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Research

Analysis of Risk Factors for Stunting in Klaten Regency: Correlation Study and Factor Analysis

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Abstract

Stunting remains a major public health problem in Indonesia, affecting children's growth and cognitive development. Despite various interventions, the stunting prevalence in Klaten Regency increased from 15.8% in 2021 to 18.2% in 2022. This study aims to analyze the risk factors associated with stunting and identify the most dominant contributing factors. This is a quantitative correlational study conducted in 9 stunting-locus health centers in Klaten, Central Java. A total of 300 children aged 2-3 years were selected using Proportional Stratified Random Sampling. Data were collected through anthropometric measurements, structured questionnaires, and interviews. Logistic regression was used to analyze the relationship between risk factors and stunting incidence. Eleven risk factors were identified, with four significant factors: parenting, socio-economic status, sanitation, and nutritional intake. Among these, parenting and sanitation were the most dominant factors (Eigenvalues = 1.876 and 1.171). Poor sanitation increased the risk of infections, while inadequate parenting affected breastfeeding, complementary feeding, and child stimulation. A multisectoral approach is required to address stunting, focusing on parenting education, sanitation improvement, nutrition interventions, and economic empowerment to achieve Indonesia's 14% stunting reduction target by 2024.

Keywords: Stunting, Risk Factors, Parenting, Sanitation, Nutrition, Socioeconomic Status.

INTRODUCTION

Stunting is one of the main health problems in Indonesia that affects children's physical growth and cognitive development. Stunting is defined as a condition of impaired growth in children due to chronic malnutrition over an extended period, particularly during the first 1,000 days of life. World Health Organization (WHO) indicates that Indonesia ranks fourth globally and second in Southeast Asia among countries with high stunting rates. This condition not only affects children's health but also has long-term consequences, such as increased risk of degenerative diseases, delayed cognitive development, and reduced productivity in adulthood, which ultimately impacts the country's economic growth (WHO, 2022).

The Indonesian government has set a target of reducing stunting rates to 14% by 2024, as outlined in Presidential Regulation Number 72 of 2021 regarding Accelerating the Reduction of Stunting. These efforts include specific and sensitive interventions, such as improving access to adequate nutrition, promoting optimal childcare practices, and enhancing sanitation and environmental conditions. However, despite the implementation of various policies, the prevalence of stunting in Klaten Regency has actually increased from 15.8% in 2021 to 18.2% in 2022 (Dinas Kesehatan Kabupaten Klaten, 2023). This situation indicates that there are still various risk factors that have not been fully addressed and require further analysis.

In general, the causes of stunting can be divided into two main categories, they are direct and indirect factors. Direct factors include insufficient and unbalanced nutritional intake and recurrent infections that hinder nutrient absorption. Indirect factors include suboptimal childcare practices, poor sanitation, family economic status, maternal education level, smoking habits within the household, and limited access to healthcare services and immunization (UNICEF, 2022)

Previous studies have shown that mothers play a very important role in preventing stunting. Maternal nutritional status during pregnancy, birth interval, exclusive breastfeeding, and complementary feeding practices greatly affect child growth. Additionally, inadequate environmental sanitation, such as limited access to clean water and proper sanitation facilities, are major risk factors for infections that can worsen children's nutritional status (Kemenkes RI, 2018).

Despite various intervention programs that have been implemented, the stunting rate in Klaten Regency remains quite high. Therefore, an in-depth analysis of the factors contributing to stunting in this area is needed. This study identified the main risk factors for stunting based on aspects of parenting, sanitation, socioeconomic status, and nutritional intake, and to determine the most dominant factors influencing stunting. This study aims to analyze the risk factors that contribute to stunting in Klaten Regency and identify the most dominant factors influencing stunting.

The results of this study are expected to serve as a basis for formulating more effective health policies and intervention programs to reduce stunting rates in Klaten Regency. In addition, these findings can help in developing educational strategies for the community, especially mothers, regarding the importance of good parenting, proper sanitation, and adequate nutrition during child growth.

METHODOLOGY

This study was a quantitative correlational study that aims to analyze the relationship between various risk factors of stunting and to identify the most dominant factors. The study was conducted in Klaten Regency, Central Java, at nine health centers designated as stunting locations based on Klaten Regent Decree No. 424/110 of 2023. Data collection took place from May to July 2024.

The study population consisted of children aged 2–3 years and their mothers in the working areas of nine community health centers. A sample of 280 children was selected from a total population of 400 using proportional stratified random sampling, with proportional distribution of stunted and non-stunted children. Inclusion criteria included children who had undergone anthropometric measurements and mothers who were willing to participate. Children with congenital diseases or severe acute infections were excluded.

