



# Determinants of stunting in children aged 6-24 months in rural areas: Case Control Study

## *Determinan faktor stunting anak usia 6-24 bulan di daerah perdesaan: Studi Kasus Kontrol*

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## Abstract

Inappropriate breastfeeding, complementary feeding and repeated infections are direct causes of stunting in children under two years of age. The objective of this research was to investigate the relationship between history of breastfeeding and history of infection with stunting in children living in rural areas who were between the ages of 6 and 24 months old. The research was conducted using a case control study, carried out in the working area of Puring Health Center in 2021 using a sample of 43 children aged 6-24 months taken by simple random sampling. The data were gathered through anthropometric measurements of child's body length and mother's height, questionnaire interviews for history of breastfeeding and infection, and the examination of Maternal and Child Health (MCH) book. The chi-square test and multiple logistic regression were utilized in the analysis that was carried out. The final results suggested that stunting was caused by gender ( $p=0,032$ ), mothers's height ( $p=0,032$ ), and food parenting pattern aged 6-8 months ( $p=0,026$ ). Food parenting pattern aged 6-8 months was the most dominant factor associated with stunting ( $p=0,026$  AOR 5,17 95% CI:1,22-21,95). In conclusion, gender, mother's height, and food parenting pattern aged 6-8 months were significantly associated with stunting.

**Keywords:** Food parenting patterns, gender, history of infection, mother's height, stunting

## Abstrak

Pemberian ASI dan makanan pendamping ASI (MP ASI) yang tidak sesuai serta terjadinya infeksi berulang merupakan faktor penyebab langsung kejadian stunting pada anak yang berusia di bawah dua tahun. Tujuan penelitian untuk mengukur hubungan pemberian ASI dan riwayat infeksi dengan stunting anak 6-24 bulan di wilayah perdesaan. Desain penelitian kasus kontrol ini telah dilakukan di wilayah kerja Puskesmas Puring tahun 2021 menggunakan sampel anak usia 6 – 24 bulan sebanyak 43 orang diambil secara *simple random sampling*. Pengukuran antropometri berupa panjang badan anak dan tinggi badan ibu, wawancara angket riwayat pemberian ASI dan riwayat infeksi, serta review catatan buku Kesehatan Ibu dan Anak (KIA) dilakukan dalam proses pengumpulan data. Uji chi-square dan regresi logistik berganda digunakan dalam analisis. Hasil akhir mengemukakan bahwa kejadian stunting disebabkan faktor jenis kelamin ( $p=0,032$ ), tinggi badan ibu ( $p=0,032$ ), dan pola asuh makanan antara usia 6 dan 8 bulan ( $p=0,026$ ). Pola asuh makan usia 6-8 bulan merupakan faktor paling dominan yang berhubungan dengan stunting ( $p=0,026$  AOR 5,17 95% CI:1,22-21,95).

**Kata Kunci:** Jenis kelamin, pola asuh makan, riwayat infeksi, stunting, tinggi badan ibu

## Introduction

An important period of growth and development for the child occurs in the first thousand days of his life, from conception to two years of age. This period has an impact on the physical development and cognition of the child (Purwanti, 2021). The growth and development of children become less optimal if nutritional factors are not fulfilled properly. One of the nutritional problems that is prone to occurring at that age is stunting, which is an indicator of chronic malnutrition. Stunting is important because it risks serious long-term impacts, such as productivity and economic problems. In addition, stunting is also associated with morbidity and mortality. The incidence of stunting is mostly found in children in developing countries (Ruaida, 2018).

Children who are stunted are more likely to experience physical and cognitive development disorders that have an impact on productivity in the future (Apriluana & Fikawati, 2018). A correlation has been found between stunting and a lack of learning achievement, characterized by a non-verbal IQ of <89 and a lower IQ of 4,57 than children who are not stunted (Daracantika et al., 2021). The increase in stunting incidence has also resulted in a 0,4% decrease in Gross Domestic Product (GDP) per capita and an average cost of 13,5% of GDP per capita for countries in developing regions (Mary, 2018).

