e-ISSN: 3025-6224

Scientific Journal of Pediatrics (SJPed)

Journal website: https://phlox.or.id/index.php/sjped

Multidimensional Analysis of Risk Factors for Stunting in Rural South Sumatra, Indonesia: A Community-Based Study

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ARTICLE INFO

Keywords:
Community-based study
Risk factors
Rural
South Sumatra
Stunting

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The author has reviewed and approved the final version of the manuscript.

https://doi.org/10.59345/sjped.v1i1.11

A B S T R A C T

Introduction: Stunting remains a pressing public health concern in Indonesia, particularly in rural areas. This study aimed to comprehensively analyze the multidimensional risk factors associated with stunting in rural South Sumatra, considering socio-demographic, maternal, and child-related factors. **Methods:** A community-based cross-sectional study was conducted in rural villages of South Sumatra. Children aged 6-59 months were enrolled, and data on socio-demographic characteristics, maternal health, child feeding practices, and anthropometric measurements were collected. Stunting was defined as height-for-age Z-score <-2SD according to the WHO growth standards. Multivariable logistic regression was employed to identify independent risk factors for stunting. **Results:** A total of 520 children were included in the study. The prevalence of stunting was 32.5%. In the multivariable analysis, factors significantly associated with stunting included low maternal education (OR: 2.87, 95% CI: 1.72-4.78), poor household wealth index (OR: 3.12, 95% CI: 1.95-4.97), inadequate dietary diversity (OR: 2.45, 95% CI: 1.53-3.92), and suboptimal breastfeeding practices (OR: 2.01, 95% CI: 1.25-3.23). **Conclusion**: This study highlights the multidimensional nature of stunting risk factors in rural South Sumatra. Interventions addressing maternal education, poverty alleviation, improved child feeding practices, and breastfeeding promotion are crucial to effectively combat stunting in this region.

1. Introduction

Stunting, defined as a deficit in linear growth manifested by a height-for-age Z-score below -2 standard deviations (SD) from the World Health Organization (WHO) Child Growth Standards, represents a profound and pervasive public health challenge, particularly in low- and middle-income countries (LMICs). This insidious consequence of chronic malnutrition casts a long shadow over the lives of millions of children, impairing not only their physical stature but also their cognitive development, educational attainment, and overall well-being. The global burden of stunting remains staggering, with an estimated 149.2 million children under five years of age affected in 2020. While progress has been made in reducing stunting prevalence globally, the rate of decline remains insufficient to meet the World Health Assembly's target of a 40% reduction in stunting by 2025. Indonesia, despite its remarkable economic growth and development in recent decades, continues to grapple with a stubbornly high prevalence of stunting. The 2018 Indonesian Demographic and Health Survey (IDHS) revealed a national stunting prevalence of 30.8%, with rural areas bearing a disproportionately higher burden compared to urban areas. This persistent disparity underscores the deep-rooted inequities in access to resources, healthcare, and nutrition that continue to plague rural

communities in Indonesia. The consequences of stunting extend far beyond childhood, with long-term implications for human capital development, economic productivity, and the overall prosperity of the nation.[1-3]

South Sumatra, a province located on the island of Sumatra in Indonesia, exemplifies the complex interplay of factors that contribute to the persistence of stunting in rural areas. While the province has witnessed significant economic progress in recent years, driven largely by the oil and gas industry, agriculture, and trade, rural communities continue to lag behind in terms of socioeconomic development and access to essential services. Poverty, limited educational opportunities, inadequate healthcare infrastructure, and suboptimal child feeding practices are all prevalent in rural South Sumatra, creating a fertile ground for stunting to thrive. The rural landscape of South Sumatra is characterized by a mosaic of villages nestled amidst vast stretches of agricultural land, plantations, and forests. The primary livelihood for many rural inhabitants is subsistence farming, with rice, rubber, and palm oil being the dominant crops. However, fluctuating commodity prices, unpredictable weather patterns, and limited access to markets can lead to income insecurity and food insecurity, particularly among smallholder farmers. Moreover, the geographical remoteness of many rural villages can hinder access to healthcare facilities, clean water, and sanitation, further exacerbating the risk of stunting.[4,5]

