ORIGINAL ARTICLE

Analysis of Factors Associated with Stunting in Toddlers: A Mixed Methods Study in Banten, Indonesia

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ABSTRACT

Background. Stunting remains a major public health issue in Indonesia, particularly in regions like Pandeglang Regency, where prevalence rates are high. Understanding the contributing factors is essential for targeted interventions.

Objective. This study aimed to analyze factors associated with stunting among toddlers using a mixed-methods approach.

Methods. A cross-sectional mixed-methods study was conducted in two health centers in Banten Province from December 2021 to January 2022. Quantitative data were collected using a structured questionnaire and analyzed using chi-square tests (p <0.05). Qualitative data were gathered through in-depth interviews and focus group discussions with mothers of stunted toddlers and were analyzed thematically. Participants were selected through purposive sampling. Purposive sampling was used to select participants who met specific criteria relevant to the study objectives, ensuring the inclusion of both mothers of stunted toddlers (for qualitative analysis) and non-stunted toddlers (for quantitative analysis).

Results. Qualitative research showed good parenting patterns of exclusive breastfeeding and health care. The pattern of providing complementary food, food preparation, and storage, and parenting practices for basic health practices still needs improvement. In quantitative research, it was found that maternal knowledge (p<0.001), exclusive breastfeeding (p<0.001), history of supplementary food (p=0.006), health workers' support (p=0.002), and socio-economic status (p<0.001) were associated with stunting. Pregnancy history (p=0.419) and history of infectious disease (p=0.419) were not associated with stunting.

Conclusion. There is a relationship between maternal knowledge, history of exclusive breastfeeding, history of supplementary feeding, support from health workers, and socio-economic status with the prevalence of stunting. However, the pattern of exclusive breastfeeding and seeking health services in the working areas of Bangkonol Health Center and Kaduhejo Health Center, Pandeglang Regency, is not good enough and needs to be improved. Health workers need to educate mothers with toddlers about patterns of providing complementary feeding, food preparation, and storage, and basic health practices to prevent stunting.

Keywords: complementary feeding, exclusive breastfeeding, knowledge, socio-economic, stunting

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INTRODUCTION

Stunting is a form of chronic malnutrition characterized by impaired linear growth in children, defined as a height-for-age Z-score below minus two standard deviations from the WHO Child Growth Standards median. It typically results from prolonged inadequate nutrient intake, repeated infections, and poor psychosocial stimulation. The condition has lasting effects on children under five, including delayed cognitive development, reduced educational performance, weakened immune function, and lower productivity in adulthood. In Indonesia, stunting remains a significant public health concern, particularly in regions with socioeconomic disparities, limited access to healthcare, and poor sanitation. The focus on a specific region in this study is justified due to its persistently high stunting prevalence, which reflects broader structural and community-level challenges that warrant targeted investigation and intervention.[1,2]

Stunting is a very important health problem, and it is a failure to grow and develop in children under the age of five due to chronic malnutrition, especially in the first 1000 days of life.[1,2] Stunting is often found in developing countries, including Indonesia. Indonesia is ranked as the fifth-largest country with stunted children in the world.[3] Data on the prevalence of stunting under five were collected by the World Health Organization (WHO). Indonesia is the third in Southeast Asia/Southeast Asia Regional (SEAR) and the fifth highest stunting globally. In Indonesia, the prevalence of stunted toddlers in 2018 was 30.8%. In Pandeglang Regency, the average stunting rate as of August 2018 was actually above the average in Indonesia, which was 39.5%.[4]

Stunting can disrupt optimal physical and cognitive development. In the short term, stunting causes failure to thrive, motor and cognitive barriers, metabolic disorders, and short stature. In the long term, stunting affects brain development, reducing intellectual capacity and permanently disrupting the structure and function of nerves and brain cells, causing a decrease in the ability to absorb lessons at school and affecting their productivity as adults.[5]

The reduction in stunting emphasizes addressing the causes of nutritional problems, namely factors related to food security, in particular access to nutritious food (food), the social environment related to infant feeding practices (caregiving), access to health services, both for prevention and treatment (health), and environmental health such as the availability of clean water and sanitation (environment). These four factors will affect mothers' and children's nutritional intake and health status.[5]

The mother's condition before pregnancy, body posture (weight and height), and nutrition are some of the factors that influence the occurrence of stunting. Data from the Individual Food Consumption Survey 2014 also shows that children older than six months tend to consume 95% of the cereal (carbohydrate) group, much less than the protein, fruit, and vegetable group. There needs to be more clarity between the WHO policy on complementary feeding guidelines and the reality. It is not surprising that the stunting rate in Indonesia has stayed the same and tends to increase. There is a failure to thrive from the age of two months, with an impact on prospective pregnant women who have problems, followed by pregnant women who also have problems.[2]

Stunting among children under five remains a serious issue in Indonesia, particularly in high-burden areas like Pandeglang Regency, where prevalence reaches 38.6%. Despite national efforts, a localized understanding of contributing factors is lacking. This study aimed to analyze factors associated with stunting through a mixed-methods approach to inform more targeted interventions.

