Determinants of Stunting Among Children Aged 24–59 Months in Kuningan District, Indonesia

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ABSTRACT

Stunting remains a persistent public health problem in Indonesia, including Kuningan District, where prevalence rates have shown fluctuating trends over recent years. In 2018, the prevalence of stunting was 8.2%, increasing slightly to 8.4% in 2019, declining to 5.4% during 2020–2021, and rising again to 6.6% in 2022. Stunting is a multifactorial condition influenced by inadequate parenting practices, limited access to health services, insufficient household food security, and poor water and sanitation conditions. This study aimed to analyze factors associated with stunting among children under five years of age in Kuningan District. This case–control study was conducted in Kuningan District, Indonesia. A total of 188 children aged 24–59 months were included, consisting of 94 stunted children (cases) and 94 non-stunted children (controls), selected using purposive sampling. Data were collected using structured questionnaires and analyzed using the Chi-square test to identify associations between independent variables and stunting incidence. The main findings indicated significant associations between maternal education level ($p = 0.001$), milk consumption patterns ($p = 0.029$), and parenting practices ($p = 0.027$) with stunting among children under five. In contrast, no significant associations were found between family income ($p = 0.166$) and the age of complementary feeding initiation ($p = 0.228$) with stunting. By identifying key maternal and behavioral factors associated with stunting, this study contributes to a better understanding of childhood stunting determinants at the district level. The findings highlight the importance of improving maternal education and child feeding practices as strategic interventions to reduce stunting prevalence. Future research should explore broader contextual and longitudinal factors to strengthen stunting prevention efforts in public health practice.

Keywords: Stunting; maternal education; family income; milk consumption; complementary feeding; parenting practices

INTRODUCTION

Stunting is one of the most critical global public health challenges, particularly in low- and middle-income countries (Targets, 2025)(Almasri et al., n.d.). Stunting, defined as impaired linear growth resulting from chronic undernutrition, reflects cumulative nutritional deficiencies and repeated exposure to adverse health conditions during the prenatal period, infancy, and early childhood (Black et al., 2011). The occurrence of stunting is closely related to maternal conditions before and during pregnancy, fetal development, and health problems experienced during early childhood, including
recurrent infectious diseases and other chronic health conditions (Uliyanti et al., 2017).

In Indonesia, stunting remains a major nutritional problem despite ongoing national efforts to reduce its prevalence. Data from the Indonesian Nutrition Status Survey (SSGI) reported that the prevalence of stunting among children under five in West Java Province decreased to 26.2% in 2021 (Beal et al., 2018). However, at the district level, stunting prevalence often shows fluctuating patterns. In Kuningan District, the prevalence of stunting was recorded at 8.2% in 2018 and slightly increased to 8.4% in 2019. Subsequent growth monitoring data indicated a decline to 5.35% in August 2021, followed by an increase to 7.3% in February 2022, corresponding to 5,135 stunted children out of 69,916 measured under-five children (Kuningan District Health Office, 2022). These fluctuations indicate that stunting remains an unresolved public health issue at the local level.

Nutritional intake is a key determinant of child growth, particularly the adequacy of macronutrients and micronutrients that support physical development. Insufficient intake of energy and protein has been consistently associated with impaired linear growth.

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Children with low protein and energy intake are at a significantly higher risk of experiencing stunting compared to those who receive adequate nutritional intake (Aritonang et al., 2020).

Previous studies have demonstrated that stunting is influenced by multiple interrelated factors. Mugianti et al. (2018) reported that low energy intake, infectious diseases, male sex, low maternal education, low protein intake, non-exclusive breastfeeding, low paternal education, and maternal employment were dominant contributors to stunting, largely driven by limited family knowledge regarding appropriate nutritional practices. Similarly, Ariati (2019) categorized the determinants of stunting into prenatal factors (such as maternal age and maternal nutritional status during pregnancy), postnatal factors (including exclusive breastfeeding, immunization history, and infectious diseases), and family characteristics (maternal education, paternal occupation, and socioeconomic status).

