

Original Article

## **Risk Factors of Stunting in Children Under Two Years of Age in Donggala District Central of Sulawesi**

**Fahmi Hafid<sup>1\*</sup>, Nasrul<sup>2</sup>, A Bungawati<sup>3</sup>, Kadar Ramadhan<sup>4</sup>**

<sup>1</sup> Department of Nutrition, Poltekkes Kemenkes Palu, Palu, Central of Sulawesi, Indonesia

<sup>2</sup> Department of Nursing, Poltekkes Kemenkes Palu, Palu, Central of Sulawesi, Indonesia

<sup>3</sup> Department of Sanitation, Poltekkes Kemenkes Palu, Palu, Central of Sulawesi, Indonesia

<sup>4</sup> Department of Midwifery, Poltekkes Kemenkes Palu, Palu, Central of Sulawesi, Indonesia

(Correspondence author's, e-mail, hafid.fahmi79@gmail.com/085255530999)

### **ABSTRACT**

*Stunting is a critical public health issue, with multifactorial risk factors that can include a child's gender, birth length, low birth weight, and unhealthy snack consumption. The aim of this research is to analyze the risk factors for stunting in toddlers in Donggala District. This study employed an analytical approach with a cross-sectional design. The research was conducted in Donggala District, with the target population being children aged 6-23 months. A sample of 397 toddlers was obtained through cluster simple random sampling. The respondents were mothers of the toddlers. Data collection took place in August 2023. The independent variables included in the study were the characteristics of mothers and households, child characteristics, disease history, healthcare access, and dietary intake. The dependent variable was stunting status. Stunting data were obtained by measuring the child's length using Length Board Measuring (LMB) and determining age by reading the birth certificate or the child's KIA book. Other data were collected through the Kobocollect questionnaire. Data analysis was conducted using SPSS version 22.00, with Z-Score values based on WHO-Antro 2005 standards. Multivariate analysis employed backward logistic regression. The research results indicated that significant factors contributing to the risk of stunting in toddlers in Donggala District included the child's gender, birth length, low birth weight, and consumption of unhealthy snacks. Birth length (AOR=1.8, 95% CI: 1.1-3.1), child gender (AOR=1.7, 95% CI: 1.0-2.7), low birth weight (AOR=2.3, 95% CI: 1.0-5.2), and unhealthy snack consumption (e.g., chips, cheese balls) (AOR=2.0, 95% CI: 1.0-3.8) were all significant factors. Policies addressing aspects such as nutrition, maternal and child healthcare services, supervision of unhealthy snacks, and monitoring and evaluation would help reduce the risk of stunting and improve the quality of life for children in Donggala District.*

**Keywords : Stunting, Child's Gender, Birth Length, Low Birth Weight, Unhealthy Snack Consumption**

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## **INTRODUCTION**

Stunting, as assessed anthropometrically, refers to a child's height in relation to their age, with a Z-score <-2 SD according to WHO standards<sup>1-4</sup>. Stunting is recognized as one of the most critical public health issues<sup>2,3,5,6</sup>. It typically manifests early in life, presenting as a long-term hindrance to linear growth and often proving difficult to recover from in subsequent growth stages<sup>6-9</sup>. The risk factors for stunting are multifactorial<sup>3,4,10-14</sup>. can vary across variables, such as a child's gender, birth length, low birth weight, and unhealthy snack consumption.

Boys have a higher risk of experiencing stunting compared to girls<sup>11,14,15</sup>. Shorter children have a higher risk of experiencing stunting compared to taller ones<sup>16-22</sup>. Children with a history of low birth weight have a higher risk of experiencing stunting compared to those with normal birth weight<sup>4,6,10,14,23-25</sup>. Children who consume unhealthy snacks have a higher risk of experiencing stunting compared to those who do not consume them<sup>26-28</sup>.

Prevalence trends of stunting show a decrease<sup>29-32</sup>. Nasrul et al.'s research indicates a 6.2% decrease in the last 9 years or an average of 0.6% per year<sup>33</sup>. Although several studies have been conducted, the prevalence of stunting

cannot be estimated<sup>34</sup>. In 2023, Donggala Regency has 41 stunting locus villages. The results of this research are expected to provide recommendations for the academic study of stunting prevention in Donggala Regency. The unknown risk factors for stunting in toddlers in Donggala Regency are the basis for conducting this research. The aim of this study is to analyze the risk factors for stunting in toddlers in Donggala Regency.