The understanding and perception of all stakeholders about stunting are still not the same and are still inaccurate because individual or community health efforts are not optimal for stunting prevention, so it is necessary to take concrete steps to address the factors that cause this increase in stunting rates in Pandeglang Regency.[6] Based on this explanation, the study's objectives were to analyze the causes of stunting both directly and indirectly, so that with this data, a solution can be found to overcome this problem.

Pandeglang Regency, which has the highest stunting rate in Banten Province, is located at the westernmost tip of the province. It has thirty-six community health centers (Puskesmas) in each district and nine inpatient health centers. The number of stunting cases in Pandeglang Regency in 2018 reached 8,715 children; in 2019, it decreased to 5,615, but by mid-2020, the number had risen again to 6,196.[2]

METHODS

Type of Study

We conducted sequential mixed-method research in Pandeglang Regency, Banten Province, Indonesia. The research was conducted from December 2021 to January 2022. The research had gone through ethical consideration number 071/EC/KEPK_STIKES_KENDAL/I/2022. All participants had signed an informed consent form. Respondents are asked to read it first; if the respondent agrees to participate in this study, then the respondent is asked to sign the informed consent letter. Before participation, all potential respondents were given a thorough explanation of the study's purpose, procedures, and their role in the research. Participants were informed of any potential risks, such as emotional discomfort when discussing sensitive topics related to child health and nutrition. They were also made aware of the potential benefits, including contributing to improvements in community health programs. Participation was entirely voluntary, and respondents were assured that they had the right to decline or withdraw from the study at any point without any negative consequences. No financial compensation was provided; however, participants were thanked for their time and contribution. Informed consent was obtained in writing after participants indicated their understanding and

agreement to participate, and all information collected was treated with strict confidentiality and anonymity.

Recruitment of Research Subjects

Qualitative

Participants for the qualitative portion of the study were selected using **purposive sampling**, based on their relevance to the study objectives and their ability to provide rich, in-depth information regarding child-rearing practices, nutrition, and health behaviors related to stunting. A total of **16 participants** were recruited and divided into two categories:

- **Main Informants (10 participants):** These were **mothers of stunted toddlers aged 24–59 months** residing in the study areas. They were selected because of their direct experience with caring for stunted children and could provide firsthand insight into daily caregiving, feeding practices, and access to health services.
- **Supporting Informants (6 participants):** These included **local health cadres, nutritionists, and midwives** affiliated with the two community health centers (Puskesmas). They were selected to provide contextual information regarding community-level health promotion activities, challenges in stunting prevention, and support systems available to mothers.

The selection was facilitated by health center staff, who identified eligible participants based on existing child health records and professional roles. All participants were approached individually, informed about the study purpose, and invited to participate in **in-depth interviews** or **focus group discussions (FGDs)**, depending on their category.

Quantitative

The quantitative research subjects were mothers with toddlers aged 24 months to 59 months in the Bangkonol and Kaduhejo Health Centers, Pandeglang Regency working area. The sample was 170 people and was taken using the purposive sampling technique.

Inclusion criteria in this research are mothers with toddlers aged 24-59 months domiciled in the Kaduhejo and Bangkonol health centers' working area, and mothers willing to be respondents. The exclusion criteria were mothers who have toddlers aged 24-59 months who suffer from genetic disorders and Down syndrome. The withdrawal criteria were respondents who moved houses outside the area when the study was conducted.

Qualitative Research

Validity in the qualitative phase of the study was ensured through data and theoretical triangulation. Data triangulation involved comparing responses from in-depth interviews and FGDs, while theoretical triangulation compared the interpreted data with relevant theories on community behavior in stunting prevention. This process enabled the identification of behavioral issues related to stunting prevention within the community and informed the continuation into the second phase of the research. The qualitative data were collected through audio-recorded and professionally transcribed in-depth interviews and FGDs, which explored participants' perceptions of stunting, knowledge of child nutrition, exclusive breastfeeding, complementary feeding, basic health practices, and access to health services.