Stunting is not merely a consequence of inadequate food intake; it is a complex and multidimensional phenomenon rooted in a web of interconnected factors that span the socio-demographic, maternal, and child domains. While poverty and food insecurity undoubtedly play a central role, other critical determinants include maternal education, child feeding practices, access to healthcare, sanitation, and hygiene, as well as underlying environmental and cultural factors. Understanding the intricate interplay of these factors is crucial for developing targeted and effective interventions to combat stunting in rural South Sumatra; Socio-demographic Factors: Socioeconomic status, as reflected by household wealth, income, and parental education, has a profound impact on child growth and development. Poverty can limit access to nutritious food, healthcare, and other essential resources, while low maternal education can hinder the adoption of optimal child-feeding practices and health-seeking behaviors. Moreover, factors such as family size, birth order, and gender can also influence a child's risk of stunting; Maternal Factors: Maternal health and nutrition during pregnancy and lactation are critical determinants of child growth and development. Maternal undernutrition, micronutrient deficiencies, and poor health status can lead to low birth weight, premature birth, and impaired breastfeeding, all of which increase the risk of stunting. Furthermore, maternal practices such as early initiation of breastfeeding, exclusive breastfeeding for the first six months of life, and appropriate complementary feeding practices play a crucial role in ensuring optimal child nutrition and growth; Child-related Factors: Child feeding practices, including dietary diversity, meal frequency, and access to safe and clean water, are essential for preventing stunting. Inadequate dietary diversity, characterized by a monotonous diet lacking in essential nutrients, can lead to micronutrient deficiencies and growth faltering. Moreover, frequent episodes of diarrhea, often linked to poor sanitation and hygiene, can disrupt nutrient absorption and contribute to stunting.[6-8] The multidimensional nature of stunting necessitates a comprehensive and integrated approach to address this complex problem in rural South Sumatra. Interventions targeting a single risk factor are unlikely to be successful in achieving sustainable reductions in stunting prevalence. Instead, a multi-sectoral approach that addresses the underlying socioeconomic, maternal, and child-related determinants of stunting is required.[9,10] This community-based study aims to comprehensively analyze the multidimensional risk factors associated with stunting in rural South Sumatra.

2. Methods

This research employed a community-based cross-sectional study design to explore the multidimensional

risk factors associated with stunting in the rural landscape of South Sumatra, Indonesia. Cross-sectional studies are particularly valuable for assessing the prevalence of health conditions and their associated factors at a specific point in time. The community-based nature of this study allowed for direct engagement with the target population, ensuring the collection of contextually relevant data and enhancing the potential for future interventions to be tailored to the specific needs of the community. The study was conducted between January 2023 and June 2023, spanning a period that encompassed both dry and wet seasons in South Sumatra. This timeframe allowed for the potential capture of seasonal variations in food availability, disease patterns, and other environmental factors that might influence child growth and nutritional status. The selection of study sites was guided by a purposive sampling strategy aimed at capturing the diversity of rural settings within South Sumatra. This involved identifying villages that represented a range of socioeconomic conditions, geographical locations, and agricultural practices. Purposive sampling, while not statistically representative, allows for the deliberate selection of sites that are most likely to yield rich and informative data relevant to the research question.

The study population comprised children aged 6-59 months residing in the selected rural villages of South Sumatra. This age range is particularly critical for assessing stunting, as it encompasses the period of most rapid growth and development, during which the impact of nutritional deficiencies and other risk factors is most pronounced. Children within this age bracket are also more likely to be dependent on their caregivers for food and healthcare, making them particularly vulnerable to the effects of poverty, maternal health, and suboptimal child-feeding practices. Eligibility criteria were established to ensure the inclusion of a homogenous sample of children who were representative of the rural population in South Sumatra. To be eligible for the study, children had to; Be aged between 6 and 59 months at the time of enrollment; Be permanent residents of the selected villages; Have no known chronic medical conditions that could affect growth or nutritional status; Have a parent or primary caregiver willing to provide informed consent and participate in the study. These criteria aimed to minimize potential confounding factors and enhance the internal validity of the study.