## METHOD

This is an analytic research with a cross-sectional study design. The research was conducted in Donggala Regency. The population consisted of toddlers aged 6-23 months. A sample of 397 toddlers was obtained through cluster simple random sampling. The respondents were mothers of the toddlers. Data collection was carried out in August 2023. The variables included in the study were characteristics of mothers and households, characteristics of children, medical history, healthcare access, and dietary intake as independent variables, while stunting status was the dependent variable. Stunting data were obtained by measuring the length of the toddlers using a Length Board Measuring (LMB) and determining their age by reading their birth certificates or child's Integrated Health Post (Posyandu) book. Other data were collected through Kobocollect questionnaire. Data analysis was conducted using SPSS version 22.00. To determine the Z-Score for TB/U, WHO-Anthro 2005 software was used. Data analysis involved three stages. First, univariate analysis was conducted to describe the frequency distribution of each variable. Second, bivariate analysis was performed to assess the relationship between the dependent and independent variables and to calculate the odds ratio (OR), which represents the relative risk between the stunting group and the normal group using the chi-square test with significance set at  $p < 0.05$ . Third, multivariate analysis was conducted using backward logistic regression. Ethical approval was obtained from the Ethics Commission of Poltekkes Kemenkes Palu with approval number 0014/KEPK-KPK/I/2023 dated February 14, 2023, and Research Permit was obtained from the Central Sulawesi Provincial Government, Regional Unity of Nationality and Politics, with permit number 070/4006/Bid.III-BKBPD/2023.

## RESULTS

The research had a total of 397 respondents, consisting of 45.8% males and 54.2% females. The majority (78.6%) of the children were aged between 7 and 23 months. Most children (60.7%) had a birth length greater than 48 cm, and the majority (91.2%) had a normal birth weight. Early breastfeeding initiation was practiced by 37.0% of the mothers. The majority of mothers (60.7%) provided exclusive breastfeeding to their children, and most children (75.6%) were still receiving breast milk. A significant portion of the children (77.3%) had experienced illness in the past 12 months, with a small number having a history of respiratory infections (11.3%), diarrhea (14.1%), pulmonary tuberculosis (0%), measles (1.8%), and parasitic infections (0.2%).

The majority of the respondents utilized healthcare facilities (84.1%). Approximately half of the mothers provided stimulation to their children (52.4%), and only a small proportion received supplementary feeding (14.9%). Most respondents had access to clean drinking water sources (93.4%) and family latrines (78.1%). A significant portion of the families had members who smoked (68.0%).

Characteristics of the Respondent Mothers: The majority of the mothers were aged 20 years and above (94.2%). Most had experienced normal childbirth (83.9%). The majority of mothers had three or fewer children (82.8%). The majority had an inter-birth interval of more than 3 years (82.9%). The majority of mothers had at least 9 years of education (75.8%).

Water was the most common complementary food (65.0%), while foods like crackers and cheese balls were less common (13.1%). Many respondents did not provide vitamin A-rich complementary foods such as orange/red-colored vegetables and fruits to their children. In 2023, the prevalence of stunting in Donggala Regency was 26.7%, while 73.3% of children had normal nutritional status.

**Table 1. The prevalence of stunting in children under two years of age in Donggala Regency.**

Nutritional Status	n (397)	%
Stunting	106	26,7
Normal	291	73,3

**Table 2. The distribution of stunting in children under two years of age among districts in Donggala Regency**

Sub-District	Nutritional Status				p-value
	Normal		Stunting		
	n (291)	%(73,3)	n (106)	%(26,7)	
Rio Pakava	16	80,0	4	20,0	0,000
Pinembani	8	80,0	2	20,0	
Banawa	56	84,9	10	15,6	
Banawa Selatan	44	73,3	16	26,7	
Banawa Tengah	6	60,0	4	40,0	
Labuan	6	60,0	4	40,0	
Tanantovea	18	85,7	3	14,3	
Sindue	24	80,0	6	20,0	
Sindue Tombusabora	15	75,0	5	25,0	
Sirenja	6	60,0	4	40,0	
Balaesang	7	77,8	2	22,2	
Balaesang Tanjung	3	15,0	17	85,0	
Dampelas	23	74,2	8	25,8	
Sojol	43	71,7	17	28,3	
Sojol Utara	16	80,0	4	20,0	

Cross-tabulation provides a deeper insight into the relationship between specific risk factors and the nutritional status of toddlers in Donggala Regency. In this table, we can observe how the proportions of children experiencing stunting and those with normal nutritional status vary based on various factors. Ownership of a family latrine significantly influences the prevalence of stunting. Children from families with latrines have a lower prevalence of stunting compared to those from families without latrines (very low p-value, <0.003).