The dependent variable was stunting (height-for-age z-score < -2 SD – WHO). While the independent variables were maternal factors: nutritional status during pregnancy, maternal age and parity, birth interval, education, occupation, exclusive breastfeeding, parenting practices, socioeconomic status, sanitation, exposure to tobacco smoke, domestic violence; and child factors: birth weight and length, immunization status, nutritional intake, history of infection (respiratory tract infection, diarrhea, pneumonia). Data were obtained through anthropometric measurements, structured questionnaires, and brief interviews to supplement information related to parenting, nutrition, and sanitation. Analysis was performed using logistic regression to test the influence of independent factors on the risk of stunting after controlling for other variables.

The study was approved by the Ethics Committee of Poltekkes Kemenkes Surakarta (No. DP.04.04/F.XXV/3954/2024). All respondents provided written informed consent and data confidentiality was guaranteed for academic purposes.

RESULTS

Table 1: Frequency distribution of maternal height

Height	Stunting		Not stunting		Total	
	f	%	f	%	f	%
<145 cm	8	2.9	0	0	8	2.7
≥145 cm	272	97.1	20	100	292	97.3
Total	280	100	20	100	300	100

Based on Table 1, most respondents in the stunting group had a height of ≥145 cm, totaling 272 respondents (97.1%). While in the non-stunting group, all respondents had a height of ≥145 cm.

Table 2: Frequency distribution of maternal nutritional status

Maternal nutritional status	Stunting		Not stunting		Total	
	f	%	f	%	f	%
Insufficient	18	6.4	1	5.0	19	6.3
Adequate	125	44.7	8	40.0	133	44.3
Good	137	48.9	11	55.0	148	49.3
Total	280	100	20	100	300	100

Based on Table 2, most respondents in the stunting group had good nutritional status, totaling 137 respondents (48.9%). While in the non-stunting group, the majority of respondents had adequate nutritional status, totaling 8 respondents (40.0%).

Table 3: Frequency distribution of maternal age during pregnancy

Maternal age during pregnancy	Stunting		Not stunting		Total	
	f	%	f	%	f	%
Low risk (20-35)	224	80.0	11	55.0	235	78.3
High risk (≤20 and >35)	56	20.0	9	45.0	65	21.7
Total	280	100	20	100	300	100

Based on Table 3, most respondents in the stunting group had a low risk, totaling 224 respondents (80.0%). While in the non-stunting group, the majority of respondents had a low risk, totaling 11 respondents (55.0%).

Table 4: Frequency distribution of parity

Parity	Stunting		Not stunting		Total	
	f	%	f	%	f	%
Primigravida (1)	76	27.1	5	25.0	81	21.0
Multigravida (2-4)	199	71.1	14	70.0	213	71.0
Grandemulti (>4)	5	1.8	1	5.0	6	2.0
Total	280	100	20	100	300	100

Based on Table 4, most respondents in the multigravida stunting group were 199 respondents (71.1%). While in the non-stunting group, the majority of multigravida respondents were 14 respondents (70.0%).

Table 5: Frequency distribution of birth interval

Birth interval	Stunting		Not stunting		Total	
	f	%	f	%	f	%
First child	76	27.2	5	25.0	81	27.0
≤2 years	39	13.9	2	10.0	41	13.7
>2 years	165	58.9	13	65.0	178	59.3
Total	280	100	20	100	300	100

Based on Table 5, most respondents in the stunting group had more than two children, totaling 165 respondents (58.9%). While in the non-stunting group, the majority of respondents had more than two children, totaling 13 respondents (65.0%).

Table 6: Frequency distribution of maternal education

Maternal education	Stunting		Not stunting		Total	
	f	%	f	%	f	%
Basic education (Elementary School and Junior High School)	83	29.7	8	40.0	91	30.3
Secondary education (Senior High School)	168	60.0	10	50.0	178	59.3
Higher education (University)	29	10.3	2	10.0	31	10.3
Total	280	100	20	100	300	100

Based on Table 6, most respondents in the stunting group had a secondary education level, totaling 168 respondents (60.0%). While in the non-stunting group, the majority of respondents had a secondary education level, totaling 10 respondents (50.0%).

