



RESEARCH ARTICLE

The Correlation Between Gender and the Risk of Stunting in Toddlers: An Empirical Study in Enrekang Regency, South Sulawesi

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Abstract

Stunting among children under five remains a major chronic nutritional problem in Indonesia. Previous studies suggest that boys may be more vulnerable to stunting than girls. This study aimed to examine the correlation between gender and stunting incidence among children under five in Enrekang Regency, South Sulawesi Province. A quantitative cross-sectional design was employed involving 100 children under five selected through purposive sampling. Data were collected using anthropometric measurements, and height-for-age status was determined based on WHO Z-score standards. The association between gender and stunting was analyzed using the chi-square test. The findings revealed that 76.7% of boys and 64.9% of girls were classified as stunted. Although boys showed a higher prevalence of stunting, the statistical analysis indicated no significant association between gender and stunting incidence ($p = 0.201$). These results suggest that stunting is influenced not only by biological characteristics such as gender but also by broader determinants, including socioeconomic conditions, parenting practices, parental education, and access to health services. Therefore, stunting prevention requires a comprehensive and multidimensional intervention approach.

Keywords: Children under five years, Gender correlation, Nutritional status, Stunting incidence, Toddler.

Abstrak

Stunting pada anak balita masih menjadi masalah gizi kronis utama di Indonesia. Sejumlah penelitian menunjukkan bahwa anak laki-laki cenderung lebih rentan mengalami stunting dibandingkan anak perempuan. Penelitian ini bertujuan untuk menganalisis hubungan antara jenis kelamin dan kejadian stunting pada anak balita di Kabupaten Enrekang, Provinsi Sulawesi Selatan. Penelitian menggunakan pendekatan kuantitatif dengan desain potong lintang (cross-sectional) yang melibatkan 100 anak balita yang dipilih melalui teknik purposive sampling. Data dikumpulkan melalui pengukuran antropometri, sedangkan status tinggi badan menurut umur ditentukan berdasarkan standar Z-score WHO. Hubungan antara jenis kelamin dan kejadian stunting dianalisis menggunakan uji chi-square. Hasil penelitian menunjukkan bahwa 76,7% anak laki-laki dan 64,9% anak perempuan mengalami stunting. Meskipun prevalensi stunting pada anak laki-laki lebih tinggi, hasil analisis statistik menunjukkan bahwa tidak terdapat hubungan yang signifikan antara jenis kelamin dan kejadian stunting ($p = 0,201$). Temuan ini mengindikasikan bahwa stunting tidak hanya dipengaruhi oleh faktor biologis seperti jenis kelamin, tetapi juga oleh faktor lain, seperti kondisi sosial ekonomi, pola asuh, tingkat pendidikan orang tua, dan akses terhadap layanan kesehatan. Oleh karena itu, upaya pencegahan stunting memerlukan pendekatan yang komprehensif dan multidimensional.

Kata kunci: Anak Balita, Kejadian Stunting, Korelasi Gender, Status Gizi.

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Introduction

Stunting in young children is a complex, multidimensional global public health issue. Defined as a condition in which a child's height is below the standard for their age, stunting reflects chronic malnutrition that begins in utero and continues through the first two years of life. The World Health Organization (WHO) classifies stunting as a consequence of prolonged nutritional imbalance exacerbated by social, economic, and environmental factors, as well as limited access to basic health services. This condition not only impairs a child's physical growth but also affects cognitive development, economic productivity, and the quality of human capital in the long term.

Globally, approximately 149 million children under the age of five suffer from stunting, with the heaviest burden occurring in South Asia and Sub-Saharan Africa (Sumon et al., 2024; Tamir et al., 2024). This disparity reflects widespread structural inequalities, ranging from poverty and food crises to socio-political instability, which exacerbate children's nutritional status, as documented in conflict-affected countries. The manifestations of these systemic inequalities burden Africa and South Asia and are evident in Southeast Asia.

As part of Southeast Asia, Indonesia faces similar challenges in addressing stunting. Although national stunting trends show a decline, the prevalence remains high, ranging from 24.4% to 37.2% (Azizah, 2023; Indahsari & Larasati, 2023; Rachmat et al., 2023). Data from the 2018 Riskesdas survey show that in South Sulawesi Province, the stunting rate reached 27.67%, and even exceeded 30% in some regencies, such as Luwu (As Salam N. et al., 2024; Rahmi et al., 2022). Enrekang Regency has the highest prevalence of stunting in South Sulawesi, making it a key focus in efforts to accelerate the reduction of stunting at the local level. This indicates that stunting remains a public health issue that requires evidence-based interventions tailored to the local community context.