Children with a birth length  $\geq 48$  cm have a lower prevalence of stunting compared to those with a birth length  $< 48$  cm (p-value=0.002). Children with normal birth weight have a lower prevalence of stunting compared to those with low birth weight (p-value=0.008). The provision of supplementary feeding (PMT) has a significant impact on the prevalence of stunting. Children receiving PMT have a lower prevalence of stunting compared to those who do not receive PMT (very low p-value, 0.000). There is no significant difference in the prevalence of stunting between children who receive stimulation and those who do not. The p-value (0.142) is not significant. There is no significant difference in the prevalence of stunting between children from families with smokers and those without. The p-value (0.479)

is not significant.

There is no significant difference in the prevalence of stunting between children with a history of illness and those without. The p-value (0.780) is not significant. There is no significant difference in the prevalence of stunting between children with a history of respiratory infections (ISPA) and those without. The p-value (0.471) is not significant. There is no significant difference in the prevalence of stunting between children with a history of diarrhea and those without. The p-value (0.504) is not significant. No children have a history of pulmonary tuberculosis. A history of measles does not significantly influence the prevalence of stunting (p-value=0.454).

Children with a history of parasitic infections have a higher prevalence of stunting than those without, although the p-value (0.097) has not reached a high level of significance. From the analysis of this table, we can see that several factors such as family latrine ownership, birth length, birth weight, and PMT provision have a significant relationship with the prevalence of stunting. Children who do not consume plain water have a higher prevalence of stunting (18.71%) compared to those who do (31.0%). The p-value (0.008) indicates that this difference is significant. Children who consume sweetened beverages like syrup, honey, tea, coffee, sugary water, fruit juice, or sweetened

condensed milk have a much higher prevalence of stunting (78.6%) compared to those who do not (24.8%). This difference is highly significant with a very low p-value (0.000). There is no significant difference in the prevalence of stunting between children who consume these foods and those who do not. The p-value (0.152) is not significant. There is no significant difference in the prevalence of stunting between children who consume legumes, tofu, or tempeh and those who do not. The p-value (0.234) is not significant.

There is no significant difference in the prevalence of stunting between children who consume milk other than breast milk and those who do not. The p-value (0.284) is not significant. There is no significant difference in the prevalence of stunting between children who consume beef, chicken, fish, or organ meats and those who do not. The p-value (0.198) is not significant. There is no significant difference in the prevalence of stunting between children who consume eggs and those who do not. The p-value (0.791) is not significant. There is no significant difference in the prevalence of stunting between children who consume these vegetables and those who do not. The p-value (0.776) is not significant. There is no significant difference in the prevalence of stunting between children who consume dark green leafy vegetables and those who do not. The p-value (0.143) is not significant. There is no significant difference in the prevalence of stunting between children who consume these fruits and those who do not. The p-value (0.342) is not significant. There is no significant difference in the prevalence of stunting between children who consume these vegetables and those who do not. The p-value (0.154) is not significant. Children who do not consume other fruits have a higher prevalence of stunting (41.5%) compared to those who do (23.8%). This difference is significant with a p-value (0.003).

From the analysis of this table, we can conclude that the consumption of certain types of food and beverages, such as plain water and sweetened drinks like syrup, honey, tea, coffee, sugary water, fruit juice, and sweetened condensed milk, has a significant correlation

with the prevalence of stunting. Therefore, promoting a healthy and balanced diet can be a crucial step in reducing stunting in Donggala Regency.

The analysis from the multivariate analysis identifying factors contributing to the risk of stunting in toddlers in Donggala Regency:

**Child's Gender:** The p-value for child's gender is 0.035, indicating a significant relationship between child's gender and the risk of stunting. The Adjusted Odds Ratio (AOR) for boys is 1.7, meaning that boys have a 1.7 times higher risk of experiencing stunting compared to girls. The 95% Confidence Interval (95% CI) for the AOR of child's gender ranges from 1.0 to 2.7.

