

# The Effect of Feeding Patterns and History of Infectious Diseases on the Incidence of Stunting in Children Under Five in the Province of East Nusa Tenggara

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## Abstract

**Background:** The prevalence of stunting of children under five years old (toddlers) in East Nusa Tenggara (NTT) reached 40.3 percent, the highest when compared to other provinces in Indonesia. This figure is above the National stunting prevalence of 29.6 percent. The prevalence of stunting in NTT consists of infants with a very short category of 18 percent and a short category of 22.3 percent. The purpose of the study was to analyze the influence of feeding patterns and a history of infectious diseases on stunting.

**Method:** This type of research is quantitative with a case-control study design, located in Kupang Regency and South Central Timor Regency in 2020. The sample of this study was 150 children under five consisting of 75 children under five who were stunted and 75 children under five were not stunted as a control and a simple random sample development technique. The method of collecting data is through measuring the height and weight of children under five and conducting interviews with parents of toddlers using a questionnaire and analyzing it by Chi-Square.

**Results and Conclusion:** The results showed that there was an influence of food feeding patterns (pattern of menu preparation, food processing, food presentation, and how to feed) and a history of infectious diseases (Ari and diarrhea) on the incidence of Stunting in children under five in East Nusa Tenggara province.

**Keywords:** feeding, infectious diseases, stunting

## 1. Introduction

Stunting is a condition of failure to grow in children under five years old (for infants under five years old) due to chronic malnutrition so that children are too short for their age. Malnutrition occurs since the baby is in the womb and in the early days after the baby is born, however, the Stunting condition appears only after the baby is 2 years old. Stunting experienced by children can be caused by lack of attention in the first 1000 days of the baby's life, which determines the level of physical growth, intelligence, and productivity of a person in the future, it is emphasized that since the time of the conference pregnant women need to get supervision, especially related to nutrition where pregnant women need to get adequate nutrition so that the baby is not born stunted. During this period, the nutrients received by the baby while in the womb and receiving breast milk have a long-term impact on life as an adult. The incidence of stunting (short) toddlers is a major nutritional problem faced by Indonesia. Based on nutritional Status monitoring (PSG) data over the past three years, Short has the highest prevalence compared to other nutritional problems such as undernourished, underweight, and obesity. The prevalence of short toddlers increased from 2016, which was 27.5% to 29.6% in 2017.

The prevalence of short toddlers in Indonesia tends to be static. The results of Basic Health Research (Riskesdas) in 2007 showed the prevalence of short toddlers in Indonesia at 36.8%. In 2010, there was a slight decrease to 35.6%. However, the prevalence of short toddlers again increased in 2013 to 37.2%. The prevalence of short toddlers will then be obtained from the results of Riskesdas in 2018 which is also a measure of the success of programs that have been pursued by the Government (Ministry of Health, 2018)

East Nusa Tenggara province stunted children as many as 319,100 children (Riskesdas, 2013). Although the prevalence of stunting in NTT in 2018 (Basic Health Research) showed a decrease of 30.8 percent, NTT province (East Nusa Tenggara) too has a high percentage of stunting toddlers at 42.6 percent. The prevalence of stunting of

children under five years old (toddlers) in East Nusa Tenggara (NTT) reached 40.3 percent, the highest when compared to other provinces in Indonesia. This figure is above the National stunting prevalence of 29.6 percent. The prevalence of stunting in NTT consists of infants with a very short category (if less than minus 3 standard deviation) of 18 percent and short less than minus 2 to minus 3 standard deviation) of 22.3 percent.

The nutritional Status of toddlers is one of the indicators that describe the level of public welfare. One way of assessing the nutritional status of toddlers is by anthropometry using an age-based Weight Index (BB/U). The categories used were overweight (Z-score  $> +2$  SD); Good nutrition (z-score-2 SD to  $+2$  SD); Malnutrition (z-score  $< -2$  SD to  $-3$  SD); Malnutrition (z-score  $< -3$  SD).