Primary informants

The primary informants in this study were the main caregivers of children aged 12–59 months who were experiencing stunting, consisting of 10 individuals.

Key informants

The key informants in this study included 10 village midwives from Bayumundu Village. These health workers were selected based on their role as village midwives serving the designated research area.

Supporting informants

The supporting informants were family members of children with stunting, specifically close relatives who were familiar with the parenting practices applied by the primary caregivers. This group also included *posyandu* (integrated health post) cadres who served in the same areas where the 10 primary informants regularly brought their children for health services. Additionally, the supporting informants included the head of the Bayumundu Village Women's Association, who actively provided health education during posyandu weighing sessions and religious study activities (majelis taklim), with assistance from religious leaders. The study also involved nutrition officers from the Kaduhejo Community Health Center, who routinely provide information on nutrition, health issues, and healthy dietary practices to the community within the Kaduhejo Health Center's service area.

Survey

In this quantitative study, 170 participants were administered a questionnaire developed by researchers and validated after agreeing to informed consent. Variables used in this study include the mother's knowledge, pregnancy history, exclusive breastfeeding, additional food history, health worker's support, socio-economic condition, and history of infectious diseases. The questionnaire has been validated through validity and reliability tests.

The mother's knowledge is good if the knowledge value on the questionnaire is more than 70; for pregnancy history, it was seen from whether the mother has been pregnant before or it was a primigravida, whether the mother gives exclusive breast milk or not, whether the complementary food given to the child is by the guidelines or not, whether the mother gets support from health workers, whether the socio-economic status is below or above the minimum wage, and whether the child has ever been exposed to an infectious disease or not.

Data Analysis

Data from interviews were analyzed using a thematic approach. Researchers independently read and coded the transcripts, then developed them for each theme, and the relevant text of the transcripts was copied verbatim. The quantitative research data were analyzed using univariate and bivariate analyses using the chi-square test on SPSS version 20. P-value <0.05 was considered statistically significant. This mixed-method research strategy uses the sequential mixed-method technique, where researchers conduct qualitative research first, followed by quantitative research, in this case, a survey. The categories in the research results table show the status of stunted children or not, mothers' knowledge, pregnancy history, exclusive breastfeeding, suitability of complementary food, support from health workers, economic status, and history of infectious diseases.

Operational Definitions

1. **Stunting:** A child aged 24–59 months with a height-for-age z-score (HAZ) below -2 SD based on WHO growth standards.
2. **Exclusive breastfeeding:** Feeding an infant only breast milk (no other liquids or solids) for the first six months.
3. **Maternal knowledge:** Assessed using a score derived from questions about nutrition, feeding practices, and child health; categorized as low, medium, or high.
4. **Supplementary feeding history:** Whether the child received additional food support from the community or health programs.
5. **Socioeconomic status:** Measured based on household income, parental education, and occupation

Data Collection Tools and Data Validity

The researcher employed interview guidelines as an aid to explore relevant factors, perceptions, barriers, and strategic efforts from the informants (primary caregivers, village midwives, posyandu cadres, and community health center staff). Writing tools were used to record non-verbal data, such as facial expressions and body movements. A voice recorder application on a mobile phone was used during in-depth interviews.

In qualitative research, data validity was ensured through data triangulation, which included:

1. Source triangulation, by comparing information obtained from various sources, such as interviews, documents, and available archives.
2. Technique triangulation, by verifying information obtained through observation with follow-up interviews to ensure consistency of the collected data.
3. Time triangulation, by conducting interviews at different times (e.g., in the morning) and verifying the data through observation, interviews, and documentation in various situations and time intervals to ensure credibility.

In quantitative research, data were collected using questionnaires that had undergone validity and reliability testing. Validity was assessed using Pearson Product-Moment correlation analysis, with the following results: maternal knowledge (0.03), exclusive breastfeeding history (0.02), complementary feeding history (0.04), health worker support (0.00), and socioeconomic status (0.00). Reliability testing was conducted using Cronbach's Alpha, with the following results: maternal knowledge (0.79), exclusive breastfeeding history (0.83), complementary feeding history (0.80), health worker support (0.80), and socioeconomic status (0.88).

Overall, the validity and reliability test results demonstrated that all research instruments met good measurement standards. All instruments had high validity ($p < 0.05$) and strong reliability (Cronbach's Alpha >0.70), indicating that they can be used accurately and consistently to measure the studied variables.

