very small number. This condition indicates a gap between IMD practices and child growth outcomes. High implementation of IMD does not necessarily guarantee success in preventing stunting if it is not accompanied by the fulfillment of macro and micro nutritional needs. This is by the results of logistic regression, which show that energy and protein intake variables have a much greater influence on stunting (25). Therefore, IMD is the initial foundation, but long-term success is largely determined by sustainable nutrition. The gap between Theory and field data is an important concern in the preparation of toddler nutrition programs. IMD-based interventions need to be combined with continued breastfeeding education and increasing family food security.

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Based on these findings, a holistic approach is needed in preventing stunting that does not only focus on IMD. Local governments and health centers need to strengthen post-IMD follow-up education, especially regarding the importance of exclusive breastfeeding, continued breastfeeding, and fulfillment of nutrients. For further researchers, it is recommended to evaluate the long-term effects of IMD through cohort or longitudinal studies. In addition, it is necessary to explore the quality of the implementation of IMD itself, whether it is carried out according to standards or just a formality. For mothers and families, it is important to realize that IMD is not the end of the breastfeeding process but the beginning of the responsibility for providing optimal nutrition. Training of cadres and health workers also needs to be improved to monitor breastfeeding practices on an ongoing basis. Research can also expand variables by including aspects such as frequency of infection, environmental cleanliness, and family nutrition education. Thus, IMD interventions will be more effective if implemented in an integrated manner with other components in the First 1000 Days of Life (HPK).

Exclusive Breast Milk for 2 Days After Birth

Exclusive breastfeeding for two days after birth is the provision of only breast milk without additional fluids or other foods in the first two days of a baby's life. These two days are considered a crucial period because the baby gets colostrum, which is rich in antibodies and essential nutrients. This practice is very important to form the baby's immunological base and strengthen the body's resistance to infection. The World Health Organization (WHO) and the Indonesian Ministry of Health recommend breastfeeding as soon as possible and continuing exclusively until the age of 6 months. These first two days are an early indicator of the success of long-term breastfeeding practices. In addition, breastfeeding in the first two days has been shown to contribute to the stabilization of the baby's blood sugar, body temperature, and colonization of intestinal microbiota.

Based on Table 3, the variable of not exclusively breastfeeding for 2 days after birth has a significance value of p = 0,003 with Exp(B) = 2,447 and 95% CI (1,365–4,385). This means that toddlers who are not given exclusive breastfeeding for the first two days have a 2.4 times greater risk of experiencing stunting than those who are given breast milk. This result is statistically significant and confirms that breastfeeding from the first day has a protective effect on growth. This is in line with the basic assumption that colostrum and early breastfeeding are the initial foundations that determine the nutritional status of toddlers. Early breastfeeding is also correlated with the success of exclusive breastfeeding for up to 6 months. This finding shows that simple interventions such as breastfeeding on the first day can have a major impact on preventing stunting.

Theoretically, early breastfeeding contributes greatly to meeting the energy and immunological needs of newborns. Within the framework of the First 1000 Days of Life (HPK) Theory, the early days of a baby's life are critical in forming long-term nutritional status. From Table 2, it can be seen that of the 63 children who experienced stunting, 33 of them did not receive breast milk for the first two days (13,2%). In contrast, from the non-stunting group, only 58 out of 187 did not receive early breast milk. This means that the percentage of stunted toddlers who were not given early breast milk was higher than those who were not stunted, supporting the results of the regression analysis, which showed a significant relationship. This confirms that early breast milk plays an important role in preventing stunting in coastal areas. Thus, the Theory and the results of data in the field support each other that breast milk for the first two days is an important determinant factor. However, there is still a gap that most mothers who do not provide early breast milk have not received adequate breastfeeding education.

The main gaps in early breastfeeding practices in the study area are lack of information, mistaken cultural beliefs, and suboptimal support from health workers. Although most mothers provide IMD, not all continue with exclusive breastfeeding from the first two days. This shows that the success of IMD is not necessarily followed by the success of early breastfeeding. Therefore, training for midwives and health workers needs to be focused on actively assisting mothers in the first two days after delivery. For further researchers, it is recommended to investigate more deeply the influence of family support, hospital policies, and local culture on early breastfeeding practices. In addition, a qualitative approach is also needed to explore mothers' perceptions and barriers to providing breast milk immediately after giving

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birth. It is important to provide respondents with an understanding that the first two days of life are a time that should not be missed for breastfeeding. With educational interventions and support from the health service system, stunting rates can be reduced more significantly.