Table 7: Frequency distribution of maternal occupation

Maternal occupation	Stunting		Not stunting		Total	
	f	%	f	%	f	%
Housewife	222	79.3	14	70.0	236	78.7
Teacher	6	2.1	2	10.0	8	2.7
Private workers	19	6.8	2	10.0	21	7.0
Seller	6	2.1	1	5.0	7	2.3
Laborer	23	8.2	1	5.0	24	8.0
Village officer	1	0.4	0	0	1	0.3
Nurse	2	0.7	0	0	2	0.7
Civil servant	1	0.4	0	0	1	0.3
Total	280	100	20	100	300	100

Based on Table 7, most respondents in the stunting group worked as housewives, totaling 222 respondents (79.3%). While in the non-stunting group, the majority of respondents worked as housewives, totaling 14 respondents (70.0%).

Table 8: Frequency distribution of exclusive breastfeeding

Exclusive breastfeeding	Stunting		Not stunting		Total	
	f	%	f	%	f	%
Yes	257	91.8	20	100	277	92.3
No	23	8.2	0	0	23	7.7
Total	280	100	20	100	300	100

Based on Table 8, most respondents in the stunting group provided exclusive breastfeeding, totaling 257 respondents (91.8%). While in the non-stunting group, the majority of respondents provided exclusive breastfeeding, totaling 20 respondents (100%).

Table 9: Frequency distribution of breastfeeding duration

Breastfeeding duration	Stunting		Not stunting		Total	
	f	%	f	%	f	%
>2 years	9	3.2	1	5.0	10	3.3
≤2 years	271	96.8	19	95.0	290	96.7
Total	280	100	20	100	300	100

Based on Table 9, most respondents in the stunted group had breastfed for ≤2 years, totaling 271 respondents (96.8%). While in the non-stunted group, the majority of respondents had breastfed for ≤2 years, totaling 19 respondents (96.0%).

Table 10: Frequency distribution of parenting style

Parenting style	Stunting		Not stunting		Total	
	f	%	f	%	f	%
Insufficient	9	3.2	1	5.0	10	3.3
Adequate	67	23.9	1	5.0	68	22.7
Good	204	72.9	18	90.0	222	74.0
Total	280	100	20	100	300	100

Based on Table 10, most respondents in the stunting group had good parenting patterns, totaling 204 respondents (72.9%). While in the non-stunting group, the majority of respondents had good parenting patterns, totaling 18 respondents (90.0%).

Table 11: Frequency distribution of social economy background

Social economy status	Stunting		Not stunting		Total	
	f	%	f	%	f	%
Insufficient	11	3.9	2	10.0	13	4.3
Adequate	32	11.4	1	5.0	33	11.0
Good	237	84.7	17	85.0	254	84.7
Total	280	100	20	100	300	100

Based on Table 11, most respondents in the stunting group had good socioeconomic status, totaling 237 respondents (84.7%). While in the non-stunting group, the majority of respondents had good socioeconomic status, totaling 17 respondents (85.0%).

Table 12: Frequency distribution of smoking family

Smoking family	Stunting		Not stunting		Total	
	f	%	f	%	f	%
Yes	113	40.4	5	25.0	118	39.9
No	167	59.6	15	75.0	182	60.7
Total	280	100	20	100	300	100

Based on Table 12, most respondents in the stunting group had families that did not smoke, totaling 167 respondents (59.6%). While in the non-stunting group, the majority of respondents had families that did not smoke, totaling 15 respondents (75.0%).

Table 13: Frequency distribution of sanitation

Sanitation	Stunting		Not stunting		Total	
	f	%	f	%	f	%
Insufficient	1	0.4	0	0	1	0.3
Adequate	8	2.9	0	0	8	2.7
Good	271	96.8	20	100	291	97
Total	280	100	20	100	300	100

Based on Table 13, most respondents in the stunting group had good sanitation, totaling 271 respondents (96.8%). While in the non-stunting group, the majority of respondents had good sanitation, totaling 20 respondents (100%).

Table 14: Frequency distribution of exposure to cigarette smoke

Exposure to cigarette smoke	Stunting		Not stunting		Total	
	f	%	f	%	f	%
Yes	116	41.4	5	25.0	121	40.3
No	164	58.6	15	75.0	179	59.7
Total	280	100	20	100	300	100

Based on Table 14, most respondents in the stunted group were not exposed to cigarette smoke, with a total of 164 respondents (58.6%). While in the non-stunted group, the majority of respondents were not exposed to cigarette smoke, with a total of 15 respondents (75.0%).

Table 15: Frequency distribution of domestic violence

Domestic violence	Stunting		Not stunting		Total	
	f	%	f	%	f	%
Yes	6	2.1	0	0	6	2.1
No	274	97.9	20	100	294	98.0
Total	280	100	20	100	300	100

Based on Table 15, most respondents in the stunted group did not experience domestic violence, totaling 274 respondents (97.9%). While in the non-stunted group, the majority of respondents did not experience domestic violence, totaling 20 respondents (100%).

