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ORIGINAL PAPER

Complementary feeding practices and stunting among children aged 6-24 months in Banda Aceh, Indonesia

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Abstract

Background: Stunting is a significant nutritional issue in Indonesia, reflecting chronic malnutrition. Key factors influencing stunting incidence include inaccuracies in complementary feeding, such as timing, texture, portion size, frequency, and variety of food.

Objective: This study aims to examine complementary feeding practices and stunting among children aged 6-24 Months in Banda Aceh, Indonesia.

Methods: This cross-sectional study was conducted in 4 public health centers with the highest stunting prevalence. A total of 105 respondents were selected using proportional random sampling. Data were collected through interviews using a questionnaire on complementary feeding practices and the Individual Dietary Diversity Score (IDDS) and anthropometric measurements from maternal and child health (KIA) books. Data were analysed using the Spearman-Rank test.

Results: The results showed that most children were aged 12–24 months (64.8%) and male (50.5%). The majority of mothers provided complementary foods at the appropriate age (91.4%), with appropriate texture (96.2%), appropriate frequency (55.2%), appropriate portion (66.7%), and moderate food diversity (47.6%). Spearman correlation analysis showed significant associations between stunting and texture (p=0.029; r=−0.213), portion (p=0.000; r=−0.499), frequency (p=0.000; r=−0.420), and food variety (p=0.000; r=−0.715). In this study, the time of first complementary feeding was the only factor that was not significantly related to stunting (p=0.580; r=−0.055).

Conclusion: In conclusion, texture, portion size, feeding frequency, and, especially, dietary variety are significantly associated with stunting. Education on correct complementary feeding practices is needed to prevent stunting.

Keywords: children 6-24 months, complementary feeding, individual dietary diversity score (IDDS), stunting

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Introduction

Child nutrition remains a major issue in the population structure. Stunting is a nutritional problem that arises when children receive insufficient nutrition. Stunting is a nutritional status assessed by height or length relative to age, indicated by a Z-Score below -2 standard deviations (SD).[1,2,3] Based on the results of the 2022 Indonesian Nutritional Status Survey (SSGI), the stunting rate in Indonesia remains quite high at 21.6%.[4] Factors directly related to stunting include food intake and infectious diseases. Indirect factors include family food security, parenting patterns, health services, and environmental sanitation.[5,6]

The golden period, namely, the first 1000 days of life, from the fetal period to the child's second birthday, is characterized by rapid growth and development.[7,8] The prevalence of stunting based on the age group of the 2022 SSGI results, namely the risk of stunting increased by 1.6 times from the age group of 6-11 months, namely 13.7%, to the age group of 12-23 months, namely 22.4%.[4] At this age, child growth is supported by the provision of complementary foods. This shows involvement in providing complementary foods from the age of 6 months, including age suitability, frequency, quantity, texture, and variety of foods.[1,5]

Complementary foods are highly nutritious foods and drinks, other than breast milk, given to babies to meet their nutritional needs.[1] Research by Resti et al.[9] states that children who are given appropriate complementary foods have a 91.7% lower chance of experiencing stunting compared to children who do not receive appropriate complementary foods. In research by Virginia et al.[10], it is stated that there is a relationship between the frequency, texture, amount, and age of first giving complementary foods with the incidence of stunting in children aged 6-24 months in Leyangan Village, East Ungaran District, Semarang Regency.

According to the Indonesian Health Survey (SKI) in Aceh province, the prevalence of stunting in 2023 was 29.8%.[11] The prevalence of stunting in Banda Aceh City in 2023 was 21.7%,[12] and the Community Health Centers with the highest prevalence of stunting were Jeulingke Community Health Center at 13.1%, Baiturrahman Community Health Center at 9.9%, Lampaseh City Community Health Center at 8.8%, and Meuraxa Community Health Center at 8.7%.[13] Based on the description above, the researcher is interested in examining the relationship between complementary feeding practices and the incidence of stunting among children aged 6-24 months at the Banda Aceh City Community Health Center.

Methods

This study used a cross-sectional approach. It was conducted at four community health centers with the highest stunting prevalence in Banda Aceh: Jeulingke Community Health Center, Baiturrahman Community Health Center, Lampaseh Kota Community Health Center, and Meuraxa Community Health Center. The study was conducted from August to September 2025. The population consisted of 1,269 mothers with children aged 6-24 months. The sampling technique used was proportional random sampling, with 105 respondents. All research procedures received ethical clearance (No. 100/EA/FK/2025) from the Ethics Committee of the Faculty of Medicine, Syiah Kuala University, and adhered to the principles of confidentiality, informed consent, and the protection of research participants.