Stunting among children under two years old in Indonesia reached 29,9% in 2018 (Kemenkes RI, 2018). This problem still continues, as evidenced by the results of the Indonesian Nutritional Status Survey (SSGI, 2021), Despite the drop, the prevalence of children under five years old is very low, and it still reached 27,67% in 2019 and 24,4% in 2021 (Kemenkes RI, 2019; Kemenkes RI, 2021). Because it is more than 20%, the prevalence is still relatively high for stunting problems (de Onis et al., 2019). In addition, the Global Hunger Index 2018 ranks Indonesia 73rd out of 118 countries (WFP, 2018). The prevalence of stunting among children under two years old in the Puring Health Center area of Kebumen Regency in 2020 was 27,9%. This figure shows that the problem of stunting needs attention.

One of the causes of stunting in children is exclusive breastfeeding for less than 6 months. One of the causes of stunting in children is exclusive breastfeeding for less than 6 months (Uwiringiyimana et al., 2019). Breast milk is the only food needed by children to meet their nutritional needs until the age of 6 months. However, Kebumen District Health Profile data shows that there are still 30,1% of children who do not get exclusive breastfeeding for 6 months (Dinkes Kabupaten Kebumen, 2019). Exclusive breastfeeding that is not given for 6 months and Early Breastfeeding Initiation (EBI) that is not done immediately after the child is born are associated with an increased risk of stunting (Dranesia et al., 2019; Gebreyohanes & Dessie, 2022). In addition, the timing and accuracy of complementary feeding (MP-ASI) are also important; giving before or exceeding the age of 6 months and poor quality of complementary foods are at risk of causing stunting (Titaley et al., 2019).

In addition, to intake factors, stunting occurs due to long-lasting and recurring factors such as infectious diseases (Beal et al., 2018). Diarrhea is an infectious disease caused by viruses and bacteria and is endemic in Indonesia. The proportion of diarrhea cases found by Puskesmas in Kebumen Regency in 2019 was 78,3%. Diarrhea is an infectious disease caused by viruses and bacteria and is endemic in Indonesia. The proportion of diarrhea cases found by the health center in Kebumen Regency in 2019 was 78,3% (Dinkes Kabupaten Kebumen, 2019). Its number is worth watching out for. The risk of stunting increases in children who have had diarrhea (Sartika et al., 2021a). Other studies have shown that, in addition to diarrhea, there is a relationship between the incidence of ARI and stunting (Ahmad et al., 2018). Reduced immunity due to inadequate nutrition makes children more susceptible to infectious diseases, whereas infection itself can decrease food intake and nutrient utilization, contributing to malnutrition.

Stunting can also be caused by a child's birth history (Boah et al., 2019). Preliminary findings from a study of 100 children conducted in Klaten Regency revealed a relationship between birth length and stunting

(Widyaningsih et al., 2018). Research (Sartika et al., 2021) revealed a higher risk of stunting in children who have low birth weight (Sartika et al., 2021). Low household socioeconomics, maternal height, and low maternal education all play a role in predicting whether a child is stunted or not (Beal et al., 2018). Another risk factor for stunting is the age of the mother at childbirth (Titaley et al., 2019).

The description above shows that children under the age of two are vulnerable to stunting due to malnutrition, infectious diseases, and long-lasting low socioeconomic conditions. Among these factors, exclusive breastfeeding coverage and the finding of infection cases are still problems. Based on the above problems, this study analyzes the relationship between breastfeeding history, infection history, child characteristics, family characteristics, maternal characteristics, and birth history with stunting in the Puring Health Center area

## Methods

The design used in this observational study was case-control. Stunting in children under the age of two was studied by comparing children in the case group with children in the control group. Children aged 6–24 months with a PB/U z-score of  $< -2SD$  were included in this study case group, as were children who were in the control group of the same age but had a PB/U z-score of  $> -2SD$ .

Research will be conducted in the Puring Health Center area of Kebumen Regency, Central Java, Indonesia, in 2021. Site selection in the Puring Health Center work area was carried out purposefully considering the high prevalence of children under the age of two who are stunted, which is 27,9%. The selection of village-level locations is done by simple random sampling. The sampling method uses a simple random sampling method from children under two years old in selected villages who took body length measurements in February 2021 at the Integrated Service Center (ISC). Body length measurements are performed by trained enumerators. The inclusion criteria were that toddlers lived in the sub-district, lived with their mothers, and were willing to be research examples for this study.

