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Study of Risk Factors for Stunting Incidents in Children Under Five in The Highlands and Lowlands of Pidie Regency

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Abstract: Stunting has been a prevalent health issue in Indonesia, and Aceh Province is not exempt from this challenge. This situation has placed a substantial responsibility on all stakeholders to collaboratively work towards reducing stunting cases in Aceh. This study aimed to investigate the risk factors associated with stunting in both the highland and lowland areas of Pidie Regency. This study employed an analytical observational design with a cross-sectional approach. The instrument used was a questionnaire, a total sampling technique was applied to survey 30 mothers with children under 2 years old in Tangse Sub-district and other 30 mothers in Mutiara Sub-district. In the highlands, specifically Tangse Sub-district, four predictors were identified as significant contributors to stunting, namely socio-economics (p value: 0.013), parents' educational background (p value: 0.036), pregnancy checks (p value: 0.005), and nutritional intake (p value: 0.011). On the other hand, in a lowland area, in Mutiara Sub-district, additionally, parenting patterns (p value: 0.002) and exclusive breastfeeding (p value: 0.001) were identified as two other significant predictors of stunting in this region.The analysis leads to the conclusion that stunting prevalence was higher in the highlands of Tangse Sub-district (60%) compared to in the lowlands of Mutiara Sub-district(20%).

Keywords: Determinant; Highlands; Lowlands; Risk factor; Stunting

Introduction

Stunting cases have long captured public attention, prompting the Indonesian government to undertake a comprehensive survey to identify various factors contributing to stunting. According to UNICEF's report in 2020, the reduction in global stunting cases over the last five years has been uneven. Specifically, the West and Central Africa region was still grappling with a 28.5% increase in stunting cases (Micklesfield et al., 2013). A similar trend was observed in the East and Southern Africa region, witnessing a 1.4% rise over the same period. In contrast, the Eastern Europe and Central Asia region experienced a noteworthy decline, showing a reduction of 46.8% in stunting cases.

Stunting cases are a global concern, and Indonesia is no exception. According to the 2018 Basic Health Research data, Indonesia witnessed a decrease in stunting cases from 37.2 to 30.18% (Widayatun, 2023). Subsequently, in 2019, the country achieved a further reduction, with stunting cases dropping by 27.67%. Despite these positive developments, the prevalence remains high compared to the WHO's standard of below 20%. As of 2022, Indonesia maintained a position among the top five countries globally with the highest cases of stunting. This persistent challenge underscores the government's recognition of stunting as a priority health issue among children that might be associated with various characteristics and socio-economic status (Kemenkes, 2022).

Aceh Province, as a part of Indonesia, also grapples with stunting, particularly in Pidie Regency. The factors contributing to and interplaying in stunting are not solely confined to the nutritional intake of pregnant

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women or toddlers (Taslim et al., 2023). Numerous studies in Indonesia have delved into the various risk factors associated with stunting. Each region exhibits unique dominant factors shaped by its specific geographical and societal characteristics. The risk of stunting emerges from the very conception period of pregnancy, involving maternal factors. Insufficient knowledge among mothers regarding the essential health and nutrition requirements from pregnancy to childbirth can contribute to stunting in the unborn child. This critical phase encompasses the necessity for comprehensive antenatal care and post natal care as well as the importance of quality parenting and early learning. These issues are associated with adequacy of iron supplements during pregnancy, the promotion of exclusive breastfeeding, and the provision of optimal complementary food for breast milk (MPASI) play pivotal roles in addressing the risk of stunting (National Development Planning Agency (Yusriadi et al., 2024).

According to the Decree of the Minister of National Development Planning Number 10/M.PPN/HK/02/2021 regarding the Determination of the Expansion of Regencies/Cities Focus Locations for Integrated Stunting Reduction Interventions in 2022, Aceh Province has been included in the intervention program. This initiative encompasses 13 districts in Aceh, namely Central Aceh, Aceh Besar, North Aceh, Aceh Tamiang, Pidie, East Aceh, Simeulue, Bireun, Nagan Raya, Subulussalam, Southeast Aceh, Bener Meriah, and Gayo Lues (PPN, 2022).

In relation to the designation of intervention focus locations for stunting prevention as outlined in the Decree of the Minister of National Development Planning Number 10/M.PPN/HK/02/2021, Pidie Regency is identified as one of the 13 loci. The Regional Government of Pidie Regency has responded proactively to this situation, implementing various stunting intervention efforts through collaborative programs involving stakeholders such as health workers, village officials, and the community. Several initiatives have been undertaken in areas affected by stunting, including the identification of specific locations (loci) for stunting intervention. The author conducted a survey of stunting data in five sub-districts. In Simpang Tiga Sub-district, there were 53 children with stunting in 2019, 32 children in 2020, 37 children in 2021, and 29 children in 2022 (Source: Community Health Center of Simpang Tiga, 2022).