Table 16: Frequency distribution of birth weight

Birth weight	Stunting		Not stunting		Total	
	f	%	f	%	f	%
<2500 gr	54	19.3	0	0	54	18.0
≥2500 gr	226	80.7	20	100	246	82.0
Total	280	100	20	100	300	100

Based on Table 16, most respondents in the stunting group had a birth weight ≥2500 gr, totaling 226 respondents (80.7%). While in the non-stunting group, the majority of respondents had a birth weight ≥2500 gr, totaling 20 respondents (100%).

Table 17: Frequency distribution of birth height

Birth height	Stunting		Not stunting		Total	
	f	%	f	%	f	%
<48 cm	119	42.5	0	0	119	39.7
≥48 cm	161	57.5	20	100	181	60.3
Total	280	100	20	100	300	100

Based on Table 17, most respondents in the stunting group had a height of ≥48 cm, totaling 161 respondents (57.5%). While in the non-stunting group, the majority of respondents had a height of ≥48 cm, totaling 20 respondents (100%).

Table 18: Frequency distribution of immunization

Immunization	Stunting		Not stunting		Total	
	f	%	f	%	f	%
Incomplete	11	4.0	0	0	11	3.7
Complete	269	96.0	20	100	289	96.3
Total	280	100	20	100	300	100

Based on Table 18, most respondents in the stunted group had completed immunization, totaling 269 respondents (96.0%). While in the non-stunted group, the majority of respondents had completed immunization, totaling 20 respondents (100%).

Table 19: Frequency distribution of nutritional intake

Nutritional intake	Stunting		Not stunting		Total	
	f	%	f	%	f	%
Insufficient	3	1.1	0	0	3	1.0
Adequate	57	20.3	1	5.0	58	19.3
Good	220	78.6	19	45.0	239	79.7
Total	280	100	20	100	300	100

Based on Table 19, most respondents in the stunting group had good nutritional intake, totaling 220 respondents (78.6%). While in the non-stunting group, the majority of respondents had good nutritional intake, totaling 19 respondents (95%).

Table 20: Frequency distribution of medical history

Medical history	Stunting		Not stunting		Total	
	f	%	f	%	f	%
None	263	93.9	19	95.0	282	94.0
Pneumonia	9	3.2	0	0	9	3.0
Allergic	6	2.1	1	0	7	2.3
Asthma	1	0.4	0	0	1	0.3
Diarrhea	1	0.4	0	0	1	0.3
Total	280	100	20	100	300	100

Based on Table 20, most respondents in the stunting group had no medical history, totaling 263 respondents (93.9%). While in the non-stunting group, the majority of respondents had no medical history, totaling 19 respondents (95.0%).

Table 21: Multivariate analysis

Risk factors of stunting	Anti Image-correlation >0.5	Communalities >0.5	Eigenvalues >1
Maternal height	0.460	-	-
Maternal nutritional status	0.766	0.401	-
Maternal age during pregnancy	0.559	0.425	-
Parity	0.498	-	-
Birth interval	0.497	-	-
Maternal education	0.560	0.448	-
Maternal occupation	0.553	0.253	-
Exclusive breastfeeding	0.761	0.472	-
Breastfeeding duration	0.383	-	-
Parenting style	0.613	0.831	1.876
Social economy status	0.639	0.637	0.293
Smoking family	0.476	-	-
Sanitation	0.615	0.733	1.171
Exposure to cigarette smoke	0.652	0.483	-
Domestic violence	0.369	-	-
Birth weight	0.465	-	-
Birth height	0.482	-	-
Immunization	0.266	-	-
Nutritional intake	0.623	0.846	0.660
Medical history	0.587	0.469	-

Based on Table 21, it can be seen that in the Anti Image-correlation analysis test, the results show that out of 20 factors contributing to stunting, 11 factors meet the criteria to be considered determinants of stunting in children, based on the Anti Image-correlation (MSA) value >0.5. These factors include maternal nutrition during pregnancy (0.766), maternal age during pregnancy (0.559), maternal education (0.560), maternal occupation (0.553), exclusive breastfeeding (0.761), parenting style (0.613), socioeconomic status (0.639), sanitation (0.615), exposure to cigarette smoke (0.652), nutrient intake (0.623), and medical history (0.587). Communalities analysis finds the relationship between factors and stunting. It shows that from 11 factors that met the test criteria, there were 4 factors related to stunting in children based on the MSA value >0.5 criterion. These factors are parenting style (0.831), socioeconomic status (0.637), sanitation (0.733), and nutritional intake (0.846). Eigenvalues test is to determine the dominant factors. It shows two dominant factors with value >1, they are parenting patterns (1.876) and sanitation (1.171).