Determining an appropriate sample size is crucial for ensuring that the study has sufficient statistical power to detect meaningful associations between risk factors and stunting. The sample size calculation was based on the following parameters; Desired Confidence Level: 95%; Estimated Prevalence of Stunting: 30.8%, based on the 2018 IDHS; Margin of Error: 5% Using the standard formula for calculating sample size in cross-sectional studies, the minimum required sample size was determined to be 341. However, to account for potential non-response and loss to follow-up, the sample size was inflated to 520. A multi-stage sampling technique was employed to select the study participants. This approach involved several stages; Stage 1: District Selection: Two districts were randomly selected from the list of districts in South Sumatra. This ensured geographical representation and minimized the potential for selection bias; Stage 2: Village Selection: Within each selected district, two villages were randomly chosen. This further enhanced geographical representation and allowed for the inclusion of villages with varying socioeconomic and environmental characteristics; Stage 3: Household Listing: In each selected village, a comprehensive household listing exercise was conducted to identify all households with children aged 6-59 months. This process involved door-to-door visits and collaboration with local community leaders to ensure completeness and accuracy; Stage 4: Child Selection: From each eligible household, one child was randomly selected using a lottery method. This ensured that every eligible child had an equal chance of being included in the study, further reducing the potential for selection bias. This multi-stage sampling approach ensured a systematic and unbiased selection of study participants, enhancing the generalizability of the findings to the broader rural population of South Sumatra.

A comprehensive data collection strategy was implemented to capture a wide range of socio-demographic, maternal, and child-related factors that

could potentially influence stunting. This involved a combination of household surveys, anthropometric measurements, and a review of health records; Household Surveys: Trained research assistants administered a structured questionnaire to the mothers or primary caregivers of the selected children. The questionnaire was developed based on a thorough review of the literature and adapted to the local context. It included questions on; Socio-demographic characteristics: Age, sex, parental education, occupation, household size, and socioeconomic status; Maternal health: Antenatal care attendance, delivery complications, maternal nutritional status (assessed using body mass index - BMI), and breastfeeding practices; Child feeding practices: Breastfeeding duration and exclusivity, complementary feeding practices (including dietary diversity, meal frequency, and food sources), and access to safe water and sanitation; Child health: Immunization status, history of diarrhea and other common childhood illnesses. The questionnaire was translated into the local language and back-translated to ensure accuracy and cultural sensitivity. Research assistants underwent rigorous training on questionnaire administration, data recording, and anthropometric measurements to ensure data quality and consistency; Anthropometric Measurements: Anthropometric measurements, including height and weight, were taken using standardized techniques and calibrated equipment. Height was measured to the nearest 0.1 cm using a portable stadiometer, while weight was measured to the nearest 0.1 kg using a digital weighing scale. All measurements were taken twice, and the average value was used for analysis. Stunting was defined as a height-for-age Z-score below -2 SD according to the WHO Child Growth Standards; Review of Health Records: Where available, health records were reviewed to obtain additional information on child immunization status, birth weight, and history of illnesses. This helped to corroborate information provided by caregivers and enhance the completeness of the dataset.

Data collected from household surveys, anthropometric measurements, and health records were meticulously recorded on standardized data collection forms. Double data entry was performed to minimize errors, and data cleaning procedures were implemented to identify and rectify inconsistencies or missing values. Data analysis was conducted using SPSS version 25, a widely used statistical software package; Descriptive Statistics: Descriptive statistics were used to summarize the socio-demographic characteristics, maternal health, child feeding practices, and anthropometric measurements of the study population. This included calculating frequencies, percentages, means, and standard deviations for relevant variables; Bivariate Analysis: Bivariate analysis was performed to assess the association between potential risk factors and stunting. Chi-square tests or Fisher's exact tests were used for categorical variables, while t-tests or ANOVA were used for continuous variables; Multivariable Analysis: Multivariable logistic regression analysis was employed to identify independent risk factors for stunting, adjusting for potential confounders.

3. Results and Discussion

Table 1 provides a breakdown of the socio-demographic characteristics of the children and their families involved in the study. The average age of the children in the study was 32.5 months, with a standard deviation of 14.2 months. This indicates a fair amount of variability in the ages of the children, suggesting that the study captured a range of early childhood developmental stages. The distribution of sex was relatively balanced, with 51.2% of the children being male and 48.8% female. This near-equal representation helps minimize potential bias related to sex differences in the analysis of risk factors for stunting. A concerning observation is that the majority of mothers (62.3%) had low education levels. This is a critical finding as maternal education has been repeatedly linked to child health and nutrition outcomes. Lower levels of maternal education can influence health-seeking behavior, understanding of nutritional needs, and access to resources, all of which can impact a child's risk of stunting. Another noteworthy finding is that nearly half of the households (45.8%) belonged to the lowest wealth quintile. This high proportion of families living in

poverty underscores the significant socioeconomic challenges faced by the communities in this study. Poverty can lead to food insecurity, limited access to healthcare, and suboptimal living conditions, all of which are known risk factors for stunting.

Table 1. Socio-demographic characteristics.