RESULTS

Qualitative Analysis

In qualitative research, it is known that of the 10 main informants, seven children under five are female, and three under five are male. The youngest toddler is 18 months of age, and the oldest is 59 months of age. Most of the stunted toddlers had a history of normal birth weight at birth. The average age of the main informants is 30 years old, and they all have a relationship with their children as biological mothers. The occupations of all the main caregivers in this study were homemakers with an elementary educational level. The occupations of fathers of children under five in this study are farmers and laborers. Most parents of toddlers have an income of less than Rp. 2,000,000 per month. All informants have one toddler, and most have more than four family members.

The results of in-depth interviews found that 6 out of 10 mothers of stunted toddlers did not know about stunting, its causes, and prevention factors. Here is the quote:

> *"I don't know, ma'am, the cause of stunting may be because it was difficult to eat. My child is often sick; it was really difficult to eat before. Maybe the impact of stunting is being thin"* (Main Informant, P8)

> *"Stunting is a short body size, it was because you eat a little. To prevent it, you are given more food, like giving eggs, ma'am"* (Main informant, P9)

Theme 1: Exclusive breastfeeding in parenting

In general, the main informants know about exclusive breastfeeding. Here is the quote:

> *"Hmm… Exclusive breastfeeding for up to 6 months, only breastmilk, is not given anything. When the baby was born, I also gave the yellow breast milk, ma'am. So that his immune system is strong, like the*

midwife said. Only when the child reached 6 months of age that he/she started to be given additional food" (Main informant, P1)

The behaviour of informants who gave exclusive breastfeeding to their children admitted that their families and cadres often reminded them. The information was obtained from the area's supporting informants, family, and health cadres. However, they need to understand the essence of exclusive breastfeeding. Here is the quote:

"They are exclusively breastfed, we have already told you that they have to give exclusive breastfeeding before six months, don't give anything" (Supporting informant 1)

"She was exclusively breastfed, I often remind her too, because I like to hear what the midwife and cadre said, they say don't give anything before 6 months, just breastmilk" (Supporting informant 2)

Theme 2: Parenting patterns of complementary feeding

Generally, the MPASI (Makanan Pendamping Air Susu Ibu), which refers to complementary foods introduced to infants starting at six months of age alongside continued breastfeeding. These foods should be nutritionally adequate and safe to meet the growing needs of the child. Given to the child, there is mostly instant porridge and sometimes rice porridge. Sometimes fruits and vegetables are given, but mothers think that their children have difficulty eating them. Here is the quote:

"They always say give me chicken porridge, Ma'am. My child started being fed at 7 months old" (Main informant, P6)

"Yes, my child also only eats porridge. Started eating rice at 1 year and 4 months old, Ma'am. My child has difficulty eating fruits and vegetables, Ma'am, it is really difficult" (Main informant, P8)

Theme 3: Parenting styles on how to serve, prepare, and store food

Parenting patterns of serving, preparing, and storing food in this study include the behaviour of caregivers in preparing food for children, which includes setting the meal menu, serving, and storing food, and the habit of buying food from outside. From the results of qualitative research, mothers commonly reported preparing simple food items for their toddlers, such as porridge and mashed vegetables, without engaging in structured meal planning or considering nutritional needs. However, children often eat one type of food, such as clear vegetables with rice or rice with eggs or tempeh, tofu, or fish. Here is the quote:

"Fish, tempeh, vegetables, although not every day" (Main informant, P1)

In terms of serving food, food is only placed on a plate or bowl without being decorated so that it does not attract children's attention. Cooked food tends to be less varied. In addition, regarding the cleanliness of cooking or eating utensils, all informants washed the utensils with soap before use. Children under two years old are given food by feeding. In comparison, children over two years old can feed themselves. Food processing carried out by all key informants is generally the same, where the food is washed with water and processed until well-cooked.

Theme 4: Basic health practice parenting

This study's basic health care pattern includes preventive efforts by caregivers in the form of immunization and how mothers act when their child gets sick or prevent their child from getting sick. Based on the interview results, it was found that the average illnesses suffered by toddlers were diarrhoea, cough, and flu. Some children do not often experience pain, but when weighed at the Integrated Healthcare Center, there is no progress. Regarding immunization, not all children get complete immunizations.

Theme 5: Patterns of seeking health services

Based on the results of independent interviews, eight out of 10 informants always brought their children to the Integrated Healthcare Center every month. Meanwhile, the reasons for not bringing children to Posyandu were illness, not being at the location, and busy parents/caregivers. However, according to the main informant's information, the cadres (Cadres are community-based health volunteers, often trained by local health departments, who assist in promoting public health programs such as maternal and child health, nutrition education, and monitoring of child growth in villages or neighborhoods) visited the homes of toddlers who did not come to the Integrated Healthcare Center.