Socioeconomic status, commonly measured through household income, plays a crucial role in determining access to nutritious food, healthcare services, and a healthy living environment. Several studies have shown a significant relationship between household economic status and stunting. Kartika (2019) reported that children from low-income families had a substantially higher risk of stunting, while Pibriyanti et al. (2019) found that children from economically disadvantaged households were 15.3 times more likely to experience stunting compared to those from higher-income families (Pibriyanti et al., 2019).

According to the Indonesian Ministry of Health, stunting is caused by a combination of factors, including inadequate parenting practices, limited access to quality health services, insufficient availability of nutritious food at the household level, and poor access to clean water and sanitation. Given the multifactorial nature of stunting and the fluctuating prevalence observed in Kuningan District, further research is needed to comprehensively examine factors associated with stunting among children under five. Therefore, this study aimed to analyze factors related to the occurrence of stunting among children under five years of age in Kuningan District.

Despite extensive evidence on stunting determinants at national and provincial levels, a clear research gap remains at the district level in Kabupaten Kuningan, where stunting prevalence shows inconsistent trends over time. Previous studies have not adequately tested the combined role of key variables—particularly nutritional intake, socioeconomic status, and child health conditions—within a single analytical framework at the local level, resulting in fragmented and sometimes inconsistent findings. This study offers novelty by focusing on a district-specific context and simultaneously examining these interrelated factors to identify dominant contributors to stunting. The objective of this study is to analyze the association between nutritional intake, socioeconomic status, and child health-related factors with stunting among children under five in Kabupaten Kuningan, thereby generating operational evidence to inform targeted public health policies and stunting intervention programs at the district level.

METHOD

To guarantee the validity and trustworthiness of the results, this study takes a straightforward and methodical approach. The elements of the technique are listed below:

Research Type

This study employed a quantitative approach with a case–control design, using a 1:1 ratio between cases and controls. This design was selected to identify factors associated with stunting among children under five years of age in Kuningan District.

Population and Sample/Informants

The study population consisted of children aged 24-59 months residing in stunting locus areas of Kuningan District. Sample size calculation was performed using the Lemeshow formula, resulting in a minimum sample size of 94 participants for each group. Accordingly, a total of 188 children were included in the study, comprising 94 stunted children (case group) and 94 non-stunted children (control group).

A purposive sampling technique was applied to select study participants based on predefined inclusion and exclusion criteria. The inclusion criteria for the case group were children aged 24–59 months who were classified as stunted in November 2022, resided in stunting locus areas of Kuningan District, and whose caregivers agreed to participate in the study. The exclusion criteria for the case group included children with

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congenital abnormalities or physical disabilities. For the control group, the inclusion criteria were children aged 24–59 months who were not classified as stunted, resided in stunting locus areas of Kuningan District, and whose caregivers consented to participate. The exclusion criteria for the control group were children with congenital abnormalities or physical disabilities.

Research Location
The study was conducted in Kuningan District, Indonesia, from November to December 2022, covering designated stunting locus areas.

Data Collection Procedures
Data were collected using a structured questionnaire administered to caregivers of eligible children. The questionnaire was used to obtain information on maternal characteristics, feeding practices, parenting patterns, and household socioeconomic conditions.

Data Analysis
Data analysis consisted of univariate and bivariate analyses. Univariate analysis was conducted to describe the distribution of each study variable, while bivariate analysis was performed using the Chi-square test to examine associations between independent variables and stunting status. Statistical analysis was conducted using Statistical Package for the Social Sciences (SPSS) software, and a p-value of less than 0.05 was considered statistically significant.

Ethical Approval
This study was conducted in accordance with ethical principles for research involving human participants. Ethical approval
was obtained from the Health Research Ethics Committee prior to data collection. Written informed consent was obtained from all participants' parents or legal guardians after a clear explanation of the study objectives, procedures, potential risks, and benefits. Confidentiality and anonymity of participant information were strictly maintained throughout the study.