Inclusion criteria were mothers/caregivers who were willing to participate, resided at the four community health centers, and brought their KIA (Child Health Information) booklets. Exclusion criteria included children with congenital abnormalities, chronic illnesses, a history of recurrent infections, premature birth, and low birth weight. The instruments used were a questionnaire containing respondent identity data and a questionnaire on complementary feeding practices compiled based on the WHO (2005) Guiding Principles for Feeding Non-Breastfed Children 6–24 Months of Age.[14] This questionnaire included questions about the age at which complementary feeding was first introduced, as well as texture, portion, and frequency, which were completed by the mother/guardian by selecting the answer that best matched the child's condition. To measure the diversity of complementary feeding and the Individual Dietary Diversity Score (IDDS) questionnaire was used, developed by the Food and Nutrition Technical Assistance Project (FANTA, 2006).[15] This instrument uses a food consumption recall method for the last 24 hours to identify the types of food consumed and assess the level of diversity of respondents' food intake. The assessment covers 7 food categories, namely cereals, nuts, animal products, eggs, dairy products and their derivatives, vegetables, and fruits that are sources of vitamin A, and other fruits and vegetables. Meanwhile, the instrument for measuring stunting incidence in children was body length-for-age (PB/U), obtained through child growth and development examinations conducted at the Community Health Center or Integrated Health Post, as shown in the KIA book. Univariate analysis used a frequency distribution table, and bivariate analysis used the Spearman rank correlation test to determine the strength of the relationship.

Results

Based on the study conducted among 105 respondents, the results are presented in **Table 1**. Based on **Table 1**, most of the subjects were in the 12-24 months age group (68 respondents, 64.7%), and 53 respondents (50.5%) were male. For maternal characteristics, the majority of mothers were aged 20-35 years, as many as 84 respondents (80%), with the majority of respondents working as housewives as many as 88 (83.8%), and the mother's last education was mostly senior high school as many as 49 respondents (46.7%).

Table 1. General characteristics of respondents

Characteristics	Frequency (n) = 105	Percentage (%)
Child's age (Months)		
6-8	11	10.5
9-11	26	24.8
12-24	68	64.8
Sex		
Male	53	50.5
Female	52	49.5
Mother's age		
<20 years	0	0
20-35 years	84	80
>35 years	21	20
Mother's occupation		
Housewife	88	83.8

Characteristics	Frequency (n) = 105	Percentage (%)
Employee	10	9.5
Self-employed	7	6.7
Mother's Education		
Elementary school	0	0
Junior high school	11	10.5
Senior high school	49	46.7
Diploma/Bachelor's degree or higher	45	42.9

Table 2. Stunting incidents and complementary feeding practices

Category	Frequency (n) = 105	Percentage (%)
Stunting status		
Length-for-Age (LAZ)		
Severely stunted	6	5.7
Stunted	43	41
Normal	55	52.3
Tall	1	1
Stunting classification		
Not stunted	56	53.3
Stunted	49	46.7
Complementary feeding practices		
Age at first introduction		
< 6 months	9	8.6
≥ 6 months	96	91.4
Texture		
Inappropriate	4	3.8
Appropriate	101	96.2
Feeding frequency		
Inappropriate	58	55.2
Appropriate	47	44.8
Portion size		
Inappropriate	70	66.7
Appropriate	35	33.3
Dietary diversity		
Low (≤ 3)	17	16.2
Moderate (4-5)	50	47.6
High (≥ 6-7)	38	36.2

Based on **Table 2** above, among the PB/U, 55 respondents (52.4%) are in the normal group, and, based on stunting incidence, 49 respondents (46.7%) are categorized as stunting. In the practice of providing complementary feeding to children aged 6-24 months based on the age of the first time providing complementary feeding as many as 96 respondents (91.4%) were given at the age of ≥6 months, the texture of providing complementary feeding as many as 101 respondents (96.2%) received food textures appropriate to their age, the frequency of providing complementary feeding that is not appropriate for their age is 58 respondents (55.2%), the portion of providing complementary feeding that is not appropriate for their age is 70 respondents (66.7%). Based on the diversity of complementary feeding, the moderate group has the largest number, namely 50 respondents (47.6%).