Various studies have shown that the incidence of stunting is influenced by multidimensional factors, including maternal nutritional status, family socioeconomic conditions, living environment, and child-rearing practices. Infants with low birth weights have a higher risk of stunting than those with normal birth weights (Shen et al., 2023; Tang et al., 2022). Additionally, mothers' knowledge of breastfeeding and nutrition contributes to the prevention of stunting in children (Fitriani & Sunarsih, 2024; Tello et al., 2022).

In addition to biological factors, socioeconomic conditions such as family income, parents' education, and the head of household's occupation also influence nutritional status and access to healthcare (Chowdhury et al., 2022; Shirisha & Bansal, 2022). Environmental factors, such as sanitation, access to clean water, and exposure to infectious diseases, also contribute to growth disorders in children (Kumalasari et al., 2023; Mulyani et al., 2025;

Siramaneerat et al., 2024). Based on UNICEF's theoretical framework regarding the determinants of malnutrition, the incidence of stunting is understood as the result of interactions among biological, social, economic, and environmental factors and family caregiving practices.

In the context of stunting epidemiology, a new dimension has emerged that highlights the role of gender as a potential determinant, providing a new direction for interventions that focus not only on clinical aspects but also on sociocultural aspects. Global empirical evidence shows differences in stunting prevalence by sex, with boys tending to have a higher risk of stunting than girls do. (Tamir et al., 2024). Biologically, this phenomenon is often attributed to boys being more vulnerable to growth impairments due to higher metabolic demands in early life. However, some sources also note that this determinant does not act in isolation; social factors and parenting practices can also influence vulnerability. Therefore, the relationship between gender and stunting incidence remains a subject of debate across various studies.

Conversely, some studies have shown no significant difference in the incidence of stunting between boys and girls. A study by Samuel et al. (2022) conducted in the Dibate District, Ethiopia, found no significant association between a child's sex and the prevalence of stunting. Similar results were reported by Rahmawati & Putri (2023), who stated that the influence of gender on stunting is not universal and depends heavily on contextual factors such as socioeconomic conditions and local culture.

These differing research findings indicate a gap in the literature regarding the relationship between gender and stunting. This underscores the need for evidence-based analyses within specific sociocultural contexts. To date, research on the correlation between gender and stunting among infants and toddlers in Enrekang Regency remains limited, even though this region has a relatively high prevalence of stunting in South Sulawesi Province. This study aimed to analyze the relationship between gender and the incidence of stunting among children under five years of age in Enrekang Regency, South Sulawesi Province. The findings are expected to contribute to the development of stunting prevention policies that are context-specific, evidence-based, and responsive to the community's social conditions.

Literature Review

Stunting is a commonly used indicator of chronic nutritional status for assessing children's growth and development. This condition is characterized by a height below the standard for a child's age, resulting from long-term malnutrition. Stunting has been shown to negatively impact physical and cognitive development, as well as an individual's productivity in adulthood (Damayanti et al., 2025). In addition to its impact on individuals, the high prevalence of stunting also poses a challenge to health development because

it is associated with low-quality human resources and an increased socioeconomic burden on society.

In recent years, academic attention has focused on the role of gender as a determinant of stunting. Other studies revealed that boys are 1.426 times more likely to experience stunting than girls, indicating a significant gender disparity in children's nutritional status (Tumaji et al., 2025). The global prevalence of stunting is 35.4% among boys and 31.3% among girls. (Dembélé, 2025). These findings suggest a tendency toward biological vulnerability in boys; however, they do not fully explain whether this difference is influenced solely by biological factors or by accompanying social and environmental factors.

Some studies have explained that gender differences in stunting rates cannot be separated from broader social, economic, and environmental factors. Observational studies have shown that maternal education and breastfeeding practices are closely associated with stunting rates, with boys tending to be more adversely affected by poor-quality care. (Handayani & Supriadi, 2020; Octavianny & Sutra, 2025). Household income disparities, culture-based dietary practices, and access to health services also exacerbate the risk of stunting, particularly among boys living in impoverished communities. (Kumar, 2023). Nevertheless, some studies indicate that the influence of gender on stunting is not always consistent across all regions. This suggests that socioeconomic factors and quality of care likely play a more dominant role than biological factors alone.