Exclusive Breast Milk <6 Months

The World Health Organization (WHO) and the Indonesian Ministry of Health recommend exclusive breastfeeding for the first 6 months of life without additional water, formula milk, or solid foods. Exclusive breastfeeding contains complete nutritional content, antibodies, and digestive enzymes needed by babies for the first six months. Providing additional food before the age of 6 months can interfere with the absorption of nutrients and increase the risk of gastrointestinal infections (1). This has an impact on growth disorders that lead to stunting. Therefore, exclusive breastfeeding is considered one of the simplest, cheapest, and most effective nutritional interventions. Babies who receive exclusive breastfeeding consistently tend to have better nutritional status and a lower risk of stunting (26).

The analysis results from Table 3 show that not being given exclusive breastfeeding for <6 months has a p-value = 0,043, with Exp(B) = 2,766 and 95% CI (1,035–7,392), which means significant. These results indicate that toddlers who do not receive exclusive breastfeeding for <6 months have a 2.76 times greater risk of experiencing stunting compared to those who do. This finding strengthens the important role of exclusive breastfeeding in supporting the optimal growth of children in the First 1000 Days of Life. Providing complementary foods too early has been shown to increase the risk of gastrointestinal infections and reduce the effectiveness of nutrient absorption (27). Thus, this practice greatly contributes to the incidence of stunting, especially in areas with less than optimal sanitation and parenting patterns. These results also strengthen the evidence that the exclusive breastfeeding promotion approach still needs to be improved.

This research is in line with that conducted by Noorhasanah et al., (2020) in Banjar Regency, showing a significant correlation between not exclusively breastfeeding and the incidence of stunting (p=0,001) (28). However, these results are not in line with research by Maesarah et al., (2021) in Gorontalo, which stated that there was no relationship between a history of exclusive breastfeeding and the incidence of stunting in toddlers (p=0,965) (29). Research by Yuwanti et al., (2021) in Grobogan Regency shows that babies who do not receive exclusive breast milk are not related to the incidence of stunting in toddlers and are also not a risk factor that causes stunting (30).

These differences in results are due to different environmental factors, including levels of sanitation, maternal education, and support for health services. In urban areas, other factors, such as the consumption of nutritious supplementary foods and access to health services, reduce the negative impact of not exclusively breastfeeding. However, in coastal areas with limited access to food and clean water, the negative effects of not exclusively breastfeeding become more pronounced. Therefore, location contextualization is important in interpreting the relationship between breastfeeding and stunting.

Theoretically, exclusive breastfeeding for 6 months is considered the ideal nutritional foundation in the 1000 HPK Theory and the life course approach. When this practice is not carried out, the risk of growth disorders increases significantly because babies do not get optimal nutrients and immunological protection from breast milk. Based on Table 2, of the total 63 toddlers who experienced stunting, 58 (23,2%) did not receive exclusive breastfeeding for <6 months. Meanwhile, from the non-stunting group, 151 out of 187 were also not given exclusive breastfeeding, but the proportion was smaller. This shows that the inconsistency of exclusive breastfeeding practices is very dominant in the stunting group. This pattern is consistent with the results of the regression analysis, which showed a significant relationship. The Theory states that the absence of exclusive breastfeeding will reduce the adequacy of nutrients and antibodies needed by babies, increase the chance of infection, and slow growth. Therefore, the data results support the Theory and confirm that exclusive breastfeeding has a major role in preventing stunting.

The gap found in this study is the still high number of mothers who do not provide exclusive breastfeeding for <6 months despite having initial knowledge about the importance of breastfeeding. Cultural myths, family pressure, or lack of support from health workers after delivery could cause this. In addition, the suboptimal monitoring by nutrition officers at the Health Center has resulted in low

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sustainability of breastfeeding practices. For this reason, a direct breastfeeding assistance program is needed in the first six months of a baby's life. For further research, it is recommended to explore the socio-cultural and psychological factors of mothers in the success of exclusive breastfeeding. Mixed methods research can explore the quantitative and qualitative dimensions of this practice in more depth. Suggestions for respondents are the importance of building awareness since pregnancy regarding the commitment to exclusive breastfeeding and avoiding giving additional food prematurely.