Table 3. Association between complementary feeding practices and stunting

	Stunting Classification				Total		p-value	r
	Not Stunted		Stunted					
	n	%	n	%	n	%		
Age at first introduction of complementary feeding								
Inappropriate	4	44,4	5	55,6	9	100		
Appropriate	52	54,2	44	45,8	96	100	0,580	-0,055
Texture of complementary feeding								
Inappropriate	0	0,0	4	100	4	100		
Appropriate	56	55,5	45	44,5	101	100	0.029	-0.213
Portion size of complementary feeding								
Inappropriate	25	35,7	45	64,3	70	100		
Appropriate	31	88,6	4	11,4	35	100	0.000	-0.499
Feeding frequency of complementary feeding								
Inappropriate	20	34,5	38	65,5	58	100		
Appropriate	36	76,6	11	23,4	47	100	0.000	-0.420
Dietary diversity of complementary feeding								
Low	0	0	17	100	17	100		
Moderate	19	38	31	62	50	100	0.000	-0.715
High	37	97,4	1	2,6	38	100		

Based on **Table 3**, 5 respondents (55.6%) experienced stunting when complementary feeding was not provided at the appropriate time (<6 months). After statistical analysis using the Spearman rank test, a p-value of 0.580 (p>0.05) and a correlation coefficient of r = -0.055 were obtained. These results indicate no relationship between the age at which complementary feeding was first given and the incidence of stunting.

Four respondents (100%) experienced stunting when the texture of complementary feeding was inappropriate for their age. After analysis using the Spearman test, a p-value of 0.029 (p<0.05) and a correlation coefficient of r = -0.213 were obtained. These results indicate a significant relationship between the texture of complementary feeding and the incidence of stunting. A negative relationship means that when one variable increases, the other variable tends to decrease. This means that the more appropriate the texture of complementary feeding given to the child's age stage, the lower the incidence of stunting tends to be.

Forty-five respondents (64.3%) reported stunting in children whose complementary feeding portions were not age-appropriate. After analysis using the Spearman test, a p-value of 0.000 (p<0.05) and a correlation coefficient of r = -0.499 were obtained. These results indicate a significant relationship between the portion of complementary feeding provided and the incidence of stunting. The correlation is moderate, meaning that the more appropriate or sufficient the complementary feeding, the lower the incidence of stunting.

Thirty-eight respondents (65.5%) reported stunting in children whose complementary feeding frequency was not age-appropriate. After analysis using the Spearman test, a significance value of p = 0.000 (p <0.05) and a correlation coefficient of r = -0.420 were obtained. These results indicate a significant relationship between the frequency of complementary feeding and the incidence of stunting. The correlation value for the

negative relationship is moderate, indicating that the more appropriate or frequent the provision of complementary feeding is to the child's age needs, the lower the incidence of stunting tends to be.

Lastly, 17 respondents (100%) in the low group experienced stunting and used a variety of complementary feeding supplements. After analysis using the Spearman test, a p-value of 0.000 ($p<0.05$) and a correlation coefficient of $r = -0.715$ were obtained. These results indicate a significant relationship between the diversity of complementary feeding and the incidence of stunting. The correlation value of the negative relationship is very strong. The direction of the negative correlation indicates that the higher the level of food diversity consumed by children, the lower the incidence of stunting tends to be.

Discussion

Stunting

Table 2 shows that 56 children aged 6-24 months (the majority) did not experience stunting. However, stunting among children aged 6-24 months was quite high, with 49 respondents (46.7%). This finding aligns with research by Ayuningtyas[16] (2022), which found that 81.9% of children did not experience stunting, while the remaining 18.1% did. Stunting is a form of chronic malnutrition influenced by various factors and can persist across generations. Stunting is caused by two factors: direct and indirect.[17,18] Direct factors that influence stunting include nutritional intake and infectious diseases such as worms, acute respiratory infections (ARI), and diarrhea. Indirect factors include family food availability, parenting patterns, environmental sanitation, and health services.[19,20] These indirect factors impact nutritional intake and the health status of mothers and children. Interventions aimed at addressing these indirect factors are expected to prevent nutritional problems.[21]

Stunting, also known as chronic malnutrition, occurs when a child experiences stunted growth, resulting in a height that is not appropriate for their age. Stunting not only affects physical development but also has long-term impacts on cognitive function, learning ability, and productivity levels in adulthood.[22,23] In Indonesia, short stature in children is often considered hereditary. This misperception is one of the obstacles to efforts to reduce stunting rates.[24]

Association between complementary feeding practices and stunting

This study aimed to analyze the relationship between complementary feeding practices and stunting in children aged 6-24 months in Banda Aceh, Indonesia. The results showed a correlation between complementary feeding texture, portion size, frequency, and variety, and stunting. However, the age at which complementary feeding was first introduced was not significantly associated with age at weaning.