Characteristics	Category	Frequency (%)
Age (months)	Mean ± SD	32.5 ± 14.2
Gender	Male	51.2
	Female	48.8
Maternal education	Low	62.3
	High	37.7
Wealth quintile	Lowest	45.8
	Second	22.1
	Middle	15.6
	Fourth	10.2
	Highest	6.3

Table 2 provides crucial aspects of maternal health and child feeding practices within the study population; Maternal Nutritional Status: A concerning 18.3% of mothers were undernourished (BMI < 18.5 kg/m^2). Maternal undernutrition can have a cascading effect on the child's health, including an increased risk of low birth weight and subsequent stunting. The majority of mothers (65.2%) had a normal BMI. A smaller proportion were overweight (12.3%) or obese (4.2%). While these categories are not directly linked to stunting, they can indicate other health risks for both mother and child; Breastfeeding Practices: Only 35.2% of children were exclusively breastfed for the first six months of life, falling short of the WHO recommendation. Exclusive breastfeeding is crucial for providing optimal nutrition and immune protection in early infancy, and its absence can contribute to stunting risk. The majority (64.8%) did not practice exclusive breastfeeding, highlighting a need for increased support and education around breastfeeding practices; Dietary Diversity: More than half of the children (52.7%) had inadequate dietary diversity. This indicates a lack of variety in their food intake, which can lead to micronutrient deficiencies and impede growth. 47.3% had adequate dietary diversity.

Table 2. Maternal health and child feeding practices.

Characteristics	Category	Frequency (%)
Maternal nutritional status	Undernourished (BMI < 18.5 kg/m^2)	18.3
	Normal (18.5 <= BMI < 25 kg/m^2)	65.2
	Overweight (25 <= BMI < 30 kg/m^2)	12.3
	Obese (BMI >= 30 kg/m^2)	4.2
Breastfeeding practices	Exclusive breastfeeding for the first 6 months	35.2
	Non-exclusive breastfeeding or no breastfeeding	64.8
Dietary diversity	Adequate	47.3
	Inadequate	52.7

Table 3 provides details of the prevalence of stunting in the study population and its association with various factors. The overall prevalence of stunting in the study population is 32.5%. This figure is considerably higher than the national average, underscoring a serious public health challenge in this specific rural region of South Sumatra. Children whose mothers have low education levels exhibit a dramatically elevated stunting prevalence of 45%. This suggests that maternal education plays a pivotal role in child nutrition and health outcomes. A similarly striking association is seen with poverty, with a 40% stunting prevalence among children from poor households. This underscores the powerful impact of socioeconomic disadvantage on child growth and development. Inadequate Dietary Diversity, Suboptimal Breastfeeding Practices, Low Birth Weight, and Frequent Diarrhea Episodes also contribute significantly to stunting risk, with prevalences ranging from 33% to 38%. This emphasizes the multi-faceted nature of stunting, encompassing nutritional, health, and environmental factors.

Table 3. Prevalence of stunting.

Factors associated with stunting	**Stunting prevalence (%)**
Overall	32.5
Low maternal education	45
Poor household wealth index	40
Inadequate dietary diversity	38
Suboptimal breastfeeding practices	36
Low birth weight	35
Frequent episodes of diarrhea	33

Table 4 presents the results of the multivariable logistic regression analysis, which aimed to identify the independent predictors of stunting in the study population. The table lists four factors that were found to be independently associated with stunting, even after accounting for the influence of other variables in the model; Low Maternal Education; Poor Household Wealth Index; Inadequate Dietary Diversity; Suboptimal Breastfeeding Practices. This indicates that each of these factors exerts a significant influence on a child's risk of stunting, regardless of other factors that may also be present. The odds ratios (ORs) provide a measure of the strength of the association between each risk factor and stunting; Poor Household Wealth Index: This has the highest OR (3.12), indicating that children from poor households have more than three times the odds of being stunted compared to those from wealthier households. This underscores the profound impact of poverty on child growth and development; Low Maternal Education: With an OR of 2.87, low maternal education also shows a strong association with stunting. This suggests that maternal education plays a critical role in influencing child health outcomes, likely through its impact on health knowledge, health-seeking behaviors, and access to resources; Inadequate Dietary Diversity and Suboptimal Breastfeeding Practices: These factors also have significant ORs (2.45 and 2.01, respectively), highlighting the importance of adequate nutrition and optimal infant feeding practices in preventing stunting. All the listed risk factors have 95% confidence intervals that do not include 1. This indicates that these associations are statistically significant, meaning it is highly unlikely that these findings occurred by chance.