**Birth Length:** The p-value for birth length is 0.020, suggesting a significant relationship between birth length and the risk of stunting. The AOR for birth length less than 48 cm is 1.8, implying that children with a birth length less than 48 cm have a 1.8 times higher risk of experiencing stunting compared to those with a birth length greater than 48 cm. The 95% Confidence Interval (95% CI) for the AOR of birth length ranges from 1.1 to 3.1.

**Low Birth Weight:** The p-value for low birth weight is 0.043, indicating a significant relationship between low birth weight and the risk of stunting. The AOR for low birth weight is 2.3, meaning that children with low birth weight have a 2.3 times higher risk of experiencing stunting compared to those with normal birth weight. The 95% Confidence Interval (95% CI) for the AOR of low birth weight ranges from 1.0 to 5.2.

**Unhealthy Snack Consumption (Kerupuk, Cheese Ball):** The p-value for unhealthy snack consumption is 0.047, suggesting a significant relationship between the consumption of unhealthy snacks like kerupuk and cheese ball and the risk of stunting. The AOR for unhealthy snack consumption is 2.0, indicating that children who consume unhealthy snacks have a 2.0 times higher risk of experiencing stunting compared to those who do not consume them. The 95% Confidence Interval (95% CI) for the AOR of unhealthy snack consumption ranges from 1.0 to 3.8.

**Table 3. Cross-tabulation of Risk Factors for Stunting in Children Under Two Years of Age in Donggala Regency**

Variable	Nutritional Status				p-value
	Normal		Stunting		
	n (291)	% (71,8)	n (106)	%(28,2)	
<b>Mother's Age</b>					
<20 years	16	69,6	7	30,4	0,677
≥20 years	275	73,5	99	26,5	
<b>Mother's Education</b>					
<9 years	255	74,8	76	25,2	0,247
≥9 years	66	68,8	30	31,2	
<b>Child's Gender</b>					
Male	128	70,3	54	29,7	0,218
Female	163	75,8	52	24,2	
<b>Type of Delivery</b>					
Normal	238	71,5	95	28,5	0,060
Cesarean Section	53	82,8	11	17,2	
<b>Child's Age</b>					
0-6 Months	68	80,0	17	20,0	0,115
7-23 Months	223	71,5	89	28,5	
<b>Source of Drinking Water</b>					
Not Improved	18	69,2	8	30,8	0,628
Improved	273	73,6	98	26,4	
<b>Family Latrine Ownership</b>					
No	53	60,9	34	39,1	<0,003
Yes	238	76,8	72	23,2	
<b>Early Breastfeeding Initiation</b>					
No	102	69,4	45	30,6	0,177
Yes	189	75,6	61	24,4	
<b>Birth Length</b>					
<48 cm	99	64,3	55	35,7	0,002
≥48 cm	187	78,6	51	21,4	
<b>Birth Weight</b>					
Low	19	54,3	16	45,7	0,008
Normal	272	75,1	90	24,9	
<b>Exclusive Breastfeeding</b>					
Not exclusive	117	75,0	39	25,0	0,538
Exclusive	174	72,2	67	27,8	
<b>Exclusive Breastfeeding (During the Study)</b>					
No	71	73,2	26	26,8	0,979
Yes	220	73,3	80	26,7	
<b>Food Insecurity</b>					
Yes	20	62,5	12	37,5	0,150
No	271	74,3	94	25,7	
<b>Number of Children</b>					
>3 Children	51	75,0	17	25,0	0,728
≤3 Children	240	72,9	89	27,1	
<b>Birth Interval</b>					
≤3 years	51	75,0	17	25,0	0,728
>3 years	240	72,9	89	27,1	
<b>Healthcare Facility Utilization</b>					
No	44	69,8	19	30,2	0,499
Yes	247	73,9	87	26,1	
<b>Supplementary Feeding (PMT)</b>					
No	266	78,7	72	21,3	<b>0,000</b>
Yes	25	42,4	34	57,6	
<b>Stimulation Provision</b>					

No	145	76,7	44	23,3	<b>0,142</b>
Yes	146	70,2	62	29,9	
<b>Family Smoking</b>					
No	96	75,6	31	24,4	0,479
Yes	195	72,2	75	27,8	
<b>History of Illness</b>					
No	67	74,4	23	25,6	0,780
Yes	224	73,0	83	27,0	
<b>History of Respiratory Infections (ISPA)</b>					
No	256	72,7	96	27,3	0,471
Yes	35	77,8	10	22,2	
<b>History of Diarrhea</b>					
No	252	73,9	89	26,1	0,504
Yes	39	69,7	17	30,3	
<b>History of Measles</b>					
No	285	73,1	105	26,9	0,454
Yes	6	85,7	1	14,3	
<b>History of Parasitic Infections</b>					
No	291	73,5	105	26,5	0,097
Yes	0	0	1	100	
<b>Consumption of Unhealthy Snacks</b>					
No	258	74,8	87	25,2	0,085
Yes	33	64,5	19	36,5	