The statistical test results showed a p-value of 0.580 ($p>0.05$) and an r-value of -0.055, indicating no relationship between the age of first introduction of complementary foods and the incidence of stunting in children aged 6-24 months. This indicates that providing complementary foods early (<6 months) or on time (≥6 months) does not significantly affect the incidence of stunting in the respondents of this study. However, children who received complementary foods too early had a higher stunting rate (55.6%) than those

given complementary foods according to age (45.8%). This indicates a tendency that providing complementary foods too early can increase the risk of stunting.

Physiologically, children who are given complementary foods before 6 months of age tend to have immature digestive systems, which can make them unable to digest foods other than breast milk properly. This is due to immature digestive enzymes, increased intestinal permeability, and suboptimal immune function of the gastrointestinal mucosa. Introducing complementary foods too early can impair nutrient absorption, increase the risk of diarrhea and gastrointestinal infections, and reduce immunity, all of which can affect a child's growth and development.[25,26,27]

This finding is consistent with Wangiyana's[28] (2020) research, which found that the age at which complementary foods were introduced was unrelated to stunting (p=0.854). However, this result differs from research by Himawati et al.[29] (2022), which showed that the time of first introduction of complementary foods was related to the incidence of stunting (p=0.012). These differences in results may be due to several factors. First, the difference in sample size: this study included 105 respondents, while Himawati's included 52. This study's larger sample size allows for more representative results. Second, differences in statistical analysis methods: this study used the Spearman rank test to assess the strength of the relationship, while Himawati's study used the chi-square test, which only assesses the presence or absence of a relationship. Third, differences in research locations: this study was conducted in an urban area that provides more adequate access to health and education services than rural areas.

Furthermore, the results showed that food texture, portion, frequency, and diversity were more strongly related than the age at which complementary feeding was first introduced. This suggests that the adequacy and quality of nutrient intake after the introduction of complementary feeding are more important in determining a child's growth and development. Research by Hasanah et al.[30] (2020) explains that the incidence of stunting is a multifactorial condition; apart from the age of giving complementary feeding, other factors such as the quality and diversity of food, frequency of giving, maternal nutritional status, and the family's socio-economic conditions also play a role in increasing the risk of stunting.

This study found a significant correlation between the texture of complementary foods and stunting (p=0.029 and r=-0.213). The negative correlation indicates that the more inappropriate the texture of the food given to the child's age, the higher the risk of stunting. A child's digestive abilities develop along with their age. Children who are frequently given complementary foods with a texture that is too runny have a higher risk of experiencing energy and protein deficiencies due to the low nutrient density in each serving. Providing complementary foods with an appropriate texture not only ensures that nutritional needs are met but also plays a role in stimulating the development of a child's eating skills, such as oral motor coordination, chewing ability, and the gradual swallowing process.[25,31]

Furthermore, this study showed a significant relationship between complementary feeding portions and stunting (p=0.000, r=-0.499). The negative correlation value indicates that the more inappropriate the portion of food given to a child, the greater the risk of stunting. Inappropriate or insufficient food portions can lead to chronic energy and protein deficiencies, which hinder a child's growth. Conversely, portions appropriate to a child's age and needs will help ensure adequate intake of macronutrients (carbohydrates, protein, fat) and micronutrients (Fe, Zinc, vitamin A, and other minerals), thereby supporting optimal growth and physical development.[32,33] These results align with

Wahyuni's[34] (2023) study, which found a relationship between adequate complementary feeding and stunting status, with a p-value of 0.037.

This study also found that the frequency of complementary feeding was significantly associated with stunting (p=0.000, r=-0.420). The negative correlation value indicates that the more irregular the frequency of complementary feeding, the higher the risk of stunting. Children who receive complementary feeding less frequently than recommended are at risk of experiencing a chronic energy deficit that can inhibit child growth, which can lead to chronic malnutrition, which is at high risk of stunting.[35] These results also align with Wangiyana's[28] (2020) research, which found a significant relationship between the frequency of complementary feeding and the incidence of stunting, with a p-value of 0.047.