Continuing Breastfeeding Age 12-23 Months

Continuing breastfeeding at 12–23 months is part of the practice of sustainable breastfeeding, which is providing breast milk along with complementary foods until the age of two years or more; WHO and the Indonesian Ministry of Health recommend continuing breastfeeding until the age of 2 years because breast milk remains a source of important nutrients, antibodies, and growth factors. At this age, even though the child has received complementary foods, the need for nutrients from breast milk still plays a role in supporting linear growth and the development of the immune system; continued breastfeeding can also reduce the risk of malnutrition and infectious diseases that are often experienced by toddlers, especially in poor sanitation environments. In the context of stunting, continued breastfeeding has been shown to play a role in reducing the risk of chronic growth failure. However, many mothers stop breastfeeding before the age of two due to social pressure, work, or lack of education.

Based on Table 3, the variable of not continuing breastfeeding at age 12–23 months has a p-value = 0.884 with Exp(B) = 0,958 and 95% CI (0,541–1,697). These results indicate that statistically, this variable does not have a significant effect on the incidence of stunting in the population studied. In other words, there is no significant difference between toddlers who receive continued breastfeeding and those who do not in terms of stunting status. This finding is contrary to a number of literature that mention the importance of continued breastfeeding in maintaining children's nutritional adequacy. However, these results still provide an important picture that the continuation of breastfeeding is not the only dominant factor in the incidence of stunting. In coastal areas, other factors, such as the quality of complementary foods, sanitation status, and infections, have a greater influence. Variation in the quality of complementary foods and overall energy intake.

Studies showing significant relationships are generally conducted in rural or coastal areas with limited access to food. Meanwhile, in areas with adequate access to nutritious food, the role of continued breastfeeding is smaller. This difference shows the importance of considering contextual factors and interactions between variables in the analysis. Theoretically, the practice of continued breastfeeding is included in the WHO's Theory of optimal infant feeding framework, which emphasizes the importance of breastfeeding until the age of 2 years. Breast milk still contains important nutrients that act as a complement to complementary foods and protection from disease. However, in Table 2, the proportion of stunting in children who did not continue breastfeeding was 31 out of 125 toddlers (12,4%), and those who continued breastfeeding were 32 out of 125 toddlers (12,8%). This means that the distribution of stunting incidence is almost balanced between the groups that continued and did not continue breastfeeding. The results of this crosstab support the regression results that the variable continued breastfeeding does not make a significant difference to the incidence of stunting. Logically, when the quality and quantity of complementary foods are sufficient, the role of continued breastfeeding can be replaced. Therefore, the Theory remains relevant, but many other factors influence its application. In this context, the child nutrition approach cannot rely on just one indicator.

The gap that emerged was the inconsistency between Theory and practice in the field, where although continued breastfeeding is recommended, its effect in this population is not significant. This could be due to the high consumption of quality complementary foods in children, especially from local food programs or assistance. In addition, the existence of other nutritional interventions could be a balancing factor for the lack of continued breastfeeding. For further research, it is recommended to include variables such as the quality of complementary foods, gastrointestinal infections, and immunization history to clarify the effect of continued breastfeeding on stunting. Research can also be focused on specific age groups (e.g., 18–23 months) to see a sharper effect of breastfeeding. For respondents, it is important to maintain

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breastfeeding practices until the age of two years while ensuring the quality of the complementary foods provided. The government can also strengthen breastfeeding education at Posyandu and integrate it with routine child nutrition monitoring.

Energy Intake

Energy intake is the total amount of energy obtained by an individual from consuming food and beverages, which is needed to carry out basic metabolic functions, physical activity, and growth. In toddlers, energy needs are crucial because this phase is a period of rapid growth and significant development of body organs. Long-term energy deficiency will cause growth disorders, one of which is stunting or chronic failure to thrive. According to the 2019 Indonesian Ministry of Health's Nutritional Adequacy Rate (AKG), the energy needs of children aged 1–3 years are around 1125 kcal per day, and those aged 4–6 years are around 1600 kcal per day (16). If energy intake is below the minimum requirement, the risk of growth disorders and poor nutritional status will increase. Sufficient energy is important to support daily physical activity, brain development, and an optimal immune system.

The results of the logistic regression analysis in Table 3 show that insufficient energy intake has a p-value = 0.001 with Exp(B) = 27,695 and a 95% confidence interval between 3,679 and 208,4. This means that children with insufficient energy intake have a 4,6 times greater risk of experiencing stunting than children with good or more energy intake. This finding is statistically significant because the p-value <0.05 confirms that energy intake is a strong predictor of stunting in this study. This indicates that interventions on energy intake are an important strategy in reducing the prevalence of stunting, especially in coastal areas. This high risk can be caused by a monotonous diet, low in calories, or lack of access to nutritious food. Thus, the results of this study support the importance of monitoring children's energy consumption through food recalls and nutritional education for parents. These results also show that energy fulfillment not only affects body weight but also height in the long term. Therefore, policies to fulfill children's nutritional needs must pay attention to the aspect of the quantity of energy consumed each day.