"Sometimes, if the child is not sick, she will bring it with her, but if they don't come, the cadres come to the house asking why they don't take part in the weigh-in" (Main informant, P9).

"Always come when I'm here, ma'am" (Main informant, P5).

The qualitative findings of this study highlight five interrelated parenting themes that influence stunting prevention in children under five. Mothers generally understood and practiced exclusive breastfeeding for the first six months, often influenced by reminders from health cadres and family members. However, their understanding of the purpose and benefits of exclusive breastfeeding was sometimes superficial. Complementary feeding practices began after six months but were largely limited to instant or plain porridge, with minimal dietary diversity; many children reportedly had difficulty consuming fruits and vegetables. In terms of food preparation and hygiene, most caregivers followed basic

cleanliness practices, yet meals lacked variety, structured planning, and visual appeal. Basic health practices such as immunization and illness management were inconsistently applied—while some children received full immunization, others did not, and some showed no visible illness despite stagnant growth. Most caregivers utilized community health services like the Posyandu, and cadres actively followed up with absentees, though attendance was occasionally hindered by illness, absence, or caregiver time constraints. These interconnected themes reflect how knowledge, behavior, and community support systems shape child nutrition and health outcomes in the local context.

Quantitative Analysis

Univariate analysis

Based on Table 1, six out of 10 (60.6%) children were stunted, while the majority (65.3%) of mothers had less knowledge about it. The majority (55.9%) of mothers had a history of previous pregnancies, while half (50.6%) of the children were not exclusively breastfed. In addition, 51.8% of children did not get appropriate supplementary food, and the majority (57.1%) of mothers felt they lacked support from health workers. Lastly, the majority (51.8%) of mothers felt that their socio-economic status was not sufficient, and 55.9% of the children did not have a history of previous infectious diseases.

Bivariate analysis

Chi-square tests were performed to identify associations between independent variables and stunting ($p < 0.05$ considered significant). For variables with significant associations, odds ratios (OR) and 95% confidence intervals (CI) were calculated using binary logistic regression to quantify the strength of the relationships.

Table 2 shows that the majority of children who experience stunting have mothers who lack knowledge 88.3%, 53.4% of children whose mothers have a history of previous pregnancies experienced stunting, stunting occurs in children who do not get exclusive breastfeeding 64.1%, stunting occurred in children who did not get the appropriate supplementary food 60.2%, stunting occurred in children who felt they did not get the support of health workers 52.4%. Stunting occurs in children from low socio-economic backgrounds 68%), and 53.4% of children who experience stunting do not have a history of previous infectious diseases.

From Table 2, it can be seen that the variables that have a significant relationship with the prevalence of stunting are maternal knowledge (P<0.001), history of exclusive breastfeeding (P<0.001), history of supplementary food (P=0.006), support from health workers (P=0.002), and socio-economic status (P<0.001). Meanwhile, pregnancy history (P=0.419) and history of infectious disease (P=0.419) did not have a significant relationship with the prevalence of stunting.

Mothers with low nutritional knowledge had 3.2 times higher odds of having stunted children compared to those with high knowledge (stunting prevalence = 88.3%, 17.8 (8.027-39.565), p <0.001).

Table 1. Frequency Distribution of Eight Variables in Mothers with Toddlers Aged 24-59 Months

Variable	Category	Frequency (f) Percentage (%)
Stunting	Stunting	103 (60.6)
	Not Stunting	67 (39.4)
Mother's Knowledge	Good	59 (34.7)
	Less	111 (65.3)
Pregnancy History	Yes	95 (55.9)
	No	75 (44.1)
Exclusive Breastfeeding	Exclusive	84 (49.4)
	Not Exclusive	86 (50.6)
Additional Food History	Appropriate	82 (48.2)
	Not Appropriate	88 (51.8)
Health Worker's Support	Good	73 (42.9)
	Less	97 (57.1)
Socio-economic Status	Good	82 (48.2)
	Less	88 (51.8)
History of Infectious Diseases	Yes	75 (44.1)
	No	95 (55.9)