DISCUSSIONS

Parenting style was significantly associated with stunting, as indicated by an MSA value of 0.831 > 0.5 and an eigenvalue of 1.876 > 1. This confirms that poor parenting style increases the risk of stunting in early childhood. Poor parenting style is often associated with mothers' lack of knowledge about exclusive breastfeeding, appropriate complementary feeding, hygiene practices, and child care when sick. A study by (Black et al., 2024) in The Lancet Global Health revealed that mothers with low levels of education tend to have inadequate parenting practices, which impact children's growth delays. Another study by (Victora et al., 2021) in the American Journal of Clinical Nutrition noted that a lack of psychosocial stimulation and social interaction during a child's developmental period contributes to an increased risk of stunting.

In addition, infants with complementary foods that do not meet nutritional standards can lead to deficiencies in essential micronutrients such as iron, zinc, and vitamin A, which play a role in child growth. Therefore, education-based interventions for parents are essential to improve their understanding of good parenting styles in order to reduce stunting rates (Dewey et al., 2022).

Environmental sanitation is also a dominant factor contributing to stunting, as indicated by MSA value of 0.733 > 0.5 and eigenvalue of 1.171 > 1. Poor sanitation increases the risk of gastrointestinal infections, diarrhea, and parasitic infections, which can inhibit nutrient absorption and disrupt child growth.

Research by (Budge et al., 2019) shows that unhygienic environments play a role in triggering Environmental Enteric Dysfunction (EED), a chronic inflammatory condition of the intestines that inhibits nutrient absorption. Another study by (Cumming & Cairncross, 2016) found that children living in environments with poor sanitation have a higher risk of stunting compared to those living in environments with access to clean water and adequate sanitation facilities.

Poor sanitation conditions, such as open defecation, lack of access to clean water, and inadequate waste disposal, often increase the risk of infection by pathogenic bacteria such as E. coli and Giardia lamblia, which cause chronic diarrhea and worsen children's nutritional status (Ngure et al., 2014). Therefore, good sanitation programs should be part of the strategy to reduce stunting in areas with high prevalence.

An MSA value of 0.846 > 0.5 indicates that inadequate nutritional intake has a strong association with stunting. Inadequate intake of protein, iron, and zinc during the growth period can lead to metabolic disorders and impaired brain development in children.

According to the World Health Organization (2024), poor nutrition during the first 1,000 days of life can cause irreversible growth delays. A study by (de Onis et al., 2019) in the Journal of Nutrition shows that children who do not receive adequate intake of animal protein (meat, fish, eggs, and milk) are at higher risk of stunting compared to those who receive a balanced protein intake.

In addition, research by (Keats et al., 2019) found that iron and essential micronutrient supplementation during pregnancy and breastfeeding significantly reduced the incidence of stunting. Therefore, nutrition education programs for pregnant and breastfeeding mothers are needed to ensure that their children receive adequate nutrition during their growth period.

The results showed that socioeconomic status had a significant relationship with stunting, as indicated by an MSA value of 0.637 > 0.5. Economic factors influenced access to nutritious food, health services, and maternal education. According to the (Micha et al., 2022) children from low-income families are at greater risk of stunting due to limited access to nutritious food and quality health services. A study by Aguayo et al. (2023) in The Journal of Pediatrics also found that mothers with low levels of education tend to have limited nutritional knowledge, which contributes to feeding practices that are not appropriate for children's needs.

In addition, research by Victora et al. (2021) shows that unstable household conditions, including exposure to domestic violence, have a negative impact on child-rearing patterns and increase the risk of malnutrition. This emphasizes the importance of a multidisciplinary approach to tackling stunting, including family economic empowerment and improving access to maternal education.

CONCLUSIONS

This study identified four main factors that are significantly associated with stunting: parenting style, socioeconomic status, sanitation, and nutritional intake with the most dominant factors are parenting practices and sanitation. Poor parenting style is associated with suboptimal breastfeeding and complementary feeding and lack of psychosocial stimulation. While poor sanitation increases the risk of infections that hinder child growth. To reduce stunting rates in Klaten District, a multisectoral approach focusing on these four key factors is needed. More effective, evidence-based interventions could be key to achieving the national target of reducing stunting to 14% by 2024. The recommendations include: parenting education to improve mothers' understanding of nutrition, hygiene, and child stimulation; sanitation improvements through better access to clean water and elimination of open defecation; nutritional interventions through the provision of protein-rich foods for pregnant women and infants; and economic empowerment to improve access to nutritious food and health services

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