Kupang regency is one of the districts in East Nusa Tenggara province, the number of children who experience smallness is 4750 children from 31,000 ballista children spread across 83 villages. Efforts to monitor the growth of toddlers are carried out through weighing activities in Posyandu regularly every month. The report of Puskesmas in Kupang regency in 2014 shows that the coverage of toddlers weighed as many as 31,223 toddlers, toddlers with more nutrition as many as 238 toddlers, toddlers with good nutrition as many as 23,367 toddlers, toddlers with less nutrition as many as 1,739 toddlers and toddlers poor nutrition as many as 212 toddlers (Kupang Health Office, 2014). Data from January-August 2019 showed that from 4,750 children under five in Kupang regency the highest number of stunting was in Kupang Tengah district, Noelbaki village as many as 78 people, Oelpua village 55 people, east Penguin 41 people, Oelmasi 41 people, Tanah Merah 34 people, Oebelo village 10 people and Tarus 2 people. The problem of malnutrition in toddlers in South Central Timor Regency in 2015 was 35.5%, of which the highest coverage of malnutrition was in Oinlasi Health Center with as many as 70 cases, Nulle Health Center with as many as 66 cases, and City Health Center as many as 39 cases. Nutritional Status of toddlers from 2015.

Some of the factors that cause stunting can be described as follows: 1). Poor parenting practices, including the mother's lack of knowledge about health and nutrition before and during pregnancy, as well as after the mother gives birth. Some facts and Information show that 60% of children aged 0-6 months do not receive breast milk exclusively, and 2 out of 3 children aged 0-24 months do not receive complimentary foods breast milk (MP-ASI). MP-ASI is given/started to be introduced when the toddler is over 6 months old. In addition to serving to introduce new types of food to infants, solid foods can also meet the nutritional needs of the baby's body that can no longer be supported by breast milk, as well as forming the immune system and the development of the child's immunological system to food and drink. 2). There are still limited health services including ANC-ante Natal Care services (health services for mothers during pregnancy) Natal Care and quality early learning. Stunting is caused by multidimensional factors, including poor nutritional parenting practices, and a lack of maternal knowledge about health and nutrition before and during pregnancy and after childbirth (Ramayulis, 2018). In addition, stunting is also influenced by various other factors including infectious diseases such as respiratory tract infections, diarrhea, and intestinal worm infections in children.

The purpose of this study was to analyze the influence of feeding patterns and history of Infectious Diseases on the incidence of stunting in children under five in East Nusa Tenggara province.

## 2. Method

This type of research is with quantitative approach and *Case-control study design*. This study was conducted in two districts, namely the Kupang regency and South Central Timor Regency in 2020. This sample size uses the following formula:

$$n = \frac{\left\{ Z_{1-\alpha/2} \sqrt{2P_2^*(1-P_2^*)} + Z_1 - \beta \sqrt{P_1^*(1-P_1^*) + P_2^*(1-P_2^*)} \right\}^2}{(P_1^* - P_2^*)^2}$$

Description:

Level of significance ( $\alpha$ ) : 5%

Power of the test ( $1-\beta$ ) : 90%

Odds Ratio: 4,643 (Khoirun, et all, 2015)

Anticipated probability of exposure given disease ( $P_1$ ):0, 88 (Khoirun, et all 2015)

Anticipated probability of exposure given no disease ( $P_2$ ): 0,61 (Khoirun, et all 2015)

Sample Size (n): 74

So n needed: 75

The large sample of this study 150 children under five consisted of 75 case samples and 75 control children under five and how to take samples with a simple random sampling technique. The independent variables of this study were the pattern of feeding (menu preparation, food processing, food presentation, and how to feed) and the history of infectious diseases, and the dependent variable was the incidence of stunting. The method of data collection was carried out by weight and height measurement, stunting determination, and interviews with parents of toddlers about feeding patterns and infectious disease history using questionnaires and analyzed using Chi-Square.

### 2.1 Research Ethics

Informed Consent is a form of approval sheet between the researcher and the research respondent (parents of toddlers) by providing an approval sheet, without a name (Anonymity) is a guarantee in the use of the research subject by not giving or including the name of the respondent on the observation sheet/questionnaire and only writing the code on the data collection sheet or the Confidentiality is an ethical issue by providing a guarantee of confidentiality of research results, both information, and other issues.

## 3. Results

### 3.1 The Effect of Feeding Patterns on Stunting There are Children Under Five

#### 3.1.1 Effect of Menu Arrangement Patterns

Table 1. Effect of food menu delivery pattern

	Menu Delivery Stunting Status Amount		P Value	OR	95% CI	
	Stunting	Normal			Low	Upper
Not Good	52(69,3%)	40(53,3%)	0,044	1,978	1,014	3,860
Good	23(30,7%)	35(46,7%)				
Total	75(100%)	75(100,%)				

Table 1 above shows the influence of the pattern of preparation of food menu to children on stunting, statistical test results show p value  $0.044 < \alpha 0.05$  then there is a pattern of preparation of food menu on stunting in children under five. The value of OR 1.978 indicates the pattern of preparation of the food menu is less good and will risk children to be stunting 1.978 times compared to children who obtain a pattern of preparation of a good food menu.