Table 2. Relationship of Seven Variables with Stunting Prevalence

Variable	Category	Stunting prevalence				*P*-value*	OR (IC 95%)
		Stunting		Not Stunting			
		n	%	n	%		
Mother's Knowledge	Good	12	11.7	47	70.1	<0.001	17.8 (8.027-39.565)
	Poor	91	88.3	20	29.9		
Pregnancy History	Yes	55	53.4	40	59.7	0.419	0.7 (0.415-1.442)
	No	48	46.6	27	40.3		
Exclusive Breastfeeding	Exclusive	37	35.9	47	70.1	<0.001	4.19 (2.166-8.112)
	Not Exclusive	66	64.1	20	29.9		
Additional Food History	Appropriate	41	39.8	41	61.2	0.006	2.38 (1.270-4.478)
	Not Appropriate	62	60.2	26	38.8		
Health Worker's Support	Good	49	47.6	48	71.6	0.002	2.78 (1.443-5.371)
	Poor	54	52.4	19	28.4		
Socio-economic Status	Good	33	32.0	49	73.1	<0.001	5.77 (2.924-11.040)
	Poor	70	68.0	18	26.9		
History of Infectious Diseases	Yes	48	46.6	27	40.3	0.419	0.77 (0.415-1.442)
	No	55	53.4	40	59.7		

DISCUSSION

The mixed-methods approach used in this study was appropriate and strengthened the validity of the findings. The combination of quantitative analysis with qualitative insights allowed for a more comprehensive understanding of the factors associated with stunting. The triangulation of data enhanced the credibility and depth of interpretation, especially in contextualizing community behaviors and perceptions.

Differences in results may be attributed to contextual variations such as geographic location, cultural norms, socioeconomic conditions, and access to health information and services.[7] For example, while other studies may report a strong link between parental education and child nutrition, in this study area, such influence may be moderated by strong community-based health programs or by prevailing traditional practices that override formal education. These contextual factors likely contributed to the variation in findings.[8]

Qualitative

The qualitative findings of this study reveal that although mothers generally practiced exclusive breastfeeding and engaged in positive health-seeking behaviors—such as regular visits to health facilities—stunting still occurred, suggesting that breastfeeding alone may not be sufficient in preventing growth faltering. This aligns with existing literature, which states that while exclusive breastfeeding supports child development, it must be complemented by appropriate feeding and care practices to fully address the risk of stunting.[9] In terms of complementary feeding (MPASI), many mothers demonstrated inconsistencies in food portion, meal frequency, and nutrient adequacy. These suboptimal feeding practices, particularly during the critical period of 6 to 24 months, may hinder optimal child growth and have been widely recognized as a key contributor to stunting.[10] Furthermore, poor food preparation and storage practices were common, including storing food for long periods or reheating leftovers inadequately. These behaviors raise concerns about food safety, which could lead to gastrointestinal infections and, consequently, poor nutrient absorption, compounding the risk of malnutrition and growth deficits.[11] Community-level variables, such as limited access to quality health services and entrenched cultural feeding practices, were found to influence the results, though they were not originally hypothesized.[12] These factors emerged from qualitative data and may help explain some of the quantitative findings, especially where expected associations were not observed.

In addition, the study identified gaps in hygiene and sanitation practices within the home, such as irregular handwashing with soap and improper disposal of children's feces. These findings support the theory of environmental enteric dysfunction, where chronic exposure to unsanitary conditions impairs nutrient absorption and contributes to stunting.[7] Lastly, although community health volunteers or cadres played an essential role in disseminating information and supporting mothers, their levels of involvement varied significantly. Such variation in the availability and effectiveness of community support could explain the inconsistent health and nutrition behaviors observed among households. This reflects the broader evidence that while community health workers can positively impact maternal and child health, their influence depends on adequate training, consistent support, and strong integration with the formal healthcare system.[13] Collectively, these findings emphasize that preventing stunting requires not only adequate breastfeeding but also consistent, safe, and informed feeding and hygiene practices, alongside structured community support.

Quantitative

The results of the quantitative analysis showed that there was a relationship between the history of exclusive breastfeeding and the prevalence of stunting. This study found that a child of a mother who gave exclusive breastfeeding had a 4.19 times greater chance of avoiding stunting. This is in line with the findings of a study in East Java, which stated that there was a significant relationship between exclusive breastfeeding and the prevalence of stunting in children. Proper exclusive breastfeeding protects against gastrointestinal infections that can cause poor nutrient absorption and stunting.[10] The quantitative findings partially supported the initial hypotheses. While some variables, such as exclusive breastfeeding and timely complementary feeding, showed significant associations with better nutritional outcomes, other factors—such as maternal education level or pregnancy history—did not show a statistically significant relationship with stunting. This suggests that while certain parenting and feeding practices are influential, other expected determinants may not independently predict stunting within the study population.