RESULT

The results of research on factors related to stunting incidents in Kuningan Regency are presented in the following table.

A total of 188 children aged 24–59 months participated in this study, consisting of 94 stunted children (case group) and 94 non-stunted children (control group). Maternal characteristics included age and occupation, while child characteristics included sex distribution.

Table 1. Distribution of Maternal and Child Characteristics

Characteristics	n	%
Maternal Age (years)		
< 25	11	5.9
25–35	109	58.0
> 35	68	36.2
Maternal Occupation		
Housewife	172	91.5
Private employee	5	2.7
Teacher	2	1.1
Civil servant	3	1.6
Housemaid	4	2.1
Entrepreneur	1	0.5
Laborer	1	0.5
Child Sex		
Male	87	46.3
Female	101	53.7
Total	188	100

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Most mothers were aged 25–35 years (58.0%) and predominantly housewives (91.5%). Female children accounted for a slightly higher proportion (53.7%) than male children.

Distribution of Study Variables

The distribution of key independent variables, including maternal education level, family income, milk consumption patterns, age of complementary feeding initiation, and parenting practices, is presented in Table 2.

Table 2. Distribution of Study Variables

Variables	n	%
Maternal Education Level		
Low	75	39.9
High	113	60.1
Family Income Level		
Low	124	66.0
High	64	34.0
Milk Consumption Pattern		
Occasionally	98	52.1
Frequently	90	47.9
Age of Complementary Feeding Initiation		
Inappropriate	44	23.4
Appropriate	144	76.6
Parenting Practices		
Poor	106	56.4
Good	82	43.6
Total	188	100

More than half of mothers had a high education level (60.1%), while the majority of families had low income levels (66.0%). Most children received complementary feeding at an appropriate age (76.6%).

Bivariate Analysis of Factors Assosciated with Stunting

Bivariate analysis was performed using the Chi-square test to examine associations between independent variables and stunting incidence. The results are presented in Table 3.

Table 3. Association between Maternal and Household Factors and Stunting

Factors	Stunting (Cases) n (%)	Non-stunting (Controls) n (%)	Total n (%)	p-value	OR
Maternal Education					
Low	49 (52.1)	26 (27.7)	75 (39.9)	0.001	2.848
High	45 (47.9)	68 (72.3)	113 (60.1)		
Family Income					
Low	67 (71.3)	57 (60.6)	124 (66.0)	0.166	1.611
High	27 (28.7)	37 (39.4)	64 (34.0)		
Milk Consumption Pattern					
Occasionally	57 (60.6)	41 (43.6)	98 (52.1)	0.029	1.991
Frequently	37 (39.4)	53 (56.4)	90 (47.9)		
Complementary Feeding Initiation Age					
Inappropriate	26 (27.7)	18 (19.1)	44 (23.4)	0.228	1.614

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Appropriate	68 (72.3)	76 (80.9)	144 (76.6)		
Parenting Practices					
Poor	61 (64.9)	45 (47.9)	106 (56.4)	0.027	2.013
Good	33 (35.1)	49 (52.1)	82 (43.6)		
Total	94 (100)	94 (100)	188 (100)		

Maternal education level, milk consumption patterns, and parenting practices were significantly associated with stunting ($p < 0.05$). In contrast, family income level and age of complementary feeding initiation were not statistically associated with stunting.

DISCUSSION

This study examined factors associated with stunting among children aged 24–59 months in Kuningan District. The findings indicate that maternal education level, milk consumption patterns, and parenting practices were significantly associated with stunting, while family income level and the age of complementary feeding initiation were not statistically associated with stunting incidence. These results highlight the multifactorial nature of stunting and the importance of maternal and behavioral factors in child growth outcomes.