The case-to-control ratio is 1:1 in the sample comparison. The minimum number of

members in each group is calculated by the following formula:

$$n_1 = n_2 = \frac{\{Z_{1-\alpha/2}\sqrt{2P(1-P)} + Z_{1-\beta}\sqrt{P_1(1-P_1) + P_2(1-P_2)}\}^2}{(P_1 - P_2)^2}$$

Information:

$$Z_{1-\beta} = 1,28$$

$$Z_{1-\alpha/2} = 1,96$$

$$P_1 = \text{Approximate proportion of cases} \\ (0,75)$$

$$P_2 = \text{Approximate proportion of controls} \\ (0,4) \text{ (Lewa et al. 2020)}$$

$$P = \frac{1}{2} (P_1 + P_2) = 0,58$$

Each group must have at least 39 samples, after an estimated 10% loss, the minimum number becomes 3 samples (children aged 6–24 months), so the total number of samples for this study is 86 children. Subjects in the case group were selected from all eligible cases in the selected village. Subjects in the control group were randomly selected after cases were identified and matched according to age group. The three-month data collection period began in January 2021 and ended in March 2021.

The information collected is a combination of primary and secondary data. Primary data were collected through anthropometric measurements and questionnaire interviews. Anthropometric measurements were carried out for data on the child's body length and the mother's height. The questionnaire interview included the child's gender, number of family members, family income, mother's occupation, mother's education, mother's age at childbirth, distance between pregnancies, history of IMD, exclusive breastfeeding, time of breastfeeding, parenting aged 6–8 months, parenting style aged 9–12 months, history of diarrhea, history of ARI, birth weight, and birth length. Secondary data were obtained from MCH book records regarding the history of IMD, birth weight, birth length, history of child infection, maternal age at childbirth, and distance between pregnancies. The secondary data was used to corroborate the interview results from the primary data collection.

The child's body length is measured directly using a length board; the measurement results are then calculated as a z score (PB / U) using WHO Anthro and then categorized into

stunting (z score  $<-2SD$ ) and normal (z score  $>-2SD$ ) (Permenkes, 2020). The mother's height was obtained from measurements using microtoise and categorized into short ( $<150$  cm) and normal ( $>150$  cm). Based on research by Andari et al. (2020), mothers with a height of  $<150$  cm are at greater risk of having stunted children.

The variable category of the number of family members is based on BKKBN 1998, namely large families if in one house there are  $>4$  people and small families if there are  $<4$  people. The cut-off for family income is the District/City Minimum Wage (DCMW) of Kebumen Regency, according to the 2018 Central Java Governor Decree, which is Rp. 1,686,000. Family income is categorized under UMK and according to MSE. A mother's education is categorized as not graduating from high school and graduating from high school, while a mother's work is categorized as not working and working. Based on the Indonesian Ministry of Health (2016), mothers are at risk of complications if pregnant at the age of  $<20$  years and  $>35$  years; besides, pregnancy is risky if the gap between pregnancies is  $<2$  years.

EBI is recommended if the child is placed on the mother's chest to breastfeed immediately after birth or  $<1$  hour after birth. EBI is not recommended if the child is not placed on the mother's chest during the first breastfeeding process or performs it within  $>1$  hour after birth. Children who are breastfed for only  $<6$  months or more than 6 months are categorized as receiving exclusive breastfeeding, not according to recommendations; on the contrary, they are said to get exclusive breastfeeding according to recommendations if they only get breast milk for 6 months. While the initial time of giving Complementary Foods for Breast Milk (CF-BM) is categorized as not according to recommendations if children are given CF-BM before the age of 6 months or more than 6 months, or according to recommendations if given when children are 6 months old, Parenting was measured using questionnaires, each consisting of 13 questions adopted from the questionnaire Feeding Infants and Children Practices (FIC) research by Rahmawati et al. (2019) The questions aimed to measure the frequency of breastfeeding, the use of CF-BM (frequency and portions), form (variation), active responsive feeding, and other aspects of

child hygiene. The answer choices for each question are always, often, sometimes, rarely, and never with a score of 4-0. Questions about secondhand smoke exposure have an inverted answer score of 0-4. The final score is the result of summing all values divided by the maximum value (52) and multiplying by 100%. The calculation results are categorized as less if the score is  $<$ average and good if the score is  $>$ average. Validity and reliability tests have been carried out on questionnaires with Sig values. (2-tailed)  $<0,05$  and Cronbach's Alpha value  $>0,6$ .