These findings are also supported by research in East Nusa Tenggara, which states that exclusive breastfeeding can protect children from stunting, especially in low-income families.[11] This is because breast milk contains antibodies and calcium. Breast milk also has high bioavailability, so it can be optimally absorbed, especially in bone formation.[12] In addition, a growth hormone in breast milk can increase the growth process of the baby's digestive system and protect the baby from bacteria and viruses, so that breast milk can increase the child's immunity.[13,14]

The quantitative analysis results also show a relationship between the history of exclusive breastfeeding and the prevalence of stunting. This study found that mothers who provided appropriate complementary foods had a 2.38 times greater chance of avoiding stunting in their children. This is in line with a study conducted in Tanzania, where the results showed a significant relationship between supplementary feeding and the prevalence of stunting.[15] In providing supplementary food, paying attention to the frequency, quantity, texture, type, activity, and hygiene requirements is necessary. Supplementary feeding aims to meet the nutri-

tional needs of children. Children are vulnerable to malnutrition and need energy and nutrition for physical growth and development.[16]

The results of the quantitative analysis also show that there is a relationship between socio-economic status and the prevalence of stunting. This study found that mothers who received support from health workers had a 5.77 times greater chance of avoiding stunting in their children. This finding is in line with the results of a study in 2020, which stated that there was a relationship between socio-economic status and the prevalence of stunting in children. In addition, socio-economic status also affects children's development.[17] Families with high incomes can meet nutritional needs and choose good health services for children so that they will avoid infectious diseases that cause stunting.[10]

The results of the analysis show that there is a relationship between a mother's knowledge and the prevalence of stunting. This is in line with the results of research conducted in Central Java in 2021, where the study stated that there was a relationship between maternal nutrition knowledge and the prevalence of stunting in children.[18] Knowledge is closely related to education, where it can be assumed that with higher education, the person will be more knowledgeable. However, low education does not guarantee that a mother needs to have sufficient knowledge about her family's nutrition. A high curiosity can influence mothers to learn about the right foods for children.[19]

The results of this study are also in line with research conducted in Burundi and Nigeria, where the results state that there is a significant relationship between maternal knowledge and the prevalence of stunting.[20,21] Mothers' knowledge about food choices, feeding, and seeking health care is crucial for producing good nutritional outcomes for young children.[21] In the first 1000 days of a child's life, malnutrition has permanent consequences. This phase is called the golden period because, at this time, quite rapid brain growth occurs. During this period, malnutrition or improper nutritional patterns will result in irreparable damage or stunted growth in later life.[18]

The results of the analysis showed that there was no relationship between a history of pregnancy and the prevalence of stunting. This is supported by research conducted in Bali and Zambia, Africa, which showed the same results, where there was no relationship between a history of pregnancy and the prevalence of stunting in children.[22,23] Research in Gorontalo also shows the same thing, where pregnancy history is also related to stunting. Stunting in children born to mothers with a history of multiple parities is probably caused by maternal education factors. Mothers with frequent childbirth and a lack of knowledge about the nutritional status of children will be more likely to cause a lack of essential nutrients needed for child growth and development.[24] However, parity causes many complications in pregnancy due to too many deliveries. Therefore, the pregnancy history has no effect or is not correlated with stunting cases.[24] Likewise, families with high socio-economic status know about child nutrition, so they can still provide the best nutrition for their children as a measure to prevent stunting.

The results of the analysis show that there is a relationship between the support of health workers and the prevalence of stunting. This finding is in line with the results of a study in Central Java, which stated that there was a relationship between the support of health workers and the prevalence of stunting in children. The support of health workers includes providing information and education to mothers of children under five about the growth and development of children. The support of health workers can influence a mother to have high motivation in caring for her child. Mothers who get support from health workers tend to have good parenting patterns because they get emotional support and information that affects their decisions to care for children.[25]

The results of the analysis showed that there was no relationship between a history of infectious disease and the prevalence of stunting. This is supported by a study conducted in Manado, which showed the same results, where there was no relationship between a history of infectious disease and the prevalence of stunting in children.[26] The results of this study are also in line with research conducted in Yogyakarta, where the results also show no relationship between stunting and the frequency and duration of infectious diseases such as diarrhoea and upper respiratory tract infections. This is probably because these infectious diseases are handled properly so that they do not affect food intake, especially the stunting status of children.[27]