Additionally, stunting data in Tangse Sub-district showed 49 children with stunting in 2019, 37 children in 2020, 32 children in 2021, and a projected 37 children in 2022 (Source: Community Health Center of Tangse, 2022). Furthermore, the Sub-district of Kembang Tanjung had 34 stunted children in 2019, 27 children in 2020, 31 children in 2021, and 22 children in 2022 (Source: Community Health Center of Kembang Tanjung, 2022). Tiro Sub-district recorded 25 stunted children in 2019, 30 children in 2020, 22 children in 2021, and 17 children in 2022 (Source: Community Health Center of Tiro, 2022). Lastly, Mutiara Timur Sub-district reported 48 children experiencing stunting in 2019, 37 children in 2020, 33 children in 2021, and 25 children in 2022 (Source: Community Health Center of Mutiara Timur). Unfortunately, the five sub-districts have not shown a significant reduction in stunting cases so far.

Building upon the provided background, the researchers aim to analyze various factors contributing to stunting risk in the highland and lowland areas of Pidie Regency in 2024. This comprehensive study encompasses factors originating from households, communities, and pregnant women themselves.

Method

This study adopts an observational approach with a cross-sectional design. The study population is derived from two distinct regions: a highland area, focusing on the Tangse Sub-district locus, and a lowland area, centered around the Mutiara Sub-district locus. The participants selected for this study include 30 mothers from Tangse Sub-district and 30 mothers from the Mutiara Sub-district with toddlers identified as stunted, spanning the period from March to December 2024. A purposive sampling technique was employed, specifically targeting mothers whose toddlers showed signs of stunting based on predefined criteria. The dependent variable in this study is the incidence of stunting, while the independent variables encompass various factors such as socioeconomic status, access to health services, parents' educational background, parenting patterns, interval between pregnancies, sanitation practices, frequency of pregnancy checks, exclusive breastfeeding practices, prevalence of infectious diseases, and nutritional intake in both regions. Data collection was facilitated through a questionnaire meticulously compiled by the authors, encompassing all the variables mentioned above.

In the realm of research methodologies, various studies have previously conducted with diverse approaches, and one notable example is the stunting modeling research entitled "WebGIS in Trend Mapping of the Incidence of Stunting in Central Java Province in 2015-2017" conducted by Setyawati et al. (2020). This study aimed to map the distribution of stunting prevalence in regencies/cities within Central Java Province, utilizing the WHO criteria for community nutrition problems. According to these criteria, areas with a prevalence exceeding 20% warrant immediate

intervention efforts to mitigate the issue. The research design employed in this study falls under the category of research and development (R&D), utilizing Quantum GIS software for the geographic information system (GIS) analysis. The main variable investigated in this study was the stunting prevalence data from 35 regencies/cities within Central Java Province, covering the period from 2015 to 2017. These data were sourced from the Nutrition Status Assessment report provided by the Central Java Provincial Service. The methodology involved the creation of a geographic system, and the process was structured in a flow diagram. The system was designed to highlight areas with stunting conditions (Setyawati et al., 2020).

Additionally, a study conducted by Lestari et al. (2018) focused on elementary school children in North Sumatra Province, specifically in Medan City and Langkat Regency. The findings of this research revealed a notably high prevalence of stunting among the studied population. The study utilized a cross-sectional analysis approach, encompassing a total sample of 400 children aged 8-13 years during the period from July to October 2017. Data collection involved the use of questionnaires and anthropometric assessments. The study reported a stunting prevalence of 38.87% among elementary school children in the area. The factors associated with this prevalence included maternal education, income, employment, energy intake, and protein intake. Among these factors, the dominant influence was attributed to energy intake (Lestari et al., 2018).

The authors of in this study processed the data using the SPSS (Statistical Package for the Social Sciences) Software version 24. The data are presented in frequency distribution tables and percentages after they were analyzed using multivariate models. The analytical approach involved the use of a logistic regression test to explore the relationship between variables, identifying significant predictors on the dependent depen. The chi-square statistical test was employed with a significance level of α=0.05, and Odds Ratio (OR) was calculated with a corresponding significance level. The primary benefit of this test in this study is its ability to identify independent variables that demonstrated a statistically significant correlation with the occurrence of the dependent variable (Lestari et al., 2018). This study has obtained ethical approval from the Ethics and Research Committee of Syiah Kuala University, Darussalam, Banda Aceh, Indonesia.

Result and Discussion

Result

The results of univariate and multivariate analyses on risk factors of stunting incidents in the highland and lowland areas of Pidie regency. According to the Table 1, in the highland area (Tangse Sub-district), among the 30 respondents, 60% of the children experienced stunting, while 40% were considered normal. The distribution of families based on socioeconomic status revealed that 23% of the families were categorized as 'high', 23% of them were categorized as 'middle', and 54% of them were 'low'. Regarding the access of health services, 23% perceived them as 'good', while 77% considered them as 'poor'. In terms of parents' educational background, 77% of the parents were elementary and high school graduates while 23% had undergraduate degree (S1).