Maternal Education and Stunting

Maternal education was found to be significantly associated with stunting, with children of mothers with lower education levels having a higher risk of stunting (Victora et al., 2008)(Ruel et al., 2013). The odds ratio indicated that children whose mothers had low education were approximately 2.8 times more likely to experience stunting compared to those whose mothers had higher education levels. This finding is consistent with previous studies reporting that maternal education plays a crucial role in shaping health-related knowledge, childcare practices, and nutritional decision-making within households. Fitri (2019) reported a similar increased risk of stunting among children of mothers with lower educational attainment, while Sutarto et al. (2020) also demonstrated a significant association between maternal education and stunting (Rahim & Rusisska, 2019)(Sutarto et al., 2020).

Higher maternal education may enhance a mother's ability to access, understand, and apply information related to child nutrition, health services, and appropriate feeding practices. Although formal education is important, health knowledge can also be acquired through non-formal channels such as community health education, counseling at integrated health posts (posyandu), and mass media. Therefore, strengthening maternal health education programs may contribute substantially to stunting prevention efforts.

Family Income and Stunting

In this study, family income was not statistically associated with stunting, despite a higher proportion of stunted children originating from low-income households. Although the odds ratio suggested a greater likelihood of stunting among children from low-income families, this association did not reach statistical significance. This finding contrasts with several studies that have identified household economic status as a key determinant of stunting(Pacheco et al., 2017).

The lack of a significant association in this study may indicate that other factors, such as caregiving practices, maternal education, or access to public health services, play a more dominant role in influencing child growth in the study area. Similar findings were reported by Syihab et al. (2021), who found no significant relationship between socioeconomic status and stunting. These results suggest that economic factors alone may not fully explain stunting without considering behavioral and environmental determinants (Syihab et al., 2021).

Milk Consumption Patterns and Stunting

Milk consumption patterns were significantly associated with stunting, with children who consumed milk only occasionally having nearly twice the risk of stunting compared to those who consumed milk frequently. This finding aligns with previous studies indicating that milk intake contributes positively to linear growth in children. Studies by Mega (2018) and Sherly (2016) similarly reported significant associations between milk

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consumption and reduced stunting risk (Widiarta et al., 2023).

Milk is an important source of animal protein and essential micronutrients such as calcium, zinc, iron, and vitamins A and D, which are critical for bone development and overall growth. Animal protein intake has been recognized as a key factor in skeletal development and gut microbiota maintenance, which supports nutrient absorption (Pereira, 2014). However, milk is not the sole source of animal protein; dietary diversity, including consumption of meat and eggs, also plays an important role in ensuring adequate nutrient intake (Eadey et al., 2018). Children with normal nutritional status tend to have more diverse diets than stunted children, emphasizing the importance of balanced and varied food consumption.

Age of Complementary Feeding Initiation and Stunting

The age of complementary feeding initiation was not significantly associated with stunting in this study. Although children who received complementary feeding at an inappropriate age showed a higher likelihood of stunting, the association was not statistically significant. This finding differs from studies that have reported early or delayed introduction of complementary foods as a risk factor for stunting (Khasanah et al., 2016)(Lisnawaty et al., 2020).

One possible explanation is that public health messaging regarding appropriate complementary feeding practices has been widely disseminated in the study area, as reflected by the high proportion of caregivers who introduced complementary feeding at the recommended age of six months or older. Nevertheless, factors such as food quality, portion size, and dietary diversity may have a stronger influence on child growth than timing alone, and these aspects warrant further investigation.

Parenting Practices and Stunting

Parenting practices were significantly associated with stunting, with poor parenting practices doubling the risk of stunting among children. This finding supports previous research demonstrating that inadequate caregiving behaviors, including feeding practices, hygiene, and health-seeking behavior, contribute substantially to chronic undernutrition (Engle et al., 2011). Indah (2019) reported an even higher risk of stunting among children exposed to poor parenting practices (Indah Nurdin et al., 2019).