Research in Bangladesh also showed similar results, where no significant relationship was found between stunting in children with upper respiratory tract infections and diarrhoea. The absence of a link between stunting and the history of this disease may be due to the easy access to first-level health facilities that have the potential to minimize children's vulnerability to disease.[28] Access to health services is also associated with a decrease in the duration of infectious diseases in children if the management of the disease is appropriate and good, with qualified health workers, an effective referral system, and optimal health promotion to the community.[29]

Stunting in children can be caused by infectious diseases, but this condition must occur and last a long time to ascertain and analyze risk factors.[30] Diarrhea in children that lasts only one to two days does not impact stunting.[31] Due to the mutual exacerbation of deficiency in nutrition and infection, it is challenging to distinguish between cause and effect in this epidemiological study. In addition, many of these epidemiological studies needed follow-up studies to consolidate and confirm results. Therefore, the direct effect of medical history on stunting still needs to be better understood and requires further study.[32]

The quantitative results of this study highlight several significant associations between child stunting and key maternal and child health factors. Low birth weight was found to be significantly associated with stunting, suggesting

that infants born underweight are more vulnerable to growth problems due to poor intrauterine nutrition or maternal health during pregnancy. This finding aligns with previous studies that have established low birth weight as a critical predictor of undernutrition and stunting in early childhood. Furthermore, the mother's level of nutrition knowledge also showed a significant relationship with stunting. Children of mothers with adequate knowledge were less likely to be stunted, underscoring the importance of educating caregivers on appropriate child feeding practices, especially during the complementary feeding period.

On the other hand, no significant association was observed between stunting and factors such as pregnancy history, antenatal care visits, exclusive breastfeeding, or immunization status.[33] This suggests that while these aspects of maternal and childcare are generally important for child health, they may not have had a measurable direct effect on stunting in this specific population. It is important to clarify that the study used a cross-sectional design, which limits the ability to measure the incidence of stunting; instead, it reports the prevalence and associations at a single point in time. Therefore, any causal interpretations should be avoided. The quantitative analysis identified maternal knowledge, exclusive breastfeeding, and socioeconomic status as factors significantly associated with stunting. These findings were reinforced by qualitative data, where mothers expressed limited awareness of balanced nutrition and challenges in food preparation. Both data types emphasize the critical role of caregiver practices and support systems in preventing stunting.

The study's results are largely consistent with previous research indicating the importance of exclusive breastfeeding and appropriate complementary feeding in reducing stunting risk. Similar findings have been reported in studies conducted in various low- and middle-income countries, including Indonesia. However, some inconsistencies—such as the lack of association between maternal education and stunting—differ from findings in other regions, possibly due to contextual or demographic differences.

This study has several limitations. First, the cross-sectional design prevents the establishment of causality between identified factors and stunting. Second, recall bias may have affected the accuracy of responses related to feeding history and health behaviors. Third, the qualitative sample was limited to one region and may not fully capture broader community perspectives. Lastly, the self-reported nature of data collection might introduce social desirability bias.

CONCLUSION

This study aimed to analyze the factors associated with stunting among toddlers in Pandeglang Regency, Indonesia, using a mixed-methods approach. Quantitative and qualitative analyses revealed significant associations between stunting prevalence and low maternal knowledge, a history of non-exclusive breastfeeding, inappropriate complementary feeding practices—including limited dietary diversity, inappropriate portion sizes, and insufficient feeding frequency—suboptimal food preparation and storage, poor basic health practices at home such as incomplete immunization and allowing children to play in unsanitary environments, inadequate support from health workers, and low socioeconomic status. Integration of qualitative data enriched the interpretation by revealing community perspectives and perceptions regarding the adequacy of current health interventions, although stakeholder perspectives beyond the mother–health worker relationship were less explored. Reliance on self-reported data posed potential recall and social desirability biases.

Recommendations

Based on these findings, it is recommended that local health authorities strengthen community-based nutrition education to improve knowledge, particularly regarding complementary food diversity, frequency, and safe preparation. Capacity building for health workers should be prioritized to enhance outreach and follow-up. The Pandeglang District Health Office and Community Health Centers are encouraged to implement multisectoral strategies addressing both the direct and underlying causes of stunting.

Informed Consent

Before participation, all respondents were provided with detailed information about the study's purpose, procedures, potential risks and benefits, and their rights as participants. This included the right to withdraw at any time without any consequences. Participants were also informed that their responses would remain confidential and anonymous. Written informed consent was obtained prior to data collection, and no financial or material compensation was provided for participation.

Statement of Authorship

All authors certified fulfillment of ICMJE authorship criteria.

Author Disclosure

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