This study is in line with a study by Tanzil & Hafriani, (2021), that that low energy intake has a 9,3 times higher risk of causing stunting compared to sufficient energy intake; insufficient energy intake is a significant risk factor for stunting, children with low energy sufficiency tend to have impaired linear growth and impaired body metabolism (OR = 9,333, 95% CI = 2,180–39,962, p = 0,003) (14). Research conducted by Kurniati et al., (2022), deficit energy intake increases the risk of stunting by 5.75 times compared to toddlers with normal energy intake. There is a significant relationship between low energy intake and the incidence of stunting. Energy deficiency causes depletion of energy reserves in the body, which can chronically inhibit the growth of children's body tissues (OR = 5,750, 95% CI = 1,956–16,899, p = 0,002) (31). However, not all studies show a strong direct relationship, Sitorus et al's (2022) study in a big city like Jakarta showed that energy intake did not directly affect stunting but was more influenced by repeated infections and poor sanitation. This shows that energy intake is important but must be viewed holistically, along with other factors such as diet, meal frequency, and food quality. Intermediary factors such as appetite, worm disease, and the mother's psychosocial condition can also affect children's energy consumption.

In Theory, the concept of "Protein-Energy Malnutrition (PEM)" explains that chronic energy deficiency is the main cause of stunting and wasting in children. This Theory emphasizes that insufficient energy will cause the body to use protein for energy so that there is not enough substance for tissue growth. The results of Table 2 support this Theory, where children experience energy deficiency; as many as 49 people experience stunting (19,6%) out of a total of 63 stunted children. Conversely, for children who have more or better energy intake, the number of stunting cases is much lower. This indicates that the lower the energy intake, the higher the risk of children experiencing growth retardation. This correlation supports the results of the regression analysis and emphasizes that nutritional interventions must start with meeting daily energy needs. Practically, this can be translated into preparing a balanced menu that prioritizes complex carbohydrates, healthy fats, and protein.

The gap that emerged from this study is the lack of in-depth analysis related to the quality of food as a source of energy consumed by children, whether it comes from processed foods or nutritious local

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foods. In addition, the data does not show daily eating patterns or meal frequencies that can affect the amount of energy absorbed by the child's body. For further research, it is recommended to include the components of the diet diversity score, infection status, and meal frequency as additional variables to see a more accurate causal relationship. Suggestions for respondents (mothers/families) are the importance of understanding children's energy needs and ensuring that the food provided is sufficient in calories according to age. Education regarding a balanced nutritious menu with local food ingredients needs to be continuously improved through Posyandu or nutrition cadres. Local governments also need to expand additional food programs for toddlers who are detected as lacking energy. Collaboration between the health and agricultural sectors can be a solution to improving family food security.

Protein Intake

Protein intake refers to the amount of macronutrients consumed in the form of protein from food and drinks consumed every day. Protein is very important in the growth phase of children because it plays a role in the formation of body tissues, enzymes, hormones, and the immune system. The protein requirement for children aged 1-3 years is around 26 grams/day, and for children aged 4-6 years, around 35 grams/day, according to the Nutritional Adequacy Rate (AKG) of the Indonesian Ministry of Health in 2019 (16). Insufficient protein intake will inhibit the linear growth process and cause cognitive and motor development disorders in children. In the context of stunting, protein plays a role in stimulating growth hormones such as IGF-1 (Insulin-like Growth Factor-1), which plays an important role in bone growth and height. Lack of protein intake can cause stunting even though energy is sufficient because the body does not have enough basic materials to build new tissue. Therefore, meeting adequate and quality protein intake is very important for children, especially during the First 1000 Days of Life (HPK). Protein can be obtained from animal sources such as eggs, fish, chicken, and milk, as well as from plant sources such as tempeh, tofu, and nuts.