Effective parenting practices encompass not only adequate feeding but also responsive caregiving, disease prevention, and utilization of health services. Poor caregiving may limit a child's nutritional intake and increase vulnerability to infections, both of which negatively affect growth. Therefore, interventions aimed at improving parenting skills and caregiving behaviors are essential components of comprehensive stunting prevention strategies.

Interpretation of Key Findings

The key findings of this study indicate that stunting among children aged 24–59 months in Kuningan District is more strongly associated with maternal and behavioral factors than with purely economic indicators. The significant associations observed for maternal education, milk consumption patterns, and parenting practices suggest that stunting in this context is closely linked to knowledge-based, caregiving, and dietary behaviors within households.

Maternal education emerged as a central determinant of stunting. This finding implies that a mother's educational level may influence child growth indirectly through improved understanding of nutrition, health-seeking behavior, and childcare practices. Mothers with higher educational attainment are more likely to access health information, utilize maternal and child health services, and make informed decisions regarding feeding and caregiving. Therefore, maternal education can be interpreted as a proxy for health literacy, which plays a critical role in shaping long-term child nutritional outcomes.

The significant association between milk consumption patterns and stunting highlights the importance of adequate intake of animal-source foods in supporting linear growth. Milk consumption reflects not only dietary quality but also household feeding priorities and caregiving attention to child nutrition. This finding suggests that insufficient intake of nutrient-dense foods may contribute to chronic growth faltering, even in settings where complementary feeding is initiated at the appropriate age. Thus, the quality and consistency of children's diets appear to be more influential than timing alone.

Parenting practices were also found to be a key factor associated with stunting. This

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finding underscores the role of caregiving behaviors, including feeding responsiveness, hygiene practices, and health service utilization, in determining child growth outcomes. Poor parenting practices may limit dietary intake and increase children's susceptibility to infections, both of which negatively affect linear growth. The interpretation of this result emphasizes that stunting prevention requires not only food-based interventions but also improvements in caregiving quality and parental engagement.

In contrast, family income level and the age of complementary feeding initiation were not significantly associated with stunting in this study. These findings suggest that economic resources alone may not guarantee optimal child growth if not accompanied by appropriate knowledge and caregiving practices. Similarly, while timely initiation of complementary feeding is important, it may not sufficiently prevent stunting without attention to food quality, diversity, and caregiving behaviors.

Overall, the key findings of this study indicate that stunting in Kuningan District is best understood as a multifactorial condition in which maternal education and caregiving-related factors play a more decisive role than household income or feeding timing. These interpretations reinforce the need for integrated stunting prevention strategies that combine nutrition education, behavioral change interventions, and strengthening of maternal and child health services.

Comparison with Previous Studies

The findings of this study are largely consistent with previous research examining determinants of stunting among children under five. The significant association between maternal education level and stunting aligns with studies conducted by Fitri (2019) and Sutarto et al. (2020), which reported that children of mothers with lower educational attainment had a substantially higher risk of stunting. Similar odds ratios reported in these studies indicate that maternal education remains a critical determinant of child growth, as it influences knowledge, attitudes, and practices related to nutrition, health service utilization, and childcare behaviors.

In contrast to some previous findings, this study did not find a statistically significant association between family income and stunting. While studies by Sutarto et al. (2020) and Pacheco et al. (2017) demonstrated a significant relationship between socioeconomic status and stunting, the present findings are consistent with research by Syihab et al. (2021), which reported no significant association between household economic status and stunting. These inconsistencies across studies suggest that economic status alone may not directly determine stunting risk without considering mediating factors such as parental knowledge, food utilization, and access to public health interventions.

The significant association between milk consumption patterns and stunting observed in this study is supported by findings from Mega (2018) and Sherly (2016), who reported that inadequate milk intake was associated with impaired linear growth in children. The role of milk as a source of animal protein and essential micronutrients has been well documented, particularly its contribution to skeletal development and nutrient absorption (Pereira, 2014). Furthermore, Widyaningsih et al. (2018) emphasized that dietary diversity, rather than reliance on a single food source, is crucial in preventing chronic undernutrition (Widyaningsih et al., 2018).