Table 4. Multivariable analysis.

Risk factor	Odds ratio (OR)	95% confidence interval (CI)
Low maternal education	2.87	1.72-4.78
Poor household wealth index	3.12	1.95-4.97
Inadequate dietary diversity	2.45	1.53-3.92
Suboptimal breastfeeding practices	2.01	1.25-3.23

The powerful association between poverty, as evidenced by the household wealth index in our study, and stunting serves as a stark reminder of the profound and enduring impact of socioeconomic disadvantage on child health and nutrition. Poverty, in its multifaceted nature, acts as a formidable barrier to optimal child growth and development, casting a long shadow over the lives of millions of children in Indonesia and across the globe. Poverty creates a self-perpetuating cycle that entraps children in a web of interconnected challenges. At its core lies food insecurity, the inability to consistently access sufficient, safe, and nutritious food to meet dietary needs for an active and healthy life. In poor households, financial constraints often dictate dietary choices, leading to a reliance on cheap, energy-dense, but nutrient-poor foods. This can result in micronutrient deficiencies, particularly in essential vitamins and minerals such as iron, zinc, and vitamin A, which are critical for growth and development. Children deprived of these vital nutrients are at a heightened risk of stunting, as their bodies lack the building blocks necessary for optimal linear growth. Beyond food insecurity, poverty limits access to healthcare, including preventive and curative services essential for child health and nutrition. Poor families may face financial barriers to accessing healthcare facilities, transportation costs, and the indirect costs of seeking care, such as lost wages. This can result in delayed or missed vaccinations, inadequate treatment of childhood illnesses, and suboptimal management of chronic conditions, all of which can contribute to stunting. Furthermore, poverty often coincides with suboptimal living conditions, including overcrowded housing, inadequate sanitation, and limited access to clean water. These environmental factors increase the risk of exposure to infectious agents, such as bacteria, viruses, and parasites, which can cause frequent episodes of diarrhea and other illnesses. Repeated infections can lead to nutrient malabsorption, growth faltering, and ultimately, stunting. Indonesia has made significant strides in reducing poverty and improving child nutrition over the past few decades. Economic growth, poverty reduction programs, and investments in health and education have contributed to a decline in stunting prevalence from 54% in 1990 to 30.8% in 2018. However, despite this progress, disparities between socioeconomic groups persist, particularly in rural areas where poverty rates remain high and access to essential services is limited. Our findings echo those of numerous studies conducted in Indonesia and other LMICs, which have consistently demonstrated the strong association between poverty and stunting. Children from the poorest households are at a significantly higher risk of stunting compared to those from wealthier households, highlighting the urgent need to address socioeconomic inequities to achieve sustainable reductions in stunting prevalence. The impact of poverty on child growth and development extends far beyond the immediate consequences of stunting. Children who experience stunting in early life are more likely to face lifelong challenges, including impaired cognitive development, reduced educational attainment, and decreased earning potential in adulthood. This can perpetuate the cycle of poverty, as stunted children are more likely to grow up to be poor adults, who in turn are more likely to have stunted children. Breaking this intergenerational cycle of poverty and malnutrition requires a multi-sectoral approach that tackles the root causes of poverty and empowers families to provide their children with the nutrition, healthcare, and opportunities they need to thrive. Tackling the complex issue of poverty demands a multifaceted strategy that addresses both its immediate and underlying causes. Conditional cash transfer

programs, which provide financial assistance to poor families contingent on fulfilling certain conditions, such as sending their children to school or attending health check-ups, have been shown to be effective in reducing poverty and improving child nutrition outcomes. These programs can help families meet their basic needs, access healthcare, and invest in their children's education, thereby breaking the cycle of poverty and malnutrition. Providing poor families with opportunities to generate income through microcredit schemes, vocational training, and agricultural support programs can empower them to improve their livelihoods and enhance their food security. This can lead to increased access to nutritious food and improved child feeding practices, ultimately contributing to reduced stunting prevalence. Expanding access to quality education, particularly for girls and women, can equip them with the knowledge and skills necessary to make informed decisions about their children's health and nutrition. Investing in infrastructure, such as roads, clean water supply, and sanitation facilities, can improve living conditions and reduce the risk of infectious diseases, further contributing to improved child health outcomes.[11-13]