Referring to research by Sahitarini et al. (2020), history of diarrheal infections is categorized into having diarrhea  $>3$  days and never diarrhea  $<3$  days, while Upper Respiratory Tract Infection (URTI) is categorized into having experienced or never having respiratory infections characterized by symptoms of cough, runny nose, fever, earache, or laryngitis. Children with a birth weight of  $<2500$  g are categorized as having a low birth weight and a normal birth weight if  $>2500$  g (WHO, 2004), while children who have a birth length of  $<48$  cm are said to be short and normal if the results of measuring body length at birth are  $>48$  cm (Kemenkes RI, 2013). The gestational age of the mother when the child is born is said to be premature at  $<37$  weeks and normal at  $>37$  weeks (WHO, 2004). The collected data is then processed through stages of editing, coding, entry, cleaning, and data analysis.

Data analysis used bivariate and multivariate data at a 95% meaningfulness level. First, bivariate analysis using the Chi Square test aims to study the relationship between all independent variables (characteristics, breast milk history, infection history, and birth history) and dependent variables (children's nutritional status based on HFA). Furthermore, a multivariate analysis was performed using the Multiple Logistic Regression test. The first step in multivariate analysis is to include all variables that have a p value of  $<0,25$  in the model. Second, remove variables with p values  $>0,05$  gradually, starting with the variable with the largest p value until the final model is obtained. The Institute for Research and Community Service, Bogor Agricultural University (KEPMSM-IPB/SK/2021) has given ethical permission to this research with the number 328/IT3.KEPMSM-IPB/SK/2021.

## Result and Discussion

### Characteristics of the Subject and Its Relationship to Stunting

In the case group, 57,5% of subjects were men, while in the control group, the percentage of women was higher (57,4%). While the number of extended family members was higher in both groups. The amount of food available and how it is distributed among family members are largely determined by the size of the family. Parents' decisions in distributing food have an impact on children's growth, development, and health (Rahmawati et al., 2020). More subjects in the case group had families with incomes below MSEs (53,2%) than subjects in the control group (38,3%). The economic status of households is generally associated with low consumption of food quality and low food diversity (Nurhayati et al., 2020). In the end, this affects nutritional status, especially during growth and development, which require a lot of nutrients (Al Rahmad et al., 2013).

The majority of mothers at the study site were not working. Working women are considered capable of improving the standard of living of their families (Amaha & Woldeamanuel, 2021). The mothers in the control group had better levels of education. Mothers have more opportunities to learn about nutrition and child health when they have a higher level of education (Khan et al., 2019). In addition, mothers with higher education are considered more likely to absorb practical knowledge and information from various media (Al Rahmad & Miko, 2016). In the case group, 19,1% of women gave birth at risk, compared with 8,5% of women in the control group. More mothers in the control group had a gap between pregnancies of <2 years. Short pregnancy distances can have the effect of stunted intrauterine growth or affect the quality of childcare (Kahssay et al., 2020).

Bivariate analysis showed maternal height had a significant association with child stunting ( $p = 0,002$ ). An increase in maternal height of 1 cm reduces the likelihood of having stunted children by 1% (Amaha & Woldeamanuel, 2021). Based on theory, the influence of maternal height on the child's height can be due to the pathological condition of the mother, who has short chromosomes, or because the mother also experiences malnutrition or disease.

Children of mothers who are short due to malnutrition or illness have more chances to grow to normal height (Miko & Al Rahmad, 2017). Supported by the statement that the mother's height interacts with environmental factors (health and nutritional status) before and during pregnancy and has an important role in the child's height (Utami et al., 2018). This suggests an intergenerational cycle of malnutrition that may be broken by intervening with modifiable factors, namely environmental factors.