Regarding complementary feeding practices, the absence of a significant association between the age of complementary feeding initiation and stunting differs from findings reported by Khasanah et al. (2016) and Lisnawaty et al. (2020), who identified early introduction of complementary foods as a risk factor for stunting. However, the current findings may reflect improved public awareness and adherence to recommended complementary feeding practices, as indicated by the high proportion of caregivers introducing complementary feeding at the appropriate age.

Finally, the significant association between parenting practices and stunting corroborates previous studies, including Indah (2019), which demonstrated that poor parenting practices substantially increased the risk of stunting. These findings reinforce the notion that caregiving behaviors play a pivotal role in shaping child nutritional outcomes, particularly in contexts where economic resources are limited.

Limitations and Cautions

Several limitations should be considered when interpreting the findings of this study. First, the case–control design limits the ability to establish causal relationships between the

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identified factors and stunting. The observed associations indicate relationships but cannot confirm temporal or causal pathways.

Second, data collection relied on self-reported information obtained through structured questionnaires, which may be subject to recall bias or social desirability bias, particularly regarding feeding practices and parenting behaviors. Third, this study was conducted exclusively in stunting locus areas of Kuningan District, which may limit the generalizability of the findings to other regions with different socioeconomic or cultural contexts.

Additionally, potential confounding variables such as birth weight, maternal nutritional status during pregnancy, and household sanitation conditions were not included in the analysis. These factors may have influenced child growth outcomes and should be interpreted as possible sources of residual confounding.

Recommendations for Future Research

Future studies are recommended to employ longitudinal or cohort study designs to better elucidate causal relationships between maternal, household, and behavioral factors and stunting. Incorporating biological and environmental variables, such as birth weight, maternal nutritional status, and sanitation conditions, would provide a more comprehensive understanding of stunting determinants.

Further research should also explore the quality and diversity of complementary feeding practices rather than focusing solely on the timing of introduction. Qualitative approaches may be valuable in capturing contextual factors, cultural beliefs, and caregiving dynamics that influence feeding and parenting behaviors. Moreover, intervention-based studies evaluating the effectiveness of maternal education and parenting support programs are needed to inform evidence-based stunting prevention strategies at the community level.

CONCLUSION

This study concludes that stunting among children aged 24–59 months in Kuningan District is significantly associated with maternal education level, milk consumption patterns, and parenting practices. Children of mothers with lower educational attainment, inadequate milk consumption, and poor parenting practices were more likely to experience stunting. In contrast, family income level and the age of complementary feeding initiation were not significantly associated with stunting in this study.

These findings emphasize the importance of addressing behavioral and maternal factors in stunting prevention efforts. Strengthening maternal education, improving child feeding practices, and promoting appropriate parenting behaviors should be prioritized within community-based nutrition and public health programs. Integrating nutrition education into existing maternal and child health services may enhance the effectiveness of stunting reduction strategies at the district level.

Overall, this study provides evidence to support targeted, behavior-focused interventions as key components in reducing stunting prevalence and improving child growth outcomes in Kuningan District.

This study has several limitations that should be considered when interpreting the findings. The cross-sectional design restricts causal inference, and the sample size and study setting were limited to Kuningan District, which may reduce generalizability. In addition, several important determinants of stunting, such as environmental sanitation, access to clean water, and maternal nutritional status during pregnancy, were not examined. Nevertheless, the findings provide practical implications for policy and intervention. The Kuningan District Health Office is encouraged to strengthen maternal education and parenting programs through integrated nutrition counseling at posyandu and primary health centers, prioritize early identification of high-risk children, and enhance behavior-based interventions focusing on appropriate feeding and caregiving practices to support local stunting reduction efforts.

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