#### 3.1.2 Influence of Food Processing Patterns

Table 2. Effect of food processing patterns

Processing	Stunting Status		Amount	P Value	OR	95% CI	
	Stunting	Normal				Low	Upper
Not good	53(70,7%)	41(54,7%)	94(62,7%)	0,043	1,998	1,019	3,918
Good	22(29,3%)	34(45,3%)	56(37,3%)				
Total	75(100%)	75(100,%)	150(100%)				

Table 2 above shows the influence of food processing patterns on the incidence of stunting in children under five, the results of the statistical test p value  $0.043 < \alpha 0.05$  then there is the influence of food processing patterns on the incidence of stunting significantly on the incidence of stunting in children under five. The or value of 1.998 indicates that poor food processing patterns will risk children being stunted 1.998 times compared with good food processing patterns.

### 3.1.3 Influence of Food Presentation Patterns

Table 3. Effect of food serving patterns

Presentation	Stunting Status		Amount	P Value	OR	95% CI	
	Stunting	Normal				Low	Upper
Not good	44(58,7%)	28(37,3%)	72(48,0%)	0,009	2,382	1,237	4,591
Good	22(29,3%)	34(45,3%)	56(37,3%)				
Total	75(100%)	75(100,%)	150(100%)				

Table 3 above shows the influence of food presentation patterns on children, the results of statistical tests p value  $0.009 < 0.05$ , there is an influence of food presentation patterns significantly on the incidence of stunting in children under five. The value of OR 2.382 indicates that if the pattern of food presentation to children is not good, the risk of children becoming stunted as 2.382 times compared to the pattern of good food presentation.

### 3.1.4 Effect of Feeding Pattern

Table 4. Effect of feeding patterns

Giving	Stunting Status		Amount	P Value	OR	95% CI	
	Stunting	Normal				Low	Upper
Not good	48(64,0%)	35(46,7%)	83(55,3%)	0,033	2,032	1,056	3,909
Good	27(36,0%)	40(53,3%)	67(44,7%)				
Total	75(100%)	75(100,%)	150(100%)				

Table 4 above shows the effect of the pattern of feeding children, the results of the statistical test p value  $0.033 < 0.05$ , there is a significant influence of the pattern of feeding children on the incidence of stunting in children under five. The OR value of 2.032 indicates that if the pattern of feeding children is not good, the child will be at risk of becoming stunted 2,032 times compared to the pattern of giving good food to children.

## 3.2 Influence of Infectious Disease History on Stunting in Children Under Five

### 3.2.1 Influence of History of Acute Respiratory Infections (Ari)

Table 5. Risk history of Ari disease

ARI history	Stunting Status		Amount	P Value	OR	95% CI	
	Stunting	Normal				Low	Upper
Yes	62(82,7%)	47(62,7%)	109(72,7%)	0,006	2,841	1,330	6,071
No	13(17,3%)	28(37,3%)	41(27,3%)				
Total	75(100%)	75(100,%)	150(100%)				

Table 5 above shows the influence of the history of ARI on the incidence of stunting in children under five p value  $0.006 < 0.05$  then there is a significant influence of Ari on the incidence of stunting in children under five. An OR value of 2,841 indicates that children with a history of ARI disease will be stunted 2,841 times compared to children who do not have a history of ARI disease

### 3.2.2 Effect of Diarrheal Disease History

Table 6. Effect of diarrheal disease history

	History of Diarrhea Stunting Status		Amount	P Value	OR	95% CI	
	Stunting	Normal				Low	Upper
Yes	41(54,7%)	23(30,7%)	64(42,7%)	0,003	2,726	1,396	5,323
No	34(45,3%)	52(69,3%)	86(57,3%)				
Total	75(100%)	75(100,%)	150(100%)				

Table 6 above shows the effect of diarrheal disease history on stunting incidence in children under five, the results of the statistical test  $p$  value  $0.003 < \alpha 0.05$  then there is a significant effect of diarrheal disease history on stunting incidence in children under five. The value of OR 2.726 indicates that if there is a history of diarrheal disease, the child will experience stunting 2.726 times compared to children who do not have a history of diarrheal disease.

## 4. Discussion

Stunting is a condition of failure to grow in children under five years old (for infants under five years old) due to chronic malnutrition so that children are too short for their age. Malnutrition occurs since the baby is in the womb and in the early days after the baby is born, however, the Stunting condition appears only after the baby is 2 years old. The incidence of stunting (short) toddlers is a major nutritional problem faced by Indonesia. Based on nutritional Status monitoring (PSG) data over the past three years, Short has the highest prevalence compared to other nutritional problems such as undernourished, underweight, and obesity. The prevalence of short toddlers increased from 2016, which was 27.5% to 29.6% in 2017.