### History of Breastfeeding and Its Relationship with Stunting

The variable history of breastfeeding is presented in Table 2. Mothers in the case group were more likely to perform EBI >1 hour after the child was born (42,6%) than mothers in the control group (29,8%). Performing EBI immediately after the baby is born is considered capable of tightening the mother-baby bond and stimulating milk production so as to ensure the adequacy of milk for the baby (Batiro et al., 2017). In addition, EBI guarantees babies get colostrum. Colostrum contains the appropriate nutrients and antibodies that newborns need (Brown, 2011). Based on this content, colostrum is able to provide protection against gastrointestinal infections, which cause malnutrition and stunting (Tafesse et al., 2021). Although nearly half of the mothers in the study did not perform EBI immediately after the baby was born, more mothers continued to give colostrum to the baby rather than remove it.

No additional intake is needed for the nutritional needs of babies until six months of age, so breast milk alone is enough. The results of the analysis showed that exclusive breastfeeding was not significantly associated with stunting. More than half of the respondents in the case and control groups did not meet the recommended duration of exclusive breastfeeding. This is because they start giving complementary foods before the child is 6 months old. In addition, bottle feeding is also done if little milk comes out, in line with research (Al Rahmad & Miko, 2016), which was done in Banda Aceh City. Caregivers worry about not having enough breast milk (ASI) and believe that if the baby is hungry, they may continue to whine even after feeding. The Kebumen District Health Office reported in 2019 that the lack of

breastfeeding counselors and the continuous marketing of formula milk to infants 0–6 months without medical reasons reduced the number of

infants exclusively breastfeeding (Dinkes Kabupaten Kebumen, 2019).

**Table1.** The relationship of subject characteristics with stunting

Faktor Risiko	Case		Control		P value
	n	%	n	%	
Gender					
Man	27	57,4	20	42,6	0,216
Woman	20	42,6	27	57,4	
Number of family members					
Big	26	55,3	26	55,3	1,000
Small	21	44,7	21	44,7	
Family income					
Under DCMW (<Rp1.686.000)	25	53,2	18	38,3	0,214
Above MSEs (≥Rp1.686.000)	22	46,8	29	61,7	
Mother's education					
Graduated from junior high school	33	70,2	28	59,6	0,387
Graduated from High School	14	29,8	19	40,4	
Mother's work					
Does not work	38	80,9	34	72,3	0,465
Work	9	19,1	13	27,7	
Age of the mother at childbirth					
Risky (<20 or >35 years old)	9	19,1	4	8,5	0,232
No risk (20-35 years old)	38	80,9	43	91,5	
Distance between pregnancies					
Risky (<2 years old)	2	4,3	6	12,8	0,267
No risk (≥2 years old)	45	95,7	41	87,2	
Mother's height					
Short (<150 cm)	24	51,1	9	19,1	0,002*
Usual (≥150 cm)	23	48,9	38	80,9	

At the age of 6 months, infants' nutritional needs increase in order to achieve optimal growth and development and require additional intake of CF-BM to meet them. Field interviews showed that children in the case group were given complementary foods at non-recommended times (21,3%) compared to children in the control group (17%). Early breastfeeding will increase the risk of infection related to the use of contaminated water, foodstuffs, and equipment, which ultimately results in reducing appetite, interfering with nutrient absorption, increasing metabolic needs, and increasing nutrient loss (Tafesse et al., 2021). Starting CF-BM at the right time does have a positive effect on children's growth and development, but providing optimal MP-ASI in quantity and quality is no less important (Abeway et al., 2018; I. Ahmad et al., 2018).

Parenting is related to how mothers and caregivers breastfeed and feed nutritious food to their children (Femidio & Muniroh, 2020). Stunting is closely related to children's parenting at two different periods. Stunting was found to be associated with food parenting between the ages of 6 and 8 months ( $p = 0,001$ ). Stunting was also significantly associated with food parenting in children aged 9–12 months ( $p = 0,007$ ). Children who received a diverse diet had an 83% lower risk of stunting (I. Ahmad et al., 2018). Children who are given a diverse diet with complete nutrients can grow optimally and healthily (Meshram et al., 2019). In addition to the timeliness of giving, the provision of CF-BM must also be considered in terms of frequency, amount of food, and how to make it in order to be able to meet the nutritional needs of children (Al Rahmad et al., 2013).