**Table 4** Multivariate Analysis of Risk Factors for Stunting in Children Under Two Years of Age in Donggala Regency

Variables	p-value	AOR	95%CI	
			Lower	Upper
<b>Child's Gender</b>				
Male	0,035	1,7	1,0	2,7
Female		1,0		
<b>Birth Length</b>				
<48 cm	0,020	1,8	1,1	3,1
≥48 cm		1,0		
<b>Low Birth Weight</b>				
Yes	0,043	2,3	1,0	5,2
No		1,0		
<b>Unhealthy Snack Consumption</b>				
No	0,047	1,0	1,0	3,8
Yes		2,0		

## DISCUSSION

Efforts to reduce stunting in Donggala Regency are a complex challenge that requires careful strategies. Research data shows significant variations in stunting rates among villages and districts in this region. Local factors such as access to resources, dietary patterns, and social environments influence the stunting rates in each location. Therefore, prevention and intervention programs need to be tailored to the specific needs of each village and district.

Differentiation by Location: High stunting rates in some villages, like Malino and Malei, require more intensive interventions.

Stunting prevention programs should prioritize these villages, focusing on improving access to nutrition and healthcare. Villages with low stunting rates or even no stunting cases, such as Ganti and Loli Dondo, can serve as best practices. Good practices from these villages should be shared and replicated elsewhere.

Attention to Specific Risk Factors: Factors such as child's gender, birth length, and low birth weight are significant risk factors. Stunting prevention programs should consider these risks when determining intervention targets. Unhealthy snack consumption like kerupuk and cheese ball is also associated with stunting risk. Nutrition campaigns should include education on balanced diets and

promote the replacement of unhealthy snacks with nutritious foods.

**Family Latrine Ownership:** Family latrine ownership has a significant impact on stunting prevalence. Sanitation programs prioritizing the construction of family latrines in villages with high stunting rates should be accelerated. While there's no significant difference in stunting prevalence between mothers under 20 years old and those 20 years and older, nutrition education and prenatal and postnatal care remain essential. Pregnant mothers need special attention in this program. Children who do not consume clean water or consume unhealthy beverages are at higher risk of stunting. Nutrition programs should include campaigns to increase clean water consumption and promote exclusive breastfeeding.

**Collaboration with Local Stakeholders:** Collaboration with local stakeholders such as community groups, health workers, and village leaders is crucial. They can help support the implementation of stunting prevention programs. **Continuous Monitoring and Evaluation:** To measure program success, a strong monitoring and evaluation system should be implemented. Collected data can be used to identify emerging issues and direct resources to areas needing further attention.

**Comprehensive Approach:** Ultimately, efforts to reduce stunting in Donggala Regency should focus on a comprehensive approach, considering aspects of health, nutrition, sanitation, and education. Local governments, in collaboration with the Ministry of Health of Indonesia, should work with NGOs, international organizations, and the private sector to achieve better outcomes in addressing the issue of stunting and improving the quality of life for children in this region, in line with the vision of health transformation set by the Ministry of Health of Indonesia.

The findings of this research indicate that child's gender, birth length, low birth weight, and consumption of unhealthy snacks are significantly associated with the risk of stunting in toddlers in Donggala Regency.

These research findings are consistent with those of Quamme (2022) in Sub-Saharan Africa, as well as the findings of Beckmann et al. (2021) in South Africa and Liang et al. (2020) in China, which all show that boys have a higher risk of experiencing stunting compared to girls<sup>11,14,15</sup>.

Anak yang terlahir pendek memiliki

risiko lebih tinggi untuk mengalami stunting dibandingkan dengan anak yang terlahir tidak pendek relevan dengan temuan Krebs NF et al (2022) penelitian dari Madinar M dkk (2021) di Central Jakarta dan penelitian dari Hastuti et al (2020), penelitian Pimenta JRR (2020). Penelitian Dhaded SM et al (2020) in South Asia. Demikian juga hasil penelitian ini relevan dengan temuan Christian P et al (2022) dan demikian juga temuan penelitian Beal T, Tumilowicz A et al (2018) di Indonesia<sup>16-22</sup>.