Stunting is a height that is less according to age ( $< -2SD$ ), characterized by the slow growth of children failing to achieve a normal and healthy height according to the age of the child. Stunting is chronic malnutrition or growth failure in the past and is used as a long-term indicator of malnutrition in children. Stunting can be diagnosed through an anthropometric index of height according to age that reflects the linear growth achieved in pre-and post-natal with indications of long-term malnutrition, resulting from inadequate nutrition and or health. Stunting is linear growth that fails to reach its genetic potential as a result of poor diet and disease. Stunting that occurs in childhood is a risk factor for increased mortality, cognitive abilities and low motor development, and unbalanced body functions.

Three main factors cause Stunting, namely unbalanced food intake (related to the content of nutrients in food, namely carbohydrates, proteins, fats, minerals, vitamins, and water), a history of low birth weight (lbw), a history of illness, poor parenting practices, including lack of maternal knowledge about health and nutrition before and during pregnancy, as well as after the mother gave birth. giving breast milk (ASI) exclusively, not receiving complementary foods breast milk (MP-ASI). In addition, it should pay attention to the pattern of feeding including the pattern of menu preparation, processing, presentation, and how to give. Preparation of balanced menu according to Rizqie Auliana (1999: 64). it is necessary to observe the following principles: quality and quantity of necessary nutrients are sufficient in the menu. In terms of quality, the menu must meet 4 healthy 5 perfect. Meanwhile, in terms of quantity, the menu must be appropriate for the age, gender, and activity of family members. b dishes should be able to be enjoyed and satisfy the tastes of all family members. c can give a feeling of satiety. d must be affordable by the financial circumstances of the family. e does not contradict socio-cultural requirements. 34 f adapted to local food availability. In addition to the things mentioned above, the principle of preparing the menu should also pay attention to the availability of the necessary tools and also human ability to process food. Menu planning is a series of plans to achieve the objectives of the organization of food to be served by taking into account various aspects, such as nutritional needs, Planning material needs, availability of materials to be used, ordering materials, processing of food ingredients, distribution of food to consumers, and estimated consumer acceptance of the composition of the menu to be presented.

Food processing is the process of processing food and beverages derived from plant or animal raw materials into products that can be consumed. The changed raw materials can be grains, meat, and milk. The process of food processing is different, depending on what the final purpose of the food will be. Such as vegetables that are frozen, wheat that is ground to produce flour, potatoes that are fried to serve as chips, and animals that are slaughtered for

meat. (Winarsi, 2016) to produce delicious food, required stages and processes to process raw materials to be ready for consumption. The stage starts with the process of preparation of raw materials, processing, then serving. After processing, the food is served in such a way as to cause appetite to eat. The presentation of food is tailored to the wishes and needs. The most common food processing technique is processing by utilizing heat. The technique has existed since 1830. The person who introduced the technique was named Nicholas Appert. In the past, Nicholas Appert faced a challenge in a food preservation competition during the war between France and England. French troops took more casualties, due to a lack of food. Nicholas also experimented with how to heat canned food, which led him to victory in the race. The technique developed until it became a technology in the development of packaged food preservation. Based on his theory, microbes like wet foods such as chicken, meat, eggs, and milk. In point of fact, the food is high in nutrition. Nicholas found a loophole, that microbes can not live in an extreme environment. With high temperatures, heating is considered effective for preserving such food. (Rezkisari Indira, 2017)

The presentation of food should be carried out according to the type of food. Hot food should be placed in a container suitable for hot food, as well as for cold food. Food that is processed immediately, should also be served immediately after processing, especially for foods that must be served hot. Food that is ready to be cooked must be placed in a food heater so that the heat remains durable until served. Serve food covered for hot food.

While cold food should be stored in a refrigerated chamber before D. present. Cold food also does not need to be covered around the serving place not far from the place of processing. Food presentation techniques are how to make the food served to appear uniform and look attractive. Food arrangement can be done by adjusting the composition of the shape, texture, and color. Hygiene and the way of controlling food before serving can affect the health of the person who will consume it. Food contaminated by bacteria or harmful ingredients can cause poisoning and disease. Hazards caused by errors in food control there are three types biological hazards, chemical hazards, and physical hazards. Biological hazards include bacterial and parasitic contamination that can cause disease. This pollution can be caused by air, soil, and water or small animals in a dirty environment. How to provide healthy food for children from childhood is very good for growth and development. Not only makes optimal growth, but the risk of children developing chronic diseases when adults can also decrease.