**Table 2.** The relationship between breastfeeding history, infection history, and birth history with stunting

Risk Factors	Case		Control		P value	Nilai OR 95% CI (Lower - Upper)
	n	%	n	%		
EBI						
>1 hour after birth	20	42,6	14	29,8	0,283	1,75 (0,75-4,09)
<1 hour after birth	27	57,4	33	70,2		
Exclusive breastfeeding						
Not as recommended	25	53,2	28	59,6	0,678	0,77 (0,34-1,75)
As recommended	22	46,8	19	40,4		
Time of feeding CF-BM						
Not as recommended	10	21,3	8	17,0	0,793	1,32 (0,47-3,70)
As recommended	37	78,7	39	83,0		
Parenting at the age of 6-8 months						
Less	31	66,0	14	29,8	0,001*	4,57 (1,92-10,89)
Good	16	34,0	33	70,2		
Parenting at the age of 9-12 months						
Less	29	61,7	15	31,9	0,007*	3,44 (1,47-8,04)
Good	18	38,3	32	68,1		
Diarrhea						
Ever	37	78,7	24	51,1	0,010*	3,55 (1,44-8,75)
Never	10	21,3	23	48,9		
Respiratory tract infections (URTI)						
Yes	31	66,0	39	83,0	0,098	0,4 (0,15-1,05)
No	16	34,0	8	17,0		
Birth weight						
Low (<2,5 kg)	9	19,1	3	6,4	0,122	3,47 (0,88-13,76)
Usual ( $\geq$ 2,5 kg)	38	80,9	44	93,6		
Birth length						
Short (<48 cm)	16	34,0	6	12,8	0,028*	3,53 (1,24-10,06)
Usual ( $\geq$ 48 cm)	31	66,0	41	87,2		
Age of birth						
Premature	5	10,6	3	8,4	0,712	1,75 (0,39-7,77)
Usual	42	89,4	44	93,6		

### History of Infection, History of Birth, and Its Relationship to Stunting

The distribution of infectious diseases and birth histories, as well as their relationship with stunting, are presented in Table 2. Children who are malnourished experience several times of diarrhea, and children with diarrhea become malnourished (Berhe et al., 2019).

Unlike URTI, diarrhea has a strong association with stunting, according to this study. Diarrhoea accounted for 42,5% of stunting cases in ethnic Papuan studies (Ramadhani et al., 2019). In addition, stunting is associated with diarrhea in children in Southern Ethiopia (Tafesse et al., 2021). Diarrhea can

eliminate children's macro- and micronutrients, and appetite becomes reduced (Musyayadah & Adiningsih, 2019). This allows for a slowdown in growth.

URTI and stunting had no correlation in this study. Sahitarini et al. (2020) revealed that children who suffer from ARI but do not experience malnutrition can be caused by the problem being handled properly, so that the child's appetite is not significantly reduced. Field observations also show that health facilities are easily accessible. People at the research site take their children to the Village Midwife or General Practitioner at the health center if they are sick, especially if they have a fever, cough, or runny nose.

Birth length was found to be an important factor in the chi-squared test findings, although birth weight and birth age were not related (table 2). In line with research conducted in Bogor, stunting is 1,6 times more likely to occur in children born with a body length of <48 cm (Utami et al., 2018). Children with a birth length of <48 cm cannot pursue linear growth during the critical period of the first thousand days of life if they do not receive proper nutrition and health protection.

Birth weight and stunting were not significantly associated in this study (p value 0,122). In line with research by Nurhayati et al. (2020), stunting is not related to children's birth weight. In addition, birth age is not significantly related to stunting. The majority of children, both in the case and control groups, in the study were born at a normal birth age. These results are supported by research by Wells et al. (2019), which states there is no significant correlation between premature birth and stunting.

**Factors Affecting Stunting**

The final model presented in Table 3 shows that gender, maternal height, and parenting at the age of 6–8 months have a significant relationship with stunting. Boys are four times more likely to be stunted than girls (p value 0,032, AOR 3,59, 95% CI: 1,12–11,49). Boys have a 1.35% higher risk of being stunted (Beal et al., 2018). As a child grows, they will need more calories. The growth of boys is more susceptible to nutritional deficiencies, diseases, or other exposures (Nshimiyiryo et al., 2019). A literature review conducted (Thompson, 2021) suggests that boys are more susceptible to stunting due to biological differences related to sex chromosomes and hormones (testosterone), which affect growth rate differences and contribute to reducing immunological function (Thompson, 2021). This makes them vulnerable to lack of intake and infection.