The results of the logistic regression analysis in Table 3 show that insufficient protein intake has a very significant relationship with the incidence of stunting, with a p-value of 0,001. The Exp(B)= 192,85 indicates that children with insufficient protein intake have a 15 times greater risk of experiencing stunting than children with more or good protein intake. The 95% confidence interval is also very narrow and does not exceed 1 (62,05–599,3), strengthening the significance of the relationship. This indicates that protein intake is the main determinant of stunting in the coastal areas of Sampang Regency. The magnitude of this risk indicates that the quality of children's intake is more determined by protein content than just total energy. Children who are deficient in protein can experience linear growth retardation even though their calorie needs are relatively met. These results are an important concern for the preparation of child nutrition programs and education on local nutritious food high in protein.

This study is in line with a study by Sari et al., (2022) which showed that toddlers with higher consumption of diverse animal protein intakes are increasingly protected from stunting (32). Likewise, a study by Nugraheni et al., (2020) found that children with low protein consumption had significantly shorter heights than groups with sufficient intake (33). Meanwhile, a study by Putri et al. (2020) in urban areas showed no direct relationship between protein intake and stunting because other variables, such as chronic infections and parenting patterns, were more dominant. The difference in results shows that the relationship between protein and stunting can vary depending on the environmental and socio-economic context. However, in general, most studies state that protein plays an important role in preventing growth retardation. Therefore, these findings strengthen the evidence that protein interventions should be a priority in preventing stunting. Further research is recommended using a more detailed dietary recall method to assess the quality and sources of protein consumed.

Theoretically, WHO and UNICEF explain that chronic protein deficiency can cause linear growth failure through decreased IGF-1 hormone and suboptimal bone remodeling process. In Table 2, it was found that of the 63 children who experienced stunting, 54 children (21,6%) had insufficient protein intake, while only seven children (2,8%) had excess protein intake. This shows that there is a large proportion of stunted children who come from groups with low protein intake. Meanwhile, in children who are not stunted, as many as 150 children (60%) have excess protein intake, strengthening that sufficient protein contributes

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to optimal growth. This relationship is in line with the Theory and logistic regression analysis in Table 3. Overall, the data supports the hypothesis that good protein intake protects against stunting. This indicates the importance of increasing consumption of animal and vegetable protein sources.

The gaps identified in this study are the absence of assessment of protein quality (animal vs vegetable protein), frequency of consumption, and children's health status as interaction factors. In addition, children's daily diet and sanitation conditions have not been analyzed as confounding factors. Suggestions for further research are to use the food frequency questionnaire (FFQ) or weighed food record approach to obtain more accurate protein estimates. For respondents (parents), it is important to increase knowledge about cheap and nutritious protein sources from local foods such as seafood, eggs, and tempeh. Mother empowerment programs through nutrition classes and healthy family kitchens can strengthen improvements in protein consumption patterns at home. Local governments can also support through protein-based food assistance for high-risk families. This intervention will not only reduce stunting but also increase children's immune systems and cognitive abilities in the future.

CONCLUSION

This study shows that the prevalence of stunting in toddlers in the coastal areas of Sampang Regency is quite high, which is 25.2%. The results of the bivariate analysis showed that factors that were significantly associated with the incidence of stunting included not being given exclusive breastfeeding for 2 days after birth (p = 0,003; Exp (B) = 2,447), not being given exclusive breastfeeding <6 months (p = 0,043; Exp (B) = 2,766), insufficient energy intake (p = 0,001; Exp (B) = 27,695), and insufficient protein intake (p = 0,001; Exp (B) = 192,85). Meanwhile, the variables of early initiation of breastfeeding (IMD) and continuing breastfeeding at the age of 12–23 months did not show a statistically significant relationship to stunting. Suboptimal early breastfeeding, lack of energy, and especially lack of protein are the main determinants of stunting in toddlers in coastal areas. These findings indicate that early nutritional intervention and improving the quality of children's diets are important in efforts to prevent stunting in the region.

It is recommended that local governments strengthen nutrition education programs and increase the coverage of exclusive breastfeeding and consumption of high-energy and protein foods in toddlers. Health workers are expected to actively assist mothers regarding appropriate feeding practices, especially during the First 1,000 Days of Life. Mothers of toddlers also need to increase awareness of the importance of breastfeeding from birth to two years of age and the selection of nutritionally balanced complementary foods. Further research is recommended to add variables such as infection status, sanitation, and birth weight to obtain a more comprehensive picture. Cross-sector collaboration is needed to create an environment that supports optimal child growth and development and Future longitudinal studies are needed to confirm the association and evaluate the impact of protein-focused nutrient intake interventions.

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CONFLICTS OF INTEREST

The authors declare that there is no conflict of interest associated with this study.

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