Children with a history of low birth weight have a higher risk of experiencing stunting compared to those with normal birth weight. The findings of this study are relevant to the research findings of Suratri MAL et al. (2023) in East Nusa Tenggara (NTT)<sup>4</sup>. This finding is also relevant to the research findings of Ejigu H et al (2023) in the Sidama region, Ethiopia<sup>6</sup>. It aligns with the findings of Halli SS et al (2022) in India<sup>10</sup>, Beckmann J et al (2021) in South Africa, Harper A, et al (2023) in South Africa, Mtongwa RH et al (2021) in Tanzania, and Abbas F et al (2021) in the Sindh province of Pakistan.

Children who consume unhealthy snacks have a higher risk of experiencing stunting compared to those who do not. This finding is consistent with the research of Pries AM et al (2019) in Kathmandu Valley, Nepal<sup>26</sup>. and is also relevant to the findings of Vanderkooy A et al (2023) in Senegal<sup>27</sup> It is further supported by the research of Pries AM et al (2019) in Nepal<sup>28</sup>.

To address the significant issue of stunting in Donggala Regency, we propose three policy recommendations that can be implemented by the local government and various stakeholders. **Specific Intervention Programs for Villages and Districts with High Stunting Rates:** It is crucial to identify villages and districts with high stunting rates, such as Tawiora Village, Malino, Malei, and Rano B. Subsequently, specific intervention programs tailored to the characteristics and needs of each village and district should be developed. The local government should collaborate with NGOs, healthcare organizations, and local communities to design and implement programs that prioritize the provision of nutritious food, access to clean water, sanitation improvements, and nutritional education for mothers and children.

**Emphasis on Specific Significant Risk Factors:** The second recommendation

emphasizes focusing on risk factors that have been proven to have a significant correlation with stunting, such as low birth weight, birth length, child's gender, and the consumption of unhealthy snacks. Programs for maternal health check-ups and maternal healthcare services need to be strengthened, with an emphasis on early detection and management of low birth weight. Active awareness campaigns should educate pregnant women and the general public about the importance of balanced nutrition, improving healthy eating habits, and the role of exclusive breastfeeding in child growth.

**Increased Access to Clean Water and Nutritious Food:** Policies should prioritize increasing access to clean water and promoting the consumption of nutritious food within families. Programs for providing safe sources of clean water in needy areas and educational campaigns on water hygiene and sanitation should be enhanced. The local government should collaborate with relevant institutions to ensure the availability and accessibility of nutritious food, especially for economically vulnerable families. By implementing these recommendations, it is hoped that Donggala Regency can reduce the prevalence of stunting and improve the long-term quality of life for children. The local government, healthcare sector, and the community, together, can actively mitigate the impact of stunting and ensure optimal growth and development for future generations.

## CONCLUSION

Factors significantly contributing to the risk of stunting in toddlers in Donggala Regency are Child's Gender, Length at Birth, Low Birth Weight, and Consumption of Unhealthy Snacks.

Boys have a 1.7 times higher risk of experiencing stunting compared to girls. Children with a birth length of less than 48 cm have a 1.8 times higher risk of experiencing stunting compared to those with a birth length greater than 48 cm. Children with low birth weight have a 2.3 times higher risk of experiencing stunting compared to those with normal birth weight. Children who consume unhealthy snacks have a 2.0 times higher risk of experiencing stunting compared to those who do not.

We recommend that the Donggala Regency government routinely monitor the

growth and development of children, especially those with risk factors such as low birth weight and short birth length. This will allow for early identification and timely interventions. Education programs for pregnant women need to be enhanced, particularly in terms of nutrition during pregnancy. Pregnant women should receive proper prenatal care to reduce the risk of low birth weight and short birth length. Nutrition campaigns should promote a balanced diet and reduce the consumption of unhealthy snacks. Nutrition education should be provided to families to ensure that children receive adequate nutritional intake. Efforts to improve access to healthcare services, especially for child growth monitoring, maternal care, and infant development monitoring, need to be enhanced in the region. Local governments, non-governmental organizations, and the private sector need to collaborate in implementing holistic stunting prevention programs. This collaboration can enhance the effectiveness of these efforts.

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## CONFLICTS OF INTEREST

The authors declare no conflict of interest.

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