**Table 3.** Final model of stunting-related factors

Variable	AOR 95% CI	P value
Gender		
Man	3,59 (1,12-11,49)	0,032*
Woman	1	
Family Income		
Under DCMW	0,68 (0,2-2,32)	0,537
Above MSEs	1	
<u>Age of the mother at childbirth</u>		
Risky (<20 or >35 years old)	4,19 (0,77-22,87)	0,098
No risk (20-35 years old)	1	
Distance between pregnancies		
Risky (<2 years old)	0,13 (0,01-1,69)	0,120
No risk (≥2 years old)	1	
Mother's height		
Short (<150 cm)	3,75 (1,12-12,55)	0,032*
Usual (≥150 cm)	1	
Parenting 6-8 months		
Less	5,17 (1,22-21,95)	0,026*
Good	1	
Parenting 9-12 months		
Less	1,45 (0,35-6,03)	0,610
Good	1	
Diarrhea		
Ever	2,3 (0,70-7,52)	0,169
Never	1	
Respiratory tract infections (URTI)		
Yes	0,30 (0,09-1,06)	0,062
No	1	
Birth length		
Short (<48 cm)	2,5 (0,62-10,07)	0,199
Usual (≥48 cm)	1	



Children born to mothers with a height of less than 150 cm were four times more likely to be stunted than children born to mothers with a height of more than 150 cm (95% CI:1, 12-12,55). Stunted children are twice as likely to be born to mothers under 145cm tall (RR 2,04) (Beal et al., 2018). The child's health relationship with his mother can be measured from the mother's height (Khan et al., 2019). Women who are shorter than average are more likely to give birth to short children. Despite the fact that genetics play a role, it is possible to break the cycle of malnutrition by providing better health intake and services at critical periods of life (Hanum, 2019).

Multivariate analysis showed only parenting patterns for children aged 6-8 were significantly associated with stunting. Some previous studies did not look at parenting patterns per period of feeding patterns recommended by the Ministry of Health. Parenting is not related to the nutritional status of toddlers in Banyumas (Sari et al., 2022). Parenting, history of breastfeeding and complementary feeding, and feeding practices in children aged 24-59 months showed significant associations in bivariate trials but not in multivariate trials (Widyaningsih et al., 2018). Based on eating behaviors and parental practices, as well as hygiene habits, food parenting is associated with stunting (Bella et al., 2019).

The golden period of growth is an important period for children to get quality and appropriate portions of MP-ASI to perform growth and development tasks, but the hygiene of MP-ASI needs to be considered (Rahmawati et al., 2019). Parenting also represents attention and support for children, which are considered to contribute to children's growth (Chaudhary et al., 2018). Stunting was 5,17 times more likely to occur in children with undereating at 6-8 months of age (95% CI:1,22-21,95), higher than the risk of undereating at 9-12 months of age OR 1,45 (95% CI: 0,35-6,03). This is because the age of 6-8 months is one of the crucial periods, the transition period from breastfeeding alone to breast milk and complementary foods. This period sets the stage for eating patterns throughout childhood, adolescence, potentially into adulthood (Chaudhary et al., 2018).

## Conclusion

The modeling results show that the risk factors for stunting in children aged 6-24 months in the Puring Health Center area are gender, maternal height, and parenting at the age of 6-8 months. Meanwhile, exclusive breastfeeding and a history of infectious diseases were not risk factors for stunting in this study.

Advice to related parties, such as the health office and the health center, to strengthen pregnancy preparation programs, during pregnancy, and the first two years of a child's life Education on nutritional fulfillment can be started early through premarital classes, classes for pregnant women, and nutritional counseling with nutritionists, in addition to examinations carried out by midwives and obstetricians. This is to break the chain of malnutrition between generations. In addition, mothers of infants and toddlers need education and support to provide appropriate and quality complementary foods. Further studies related to the effectiveness of the program to overcome the factors that cause stunting can be carried out.

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