Environmental factors, such as food security and sanitation, exacerbate this situation. Households with limited access to nutritious food and clean water generally face a higher risk of stunting, and some studies show a greater impact on boys than on girls (Adi et al., 2023; Sihite, 2022). However, other studies have found that poor environmental conditions can increase the risk of stunting in all children, regardless of gender, particularly in communities with high poverty rates and limited access to health services. These findings demonstrate that the relationship between gender and stunting is contextual and influenced by the interaction of various social determinants of health.

Qualitative research has also revealed that gender norms in child-rearing and the distribution of resources within families can create disparities in nutritional intake. In some cultural contexts, boys may receive either more or less attention regarding health and nutrition, depending on family perceptions and practices (Nurmawati et al., 2022). Therefore, promoting gender equality in childrearing is a key strategy for reducing stunting rates. (Rambi & Budyanra, 2024). However, most previous research has focused on describing the relationship between gender and stunting without deeply analyzing the interplay between biological factors and social determinants that

influence stunting in infants and toddlers. Various studies have emphasized the need for policy approaches that incorporate gender considerations into interventions to address stunting. Food security initiatives combined with gender-sensitive nutrition education is considered effective in reducing the prevalence of stunting (Abdullahi et al., 2025; Sarwar et al., 2024).

Furthermore, interventions that specifically target boys and strengthen the caregiving relationship between mothers and children can enhance the effectiveness of stunting prevention programs, particularly in areas with high gender disparities (Kurniawati et al., 2025). Nevertheless, the effectiveness of gender-based approaches requires further testing across various social and cultural contexts. Therefore, this study was conducted to examine the relationship between gender and the incidence of stunting among children under five in Enrekang Regency, an area with the highest prevalence of stunting, to provide a more context-specific understanding of the role of gender in stunting.

Method

The issue of stunting among children under five was chosen as the focus of this study because of its high prevalence in Indonesia, particularly in South Sulawesi Province. Stunting is a key indicator of chronic malnutrition, which has long-term effects on the quality of human resources. Enrekang Regency was selected because, according to data from the South Sulawesi Provincial Health Office, this region has the highest prevalence of stunting, 34.3%, as reported by the Indonesian Nutrition Status Survey (SSGI). Additionally, the diversity of findings in previous studies regarding the influence of gender on stunting incidence was a key consideration for making gender a primary variable in this study. This study aimed to empirically examine whether biological factors (gender) contribute to children's stunting status to strengthen the scientific evidence for formulating gender-equitable nutrition policies.

This quantitative study used a descriptive-analytical design. This cross-sectional study examined the relationship between gender and the incidence of stunting among children under five. The subjects of this study were children under the age of five and their mothers residing in Enrekang Regency. The sample size was calculated based on the formula for the correlation of two variables with a moderate effect size of 0.3 and significance level of 0.5. The sample size was calculated using the G*Power application, which resulted in a required sample size of 100 children. Sampling was conducted using a purposive approach, with the inclusion criteria for participants being mothers who had a toddler and were willing to have their child participate in the study. The exclusion criterion was congenital abnormalities.

Data collection in this study was conducted through interviews and anthropometric measurements of the participants. Interviews were used to

collect demographic and child characteristics data. Anthropometric measurements used a microtoice to measure the height of children who could stand and a measuring board to measure the length of infants aged 0–24 months old. The WHO Z-score tables for height-for-age (HAZ) or length-for-age (LAZ) were used as standards to determine stunting. Data were analyzed using the chi-square test.

This study involved 100 toddlers in Enrekang Regency, with a relatively balanced gender distribution between boys (43%) and girls (57%). By age group, the largest proportion was found among toddlers (12–36 months old). This period is a critical phase (vulnerable phase) as it marks the transition from exclusive breastfeeding to complementary feeding. During this period, children are vulnerable to nutritional deficits due to an immature digestive system or improper care practices, which can directly lead to stunting. A child's success in learning to eat independently during family meals at this age depends heavily on stimulation and the quality of food provided at home.

Parents' educational levels in this study indicated a significant vulnerability regarding family health understanding. A total of 37% of fathers and 34% of mothers fall into the low-education category; some parents have never attended school or did not complete elementary school. This low level of formal education implies limited nutritional literacy among parents. Mothers with low educational attainment tend to have limited access to information regarding a variety of nutritionally balanced complementary feeding menus, while fathers with low educational attainment may be less supportive of decision-making regarding healthy eating patterns at the household level.