The results showed that there was an influence of feeding patterns on the incidence of stunting in children under five in East Nusa Tenggara province. Feeding patterns include patterns of menu preparation, food processing patterns, food presentation patterns, and patterns of how to give food to children under five. The effect of the pattern of preparation of food menu to children on stunting, the results of statistical tests show  $p$  value  $0.044 < \alpha$  0.05 then there is a pattern of preparation of food menu on stunting in children under five. Value or 1.978 shows the pattern of preparation poor diet will risk children stunting 1,978 times. The effect of food processing patterns on the incidence of stunting in children under five, the results of the statistical test  $p$  value  $0.043 < \alpha$  0.05 then there is the influence of food processing patterns on the incidence of stunting significantly on the incidence of stunting in children under five. The or value of 1.998 indicates that poor food processing patterns will risk children becoming stunted 1.998 times. effect of food presentation patterns to children, the results of statistical tests  $p$  value  $0.009 < \alpha$  0.05 then there is the influence of food presentation patterns significantly to the incidence of stunting in children under five. The value of OR 2.382 indicates if the pattern of food presentation to children is not good, it will risk the child being stunted 2.382 times. The effect of the pattern of feeding to children, the results of the statistical test  $p$  value  $0.033 < \alpha$  0.05 then there is an influence of the pattern of feeding to children significantly on the incidence of stunting in children under five. The value of OR 2.032 indicates that if the pattern of feeding children is not good, the risk of children becoming stunted is 2.032 times compared to the pattern of feeding children. The results of this study are not much different from the research of Dayuningsi et al where the risk of stunting in toddlers is the most dominant parenting pattern of feeding ( $p$  value= 0.000; odds ratio= 6.496; 95% CI= 2.486-16.974) (Dayuningsi, 2020).

History of infectious diseases affects the incidence of stunting under five, the results showed the influence of the history of Ari disease on the incidence of stunting in children under five  $p$  value  $0.006 < \alpha$  0.05 then there is a significant influence of Ari disease history on the incidence of stunting in children under five. The value of or 2,841 indicates that if there is a history of Ari disease, the child will experience stunting 2,841 times. The results of the study are not much different from the study Subroto Tiro, where the incidence of infection in children aged 12-59 was as many as 65 respondents (31.9%) not as many as 139 respondents (68.1%). In the incidence of stunting, as many as 102 respondents (50%) did not stunt as many as 102 respondents (50%).  $P$ -Value = 0.000 so that the  $P$ -Value is  $< \alpha$  (0.000<0.05), so that there is a relationship between the history of infectious diseases and the incidence of stunting in children aged 12-59 months in the Working Area of the Rama Indra Health Center (Subroto Tiro et al., 2021). Research by Nabuasa et al., (2013) shows that there is a relationship between infectious

diseases with the incidence of stunting.

The effect of diarrheal disease history on stunting incidence in children under five, the results of statistical test  $p$  value  $0.003 < UTC 0.05$  then there is a significant effect of diarrheal disease history on stunting incidence in children under five. The value of OR 2.726 indicates that if there is a history of diarrheal disease, the child will experience stunting 2.726 times. The results of this study are not much different from the study by Desyanti et al., (2017), where most of the children in the stunting group often have diarrhea (72.7%). There is a history of diarrheal disease relationship ( $p=0.025$ ,  $or=3.619$ ) that has a significant association with the incidence of stunting. History of other infectious diseases such as dental caries, based on research results by Rahman *et All* (2014) that there is a relationship between short nutritional status (stunting) with the level of dental caries ( $p = 0.000$ ) in kindergarten students in Kertak Hanyar District, Banjar Regency.

## 5. Conclusion

- 1) There is an influence of feeding patterns (menu preparation patterns, food processing patterns, food presentation patterns, and feeding patterns) on the incidence of stunting in children under five in East Nusa Tenggara province
- 2) There is an influence of a history of infectious diseases (Ari and diarrhea) on the incidence of stunting in children under five in East Nusa Tenggara province

## 6. Recommendations

- 1) The government through the Health Office and Puskesmas should periodically conduct preventive effort campaigns to prevent the occurrence of acute respiratory infections
- 2) The government through related agencies (health and social) provides training to the community regarding the processing of local food that is rich in nutrients as an additional food source to overcome the problem of stunting
- 3) Families (parents) try to change adequate feeding patterns so that children get sufficient food intake to prevent stunting in children under five.

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## Competing Interests Statement

The authors declare that there are no competing or potential conflicts of interest.

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