The frequency of giving complementary food should be adjusted to the growth and development stages of children aged 6-24 months, namely, 6-8 months receive complementary food 2-3 times a day, 9-11 months and 12-24 months receive complementary food 3-4 times a day, each age group is given additional snacks or nutritious snacks 1-2 times a day.[31] The frequency of complementary food for children should be as often as possible because children can only consume food little by little, while their energy and nutritional needs must still be met. A sufficient, or even optimal, frequency of providing complementary foods will help ensure adequate energy, protein, and important micronutrient intake, in line with the physiological needs of children at each stage of their development.[35,36]

The variable with the strongest relationship with stunting in this study was complementary foods diversity (p=0.000, r=-0.715). The strong negative correlation indicates that the greater the diversity of the food provided, the lower the risk of stunting in children. Children who receive only monotonous or carbohydrate-rich foods are at increased risk of micronutrient deficiencies, which can inhibit growth hormone synthesis and tissue formation, thereby increasing the risk of stunting.[37] According to the WHO, complementary feeding diversity is defined as the variety of foods provided to children aged 6-24 months, consisting of staple foods, side dishes, vegetables, and fruits. This variety of foods is measured by the number of food groups consumed by children over 24 hours.[25,33] World health organization (WHO) recommends that children consume at least 4 types of foods from 7 food categories: cereals, nuts, animal products, eggs, dairy products and their derivatives, vegetables, and other fruits and vegetables, which are sources of vitamin A. Providing a variety of foods is highly effective in overcoming malnutrition in children.[33,38]

These results align with research by Prasetyo et al.[39] (2023) in Batur Village, which found a significant relationship between dietary diversity and nutritional status (height/age), with a p-value of <0.001 and a correlation coefficient of r=0.618. This finding aligns with research in Indonesia (based on data from the 2014-2015 Indonesia Family Life Survey), which showed that dietary diversity is significantly associated with stunting. The types of food significantly associated with stunting are meat, eggs, milk, and dairy products, as well as vegetables and fruit as sources of vitamin A.[40]

The diversity of food as a dominant factor in preventing stunting in this study is also relevant to local conditions in Banda Aceh, a coastal area with abundant availability of animal food sources, especially sea fish such as tuna, mackerel, and tuna, which contain high protein sources and important micronutrients such as iron, zinc, and omega-3. In addition, the community has access to other foods, such as eggs, chicken, beef, nuts, vegetables, and local fruits, that support children's nutritional needs. The availability of

diverse food sources theoretically provides families with a high opportunity to prepare balanced, nutritious meals for children.[41,42]

However, the results of this study indicate that although local food sources are available, the diversity of food provided to children is not optimal. This indicates that the problem of stunting in this region is not caused by limited access to food but is influenced by factors such as mothers' levels of education and knowledge, maternal occupation, economic conditions, and socio-cultural values. Mothers with higher education and adequate nutritional knowledge tend to understand the importance of food variety and can adjust their macro- and micronutrient intake to meet their needs properly.[43,44] Economic limitations and low levels of education often lead to monotonous, unvaried complementary feeding, which can lead to deficiencies in essential nutrients and increase the risk of stunting. In addition, maternal occupation can affect the time and attention devoted to preparing food. At the same time, cultural habits and family traditions passed down from generation to generation can limit the variety of food ingredients provided.[45,46] This condition shows that the availability of food sources alone is not enough to prevent stunting without the practice of providing a diverse, nutritionally balanced diet.

Thus, the results of this study indicate that stunting prevention efforts in Banda Aceh need to focus on increasing the diversity of food provided to children by utilizing available local food sources and educating mothers and families about the importance of providing a diverse and nutritionally balanced diet to support child growth and prevent the risk of stunting.

This study has limitations because dietary diversity was assessed using the IDDS score, which relies on interviews with mothers/guardians and may be subject to recall bias. Furthermore, the questionnaire counted only the number of food groups consumed, without considering portion sizes. Therefore, it is possible that subjects consumed a diverse diet, but not in sufficient quantities.

Conclusion

Based on the research results, it can be concluded that there is a relationship between the texture, portion, frequency, and diversity of complementary feeding and the incidence of stunting among children aged 6-24 months in Banda Aceh, Indonesia. However, the age at which complementary feeding was first introduced was not associated with stunting. Future studies are recommended to include socioeconomic factors and maternal characteristics, and to analyse energy intake, to provide a more comprehensive understanding of stunting determinants.

Conflict of interest

The authors declared no conflict of interest regarding this article.

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Author Contributions

NM: contributed to conceptualization, study design, data collection, formal analysis, interpretation of the findings, and drafting of the manuscript. MS: contributed to supervision, and methodological guidance. HN: contributed to validation of the data, interpretation of the findings, and critical revision of the manuscript for important intellectual content. BT: contributed to academic supervision and substantial revision of the manuscript. DA: contributed to methodological support, critical review, and final approval of the manuscript for publication. All authors have read and approved the final version of the manuscript.

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