This cognitive vulnerability is exacerbated by the economic structure of the family. Most fathers work as farmers (69%), and most mothers are homemakers (77%). Although farming provides direct access to agricultural food sources, the income from this sector is often seasonal and unpredictable. This employment structure indicates limited economic stability for families. Low household income restricts the purchasing power (economic access) to high-quality animal protein sources (such as meat, fish, or milk), which are essential for toddlers to prevent stunting. Furthermore, while a mother's role as a homemaker should provide an opportunity for optimal child-rearing, if she lacks sufficient nutritional knowledge due to the low educational attainment mentioned above, this free time does not positively correlate with improvements in the child's nutritional status. A comprehensive overview of the respondents' sociodemographic characteristics is presented in Table 1.

Table 1. Respondent Characteristics

Characteristics	Criteria	Frequency
Age	Infant (1–12 months)	3

	Toddler (12–36 months)	65
	Preschooler (37–60 months)	32
Father's Education	No Schooling	8
	Elementary School	11
	Junior High School	18
	Senior High School	52
	College	11
Mother's Education	Did Not Complete Elementary School	2
	Elementary School	14
	Junior High School	20
	Senior High School	38
Father's Occupation	College	26
	Service Worker (Motorcycle Taxi Driver/Driver)	5
	Civil Servant	7
	Self-Employed	19
Mothers' Occupations	Farmer	69
	Housewives	77
	Temporary Employees	12
	Civil Servants	6
	Self-Employed	5

Source. Primary data

Result

The Correlation Between Gender and the Incidence of Stunting

This study assessed stunting status based on the WHO classification, in which height-for-age (HFA) < -2 standard deviation (SD) is categorized as stunting. Of the 43 boys, 33 (76.7%) were categorized as stunted and 10 (23.25%) were not stunted. Of the 57 girls, 37 (64.9%) were stunted and 20 (35.08%) were not. Although the percentage of boys with stunting was higher than that of girls, statistical analysis showed that this difference was not statistically significant ($p=0.201$) (Table 2).

Table 2. Correlation Between Gender and the Prevalence of Stunting

Gender	Incidence of Stunting				Total		P Value
	Stunting		Normal				
	n	%	n	%	n	%	
Male	33	76,7	10	23,25	43	100	0,201*
Female	37	64,9	20	35,08	57	100	

Total	70	70	30	30	100	100
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Source: Primary data. *Chi-square test

Although there was a higher prevalence of stunting among boys, this difference was not statistically significant (Table 2). These results confirm that stunting intervention policies cannot rely solely on differentiation based on a child's sex but must also consider other contextual factors such as socioeconomic disparities and parents' knowledge of child-rearing.

Discussion

The Relationship Between Gender and the Prevalence of Stunting in Under-Five Children

The results of this study indicate that there is no significant association between gender and the prevalence of stunting in children under five years of age, although a trend toward a higher prevalence was observed among boys. These findings reinforce the evidence that biological factors, such as sex, cannot be used as the sole determinant of a child's nutritional status, particularly in the context of stunting. These results are consistent with previous studies showing that differences in stunting rates between boys and girls tend to be statistically insignificant after adjusting for sociodemographic variables (Rafisa et al., 2023; Ruminem & Sukmana, 2022; Suratri et al., 2023).

This phenomenon is also reflected in cross-national research. Studies in Ethiopia and Pakistan reported higher prevalence of stunting among boys, but emphasized that these differences were not statistically significant when socioeconomic variables and demographic characteristics were taken into account (Asif et al., 2022; Tsega et al., 2025). Similar findings were observed in analyses from Egypt and India, which showed that socioeconomic status plays a more dominant role than biological factors such as sex in influencing the incidence of stunting (Aboakrab, 2024; B.S. & Guddattu, 2022). Gender differences in malnutrition are highly contextual, depending on environmental, economic, and public health conditions in each region (Thurstans et al., 2022). These conditions align with the sociodemographic characteristics of the study site in Enrekang Regency, where most parents work as farmers (69%) and have relatively low levels of education. The lack of economic stability and low nutritional literacy within these farming families appear to be far more decisive factors in triggering the risk of stunting in toddlers, regardless of whether the child is male or female.