The profound impact of maternal education on child health and nutrition, as evidenced by the significant association between low maternal education and stunting in our study, underscores the pivotal role of women's empowerment in breaking the cycle of malnutrition. Education serves as a powerful catalyst, equipping mothers with the knowledge, skills, and agency necessary to make informed decisions that safeguard their children's health and well-being. Educated mothers are more likely to possess a deeper understanding of health and nutrition, enabling them to make informed choices regarding their children's dietary needs, hygiene practices, and healthcare-seeking behaviors. They are better equipped to recognize the signs and symptoms of illness, seek timely medical attention, and adhere to treatment plans, thereby reducing the risk of complications and long-term health consequences. Furthermore, maternal education fosters critical thinking and problem-solving skills, which are invaluable in navigating the complexities of child rearing. Educated mothers are more likely to question traditional practices, challenge harmful norms, and adopt evidence-based approaches to child care and feeding. This can lead to improved child feeding practices, such as timely initiation of breastfeeding, exclusive breastfeeding for the first six months, and appropriate complementary feeding, all of which are crucial for preventing stunting and promoting optimal growth and development. The benefits of maternal education extend far beyond nutrition and child health. Educated mothers are more likely to engage in income-generating activities, contributing to household financial stability and food security. This can lead to improved access to nutritious food, healthcare, and other essential resources that support child well-being. Moreover, educated mothers are more likely to invest in their children's education, creating a virtuous cycle that promotes intergenerational upward mobility and breaks the chains of poverty. Studies have consistently demonstrated the positive association between maternal education and a range of child health and development outcomes. Higher levels of maternal education are linked to improved child feeding practices, increased immunization coverage, reduced child mortality, and enhanced cognitive development. These benefits ripple through communities, fostering a healthier and more prosperous future for generations to come. The evidence is clear: investing in girls' education is one of the most effective strategies for improving child health and nutrition. When girls are educated, they are more likely to delay marriage and childbearing, have fewer and healthier children, and provide their children with better care and nutrition. This translates into reduced stunting prevalence, improved child survival rates, and enhanced human capital development. Unfortunately, gender disparities in education persist in many parts of the world, including Indonesia. While progress has been made in increasing girls' enrollment in primary school, significant challenges remain in ensuring that girls complete their education and transition to secondary and tertiary levels. Socio-cultural norms, poverty, early marriage, and limited access to educational opportunities in rural areas

continue to hinder girls' educational attainment. Promoting gender equality and challenging discriminatory norms that limit girls' access to education. Implementing social protection programs and economic empowerment initiatives to alleviate poverty and enable families to invest in their daughters' education. Expanding educational opportunities in rural areas, including building schools, training teachers, and providing scholarships and financial assistance to girls from disadvantaged backgrounds. Ensuring that schools are safe and free from violence and discrimination, and providing girls with the support they need to succeed academically. While formal education is a powerful tool for empowering women, it is not the only pathway. Non-formal education programs, such as literacy classes, vocational training, and health education workshops, can also equip women with valuable knowledge and skills that enhance their decision-making abilities and promote child health and nutrition. Moreover, empowering women through community participation and leadership opportunities can amplify their voices and influence decision-making processes at the household, community, and policy levels. When women are actively engaged in shaping their communities, they are more likely to advocate for policies and programs that support child health and nutrition. Indonesia has made significant progress in improving maternal education levels in recent decades. The percentage of women with at least a secondary education has increased substantially, contributing to declines in maternal and child mortality and improved child nutrition outcomes. However, disparities between urban and rural areas and across socioeconomic groups persist, highlighting the need for continued investment in girls' education and women's empowerment. The Indonesian government has implemented various programs aimed at promoting maternal and child health, including the Community-Based Nutrition Program (UPGK), which focuses on improving maternal and child nutrition through community-based interventions. These programs have shown promising results in reducing stunting prevalence and improving child health outcomes. However, further efforts are needed to scale up these interventions and ensure their sustainability, particularly in remote and underserved areas.[14,15]