Although there are biological arguments suggesting that boys have greater metabolic needs and are more vulnerable to growth disorders in early childhood (Haq & Abbas, 2022; Nguyen et al., 2022), this predisposition cannot be separated from social influences. Inequalities in food allocation,

biased parenting practices, and limited access to health services exacerbate this vulnerability. Therefore, gender should be viewed not as a single determinant, but as part of a complex interplay between biological and social factors (Karlsson et al., 2023; Thurstans et al., 2022). Therefore, the direction of policies and stunting intervention programs in Enrekang Regency should not be compared or categorized based on a child's gender. The focus of interventions must be directed toward strengthening the economic capacity of farming families, improving access to nutritious food, providing intensive education on child-rearing practices, and ensuring adequate intake of macro- and micronutrients during the transition to complementary feeding.

The Influence of Socioeconomic Factors and Parental Education

The findings of this study indicate that most parents in the sample had a secondary education or lower, with fathers working as farmers and mothers as homemakers. This aligns with previous research, which states that parents' educational level and occupation significantly shape the child-rearing environment. Being a traditional farmer often limits the time parents can devote to learning about ideal health and child-rearing practices. On the other hand, the mother's role as a homemaker holds great potential for optimizing developmental stimulation and home-based feeding, as observed in various regions. (Sherpa et al., 2022; Türker & Çimşir, 2025; VanderPyl et al., 2022; Wang et al., 2024). However, these dynamics significantly influence the quality of health education, expectations regarding nutritional adequacy, and access to nutritious food resources, particularly when awareness of children's health is high but the family's limited economic capacity serves as the primary barrier (Alvi et al., 2022; Monaghan, 2024).

Although some studies note a global shift toward more egalitarian parenting patterns in meeting children's nutritional needs, which varies by local culture (Ho et al., 2023; Jeong & Bang, 2025; Scheibling & Milkie, 2023), the material and time constraints faced by farming families in the current study's research locations remain a real threat to the physical growth and nutritional status of toddlers. If these economic constraints and low literacy levels persist, the parental profile depicted in this study will continue to increase the risk of sustained nutritional deficits among children. Therefore, future research should explore in greater depth whether improving parents' formal education or increasing fathers' active involvement in nutrition-related care can break this cycle of risk. Furthermore, optimizing partnerships between health care facilities (such as Posyandu) and families is essential to mitigate the adverse effects of these socioeconomic constraints (Beltrán-Grimm, 2022; Vivian et al., 2022).

Specifically, in the context of Enrekang Regency, these socioeconomic challenges pose a high risk of triggering nutritional deficiencies during the critical toddler phase (12–36 months). Seasonal income constraints faced by

farmers, compounded by housewives' limited understanding of dietary variety, directly result in poor-quality complementary foods (MPASI). Toddlers in this environment do not receive solid foods rich in animal protein; instead, they are often fed whatever is available from the family's meager diet, which is high in carbohydrates but deficient in micronutrients. Therefore, the socioeconomic profile of parents in this study is not merely passive demographic data but a structural indicator that explains why stunting interventions in Enrekang must begin with the stabilization of household microeconomics and nutrition education based on local foods.

Policy Implications and Research Limitations

The findings of this study have important implications for the development of policies to address stunting, particularly in the context of strengthening multisectoral approaches based on the social determinants of health. The results indicate that gender is not a dominant determinant of stunting prevalence; therefore, policy interventions should not focus exclusively on children's biological factors. Instead, efforts to prevent stunting must address more complex structural factors, such as parental education levels, family socioeconomic status, access to primary healthcare, environmental sanitation quality, and household food security. These findings align with the social determinants of health approach, which identifies social and economic conditions as fundamental factors influencing children's health status and growth (Asongu & Odhiambo, 2023; Nisbett et al., 2022).

In the context of policy implementation, both central and local governments must strengthen integration between specific and nutrition-sensitive interventions. Specific interventions, such as nutritional supplementation, child growth monitoring, and maternal and child health services, are necessary to address the direct impacts of malnutrition. However, these interventions must be supported by sensitive policies capable of sustainably improving the socioeconomic conditions of communities, including strengthening social protection programs, enhancing family health literacy, empowering women, and developing community-based nutrition education systems. This integrative approach has proven effective in reducing health inequities and sustainably improving the quality of children's growth and development (Kalbarczyk et al., 2022; Mansfield et al., 2025).

Furthermore, this study emphasizes the importance of a policy approach that accounts for spatial heterogeneity across regions. Variations in demographic, socioeconomic, cultural, and geographic characteristics at the district and provincial levels can influence the effectiveness of stunting prevention program implementation. Therefore, local governments must develop contextual and adaptive intervention strategies tailored to the needs of local communities, particularly in agricultural areas and regions with limited access to health services. Nationally uniform policies risk reducing program

effectiveness because they cannot fully address specific local-level challenges. These findings support previous research indicating that locally context-based approaches are more effective in enhancing the success of public health programs compared to universal approaches (Khan & Mohanty, 2024; Phiri et al., 2022).

More broadly, these findings underscore the urgency of public health policy reforms that focus not only on short-term nutritional recovery but also on strengthening the socioeconomic capacity of communities in the long term. Sustained efforts to reduce the prevalence of stunting require cross-sectoral synergy, including in the health, education, agriculture, social protection, and rural development sectors. Thus, an ideal intervention strategy must strike a balance between directly meeting children's nutritional needs and strengthening families' socioeconomic systems as a protective factor against future stunting risks (Dassie, 2025; Jabbour et al., 2023).

However, this study has several methodological limitations that must be considered when interpreting the results. First, the cross-sectional study design limits the ability to explain temporal cause-and-effect relationships between independent variables and the occurrence of stunting. The relationships identified in this study are associative in nature and, therefore, cannot be used to determine the direction of causality between variables. Second, the quality of field data collection may have been influenced by variations in enumerators' skills and the accuracy of anthropometric measurements, which means that information bias cannot be entirely avoided. Third, this study did not account for macro-level factors that could potentially influence children's nutritional status, such as regional climate conditions, regional food security, local government, and the sociocultural dynamics of the community.

Given these limitations, future research should use a longitudinal design to comprehensively evaluate the causal relationships and dynamics of changes in children's nutritional status. Future studies should integrate broader contextual variables, such as climate variability, effectiveness of local policies, quality of bureaucratic governance, gender-based caregiving patterns, and division of labor within families. The integration of these multidimensional variables is expected to improve the targeting of policies, reduce the risk of unintended program consequences, and produce a more accurate stunting risk prediction model that is adaptive to social and environmental changes (Roy et al., 2024; Usman & Kopczewska, 2022).

Overall, this study confirms that stunting is a multidimensional and complex public health problem. The lack of a significant association between gender and the incidence of stunting indicates that biological factors are not the sole determinants influencing children's nutritional status. Although there is a tendency for higher vulnerability among boys, the results of this study

show that the interaction between social, economic, environmental, and child-rearing factors plays a far greater role in determining the quality of children's growth than gender. Therefore, strategies to prevent stunting must be designed holistically, based on scientific evidence, and consider the multidimensional interactions among health determinants to achieve sustainable and equitable improvements in children's nutritional status.

Conclusion

This study confirms that stunting among toddlers is a multidimensional problem that cannot be explained solely from a biological perspective, such as the child's sex. The absence of a significant association between sex and stunting incidence demonstrates that upstream sociodemographic determinants are far more dominant. In agrarian communities such as Enrekang Regency, physical growth failure in toddlers, particularly during the critical toddler phase (12–36 months), stems from a structural combination of low parental education levels and the fact that the majority earn a seasonal income through farming. These conditions limit the purchasing power of local foods rich in animal protein, a situation exacerbated by low nutritional literacy among homemakers in practicing optimal childcare and complementary feeding (MPASI) during the transition period.

As a practical implication, the Enrekang Regency Government is recommended to shift its focus from partial clinical interventions to multisectoral, context-sensitive interventions that account for spatial heterogeneity. Intervention strategies should focus on socioeconomic protection for farming families, expanding access to nutritious food based on local commodities, and intensive nutrition education at the community level. Ideal policies must balance short-term nutritional recovery support (specific interventions) and long-term structural reforms (sensitive interventions) to achieve equitable reduction in stunting prevalence.

Although theoretically significant, this study has methodological limitations due to its cross-sectional design, which restricts the analysis of temporal cause-and-effect relationships between variables. Furthermore, this study did not integrate dynamic macro-contextual factors such as climate variability, the effectiveness of bureaucratic governance, and the dynamics of the domestic division of labor. Therefore, future research should use longitudinal designs or large-scale cohort studies with complex multivariate analyses to map mediating pathways more precisely, accurately, and comprehensively.

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Author Contribution Statement

AA designed the study, performed data analysis, and drafted the manuscript. HH contributed to the field data collection, preliminary data processing, and development of the theoretical framework. AAA was involved in the literature review, interpretation of the results, drafting of the manuscript, and final editing of the manuscript. All authors have read and approved the final manuscript submitted for publication.

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