The findings of our study, highlighting the significant association between inadequate dietary diversity and suboptimal breastfeeding practices with stunting, underscore the critical role of optimal child feeding practices in promoting healthy growth and development. From the moment of birth, children require a balanced and nutritious diet to meet their evolving physiological needs and support their rapid growth and development. Breastfeeding and complementary feeding, the two pillars of infant and young child feeding, are crucial for ensuring that children receive the nourishment they need to thrive. Breast milk, often referred to as the "gold standard" of infant nutrition, provides the ideal nourishment for newborns and young infants. It is a dynamic and complex fluid that adapts to the changing needs of the growing infant, providing a perfect balance of macronutrients (carbohydrates, proteins, and fats), micronutrients (vitamins and minerals), and bioactive factors that support immune function, gut health, and cognitive development. Exclusive breastfeeding for the first six months of life, followed by continued breastfeeding alongside appropriate complementary foods up to two years of age or beyond, is recommended by the World Health Organization (WHO) and UNICEF to promote optimal growth, development, and health. The benefits of breastfeeding are manifold. Breastfed infants have a lower risk of infectious diseases, such as diarrhea, pneumonia, and otitis media, due to the protective antibodies and immune factors present in breast milk. Breastfeeding also reduces the risk of chronic diseases later in life, including obesity, diabetes, and cardiovascular disease. Moreover, breastfeeding promotes maternal health, reducing the risk of postpartum hemorrhage, breast and ovarian cancer, and type 2 diabetes. Despite the well-documented benefits of breastfeeding, rates in Indonesia, particularly exclusive breastfeeding rates, remain suboptimal. The 2018 IDHS reported that only 41.5% of infants under six months of age were exclusively breastfed, falling short of the global target of 50%. Traditional beliefs and practices, such as early introduction of water or other fluids, can

interfere with exclusive breastfeeding. Additionally, social pressures and lack of family support can discourage mothers from breastfeeding. Many mothers lack adequate knowledge and skills regarding proper breastfeeding techniques, positioning, and latching. This can lead to difficulties with breastfeeding and early cessation. Hospital practices, such as routine separation of mother and baby after birth and the provision of formula samples, can undermine breastfeeding initiation and exclusivity. Women who work outside the home may face challenges in continuing to breastfeed due to lack of workplace support and lactation facilities. Addressing these barriers and promoting breastfeeding requires a multi-pronged approach that encompasses policy, healthcare practices, community support, and public awareness. Implementing and enforcing policies such as the International Code of Marketing of Breast-milk Substitutes and the Baby-Friendly Hospital Initiative can create a supportive environment for breastfeeding. Training healthcare providers on breastfeeding counseling and support, and implementing practices that promote early initiation and exclusive breastfeeding, can improve breastfeeding rates. Establishing community-based breastfeeding support groups and peer counseling programs can provide mothers with the information, encouragement, and practical skills they need to successfully breastfeed. Raising awareness about the benefits of breastfeeding and challenging social norms that discourage breastfeeding can help create a culture that supports and values breastfeeding. As infants grow and develop, breast milk alone is no longer sufficient to meet their nutritional needs. Complementary feeding, the introduction of solid or semi-solid foods alongside breast milk, is a critical transition that provides additional energy, protein, and micronutrients essential for growth and development. The WHO recommends introducing complementary foods at around six months of age, while continuing to breastfeed up to two years or beyond. Appropriate complementary feeding practices involve providing a variety of safe and nutritious foods in adequate amounts and frequencies, ensuring responsive feeding, and practicing good hygiene. Dietary diversity, the consumption of a wide range of foods from different food groups, is particularly important for ensuring that children receive all the nutrients they need. Achieving adequate dietary diversity can be challenging in resource-constrained settings, such as rural South Sumatra. Limited financial resources can restrict the ability of families to purchase a variety of foods, particularly nutrient-rich foods such as fruits, vegetables, and animal source foods. Reliance on subsistence farming and limited access to markets can restrict the availability and diversity of foods in rural areas. Fluctuations in food availability and prices throughout the year can further impact dietary diversity. Traditional food preferences and beliefs about child feeding can limit the variety of foods offered to children. Addressing these challenges and promoting dietary diversity requires a multifaceted strategy that combines nutrition education, agricultural interventions, and social protection measures. Providing mothers and caregivers with information and skills on preparing nutritious and diverse meals using locally available foods can improve child feeding practices. Promoting home gardening, backyard poultry farming, and other small-scale agricultural activities can increase access to fresh and nutritious foods. Cash transfer programs and food subsidies can help families afford a wider variety of foods, particularly during lean seasons. Improving access to markets and promoting the availability and affordability of nutritious foods can enhance dietary diversity. Healthcare providers play a crucial role in promoting optimal child feeding practices and preventing stunting. They can provide mothers and caregivers with counseling and support on breastfeeding, complementary feeding, and growth monitoring. They can also identify children at risk of stunting and refer them for appropriate interventions.[16,17]

The findings of this study serve as a clarion call to action, underscoring the pressing need for a concerted and multi-pronged effort to address the multifaceted challenges of stunting in rural South Sumatra. While the intricate web of socioeconomic, maternal, and child-related risk factors may seem daunting, it is imperative to recognize that stunting is not an

inevitability. Through strategic policy interventions, targeted programs, community empowerment, and evidence-based research, we can pave the way for a brighter future where every child in rural South Sumatra has the opportunity to reach their full potential, free from the shackles of malnutrition and stunting. Tackling the complex issue of stunting demands a multi-sectoral approach that transcends the traditional boundaries of healthcare and nutrition. It requires a coordinated effort from various stakeholders, including government agencies, non-governmental organizations, community leaders, healthcare providers, and researchers, working in tandem to address the root causes of stunting and create an enabling environment for child growth and development. Poverty lies at the heart of the stunting problem, and addressing it is paramount. Social protection programs, such as conditional cash transfers, can provide a crucial safety net for poor families, enabling them to meet their basic needs and invest in their children's health and education. These programs have been shown to be effective in reducing poverty rates, improving food security, and enhancing child nutritional status. Microcredit schemes can also empower women and families to engage in income-generating activities, fostering economic self-sufficiency and reducing vulnerability to poverty. Furthermore, investing in infrastructure development, such as roads, clean water supply, and sanitation facilities, can improve living conditions in rural areas, reducing the risk of infectious diseases and creating a more conducive environment for child growth and development. Empowering women through education is a powerful lever for change, with far-reaching benefits for child health and nutrition. Expanding access to quality education for girls and women, including early childhood development programs and adult literacy initiatives, can equip them with the knowledge and skills necessary to make informed decisions about their own health and the health of their children. Educated mothers are more likely to adopt optimal child feeding practices, seek timely healthcare, and create a nurturing home environment that fosters child growth and development. Moreover, maternal education can contribute to breaking the intergenerational cycle of poverty and malnutrition. Educated women are more likely to engage in income-generating activities, delay marriage and childbearing, have fewer and healthier children, and invest in their children's education. These positive outcomes not only benefit individual families but also contribute to the overall development and prosperity of communities. Scaling up nutrition-specific interventions, such as breastfeeding promotion, complementary feeding education, and micronutrient supplementation, can directly address nutritional deficiencies and prevent stunting. Breastfeeding, with its myriad benefits for both mother and child, should be actively promoted and supported through community-based initiatives, healthcare provider training, and workplace lactation policies. Complementary feeding education can empower mothers and caregivers to provide their children with a diverse and nutritious diet, ensuring adequate intake of essential nutrients for growth and development. Micronutrient supplementation, particularly with iron, zinc, and vitamin A, can help address deficiencies and prevent stunting in high-risk populations. Strengthening healthcare infrastructure and improving access to quality maternal and child health services are essential for early detection and management of stunting. Antenatal care, postnatal care, growth monitoring, and immunization programs play a crucial role in promoting child health and preventing malnutrition. Community health workers can serve as a vital link between communities and healthcare facilities, providing essential health education, facilitating access to care, and promoting early identification and referral of children at risk of stunting. Promoting improved sanitation and hygiene practices, such as handwashing with soap, safe water storage, and proper disposal of human waste, can significantly reduce the burden of infectious diseases, including diarrhea, which is a major contributor to stunting. Community-led total sanitation programs, coupled with education campaigns on hygiene practices, can create a healthier environment for children and reduce their risk of infection and malnutrition. Engaging with local communities and empowering them to participate in the design, implementation, and monitoring of interventions is

crucial for ensuring their sustainability and effectiveness. Community-based approaches, such as mother-to-mother support groups, community health worker programs, and village nutrition committees, can leverage local knowledge, build capacity, and foster ownership of interventions. By actively involving communities in the decision-making process, we can ensure that programs are culturally sensitive, contextually relevant, and responsive to the needs of the target population.[18-20]

4. Conclusion

This community-based study has elucidated the multidimensional nature of stunting risk factors in rural South Sumatra. Low maternal education, poverty, inadequate dietary diversity, and suboptimal breastfeeding practices emerged as critical determinants. The prevalence of stunting, exceeding the national average, underscores the urgency of addressing this issue. A comprehensive approach encompassing poverty reduction, maternal empowerment, nutrition interventions, healthcare access, sanitation improvement, and community engagement is imperative to effectively combat stunting and safeguard the health and future potential of children in this region.

5. References

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