Table 1. Frequency Distribution of Risk Factors for Stunting Incidents in the Highland Area, Tangse Sub-district, Pidie Regency in 2024

Variable	Frequency	Percentage (%)
Stunting Incident		
Stunting	18	60
Normal	12	40
Socioeconomic Status		
High	7	23
Middle	7	23
Low	16	54
Health Service Access		
Good	7	23
Poor	23	77
Parents' Educational Background		
Elementary School	2	7
Junior High School	8	27
Senior High School	13	43
Undergraduate Degree (S1)	7	23
Parenting Pattern		
Good	9	30
Poor	21	70
Interval between Pregnancies		
> 36 Months (Ideal)	13	43
< 24 Months (Not Ideal)	17	57
Sanitation		
Good	10	33
Fair	11	37
Poor	8	30
Pregnancy Checks		
>4 >4 Times (Normal)	11	37
<3 Times (Not Normal)	19	63
Exclusive Breastfeeding		
Yes	10	33
No	20	67
Infectious Diseases		
Severe	12	40
Mild	28	60
Nutritional Intake		
Good	12	40
Sufficient	13	43
Poor	5	17

Parenting pattern variable showed that 30% had good patterns for children's growth and development, while 70% did not. For interval between preganancies, 43% had an ideal interval (>36 months), and 57% did not. The sanitation variable indicated that 33% had good sanitation, and 30% had poor sanitation while 37% had fair sanitation level. For the variable of pregnancy check, it was indicated that 37% of mothers had more than 4 times of pregnancy checks (normal) while 63% of them did not meet the normal frequency (less than 3 times) of medical checks during preganancy. Moreover, exclusive breastfeeding was practiced by 33% of the mothers, while 67% did not exclusively breastfeed. In terms of infectious diseases, 40% of the children experienced severe infectious diseases, and 60% had mild infectious diseases. Lastly, for the nutritional intake variable, 40% of children had good nutritional intake, 43% had sufficient nutritional intake, and 17% had poor nutritional intake.

Table 2 shows the distribution of stunting incidents and the ten variables of risk factors in the lowland area (Mutiara Sub-district). Of the 30 respondents, 20% of the children experienced stunting, while 80% were considered normal. The distribution of families based on socioeconomic status revealed that 23% of the families were categorized as 'high', 63% of them were categorized as 'middle', and 14% of them were 'low'. Regarding the access of health services, 23% perceived them as 'good', while 77% considered them as 'poor'. In terms of parents' educational background, 87% of the parents were elementary and high school graduates while 13% had undergraduate degree (S1).

Parenting pattern variable showed that 43% had good patterns for children's growth and development, while 57% did not. For interval between preganancies, 80% had an ideal interval (>36 months), and 20% did not. The sanitation variable indicated that 30% had good sanitation, and 13% had poor sanitation while 57% had fair sanitation level. For the variable of pregnancy check, it was indicated that 6.7% of mothers had more than 4 times of pregnancy checks (normal) while 93.3% of them did not meet the normal frequency (less than 3 times) of medical checks during preganancy. Moreover, exclusive breastfeeding was practiced by 27% of the mothers, while 73% did not exclusively breastfeed. In terms of infectious diseases, 30% of the children experienced severe infectious diseases, and 70% had mild infectious diseases. Lastly, for the nutritional intake variable, 70% of children had good nutritional intake, 33% had sufficient nutritional intake, and no children had poor nutritional intake.

Table 2. Frequency Distribution of Risk Factors for Stunting Incidents in the Highland Area, Mutiara Sub-district, Pidie Regency in 2024

Variable	Frequency	Percentage (%)
Stunting Incidents		
Stunting	6	20
Normal	24	80
Socioeconomic Status		
High	7	23
Middle	19	63
Low	4	14
Health Service Access		
Good	7	23
Poor	23	77
Parents' Educational Background		
Elementary School	2	6.7
Junior High School	8	26.7
Senior High School	16	53.3
Undergraduate Degree (S1)	4	13.3
Parenting Pattern		
Good	13	43
Poor	17	57
Interval between Pregnancies		
> 36 Months (Ideal)	24	80.0
< 24 Months (Not Ideal)	6	20.0
Sanitation		
Good	9	30
Fair	17	57
Poor	4	13
Pregnancy Checks		
>4 >4 Times (Normal)	2	6.7
<3 times (Anormal)	28	93.3
Exclusive Breastfeeding		
Yes	8	27
No	22	73
Infectious Diseases		
Severe	9	30
Mild	21	70
Nutritional Intake		
Good	21	70
Sufficient	9	30
Poor	0	0

Additionally, Table 3 presents eight predictor variables that have been deemed eligible to be included in the Step 2 of the logistic regression model. These variables include socioeconomic status, health service access, parents' educational background, interval between pregnancies, sanitation, pregnancy checks, exclusive breastfeeding, and nutritional intake. Detailed information can be found in the Table 3.

The eligibility test results for the stunting risk model in the highland area of Tangse Sub-district determined the significant predictors after removing non-candidate variables in step 2. Among the identified

8 predictors, socioeconomic status was the variable with the highest risk of stunting (p = 0.013), followed by parents' educational background (p = 0.036), interval between pregnancies (p = 0.001), pregnancy checks (p = 0.005), and nutritional intake (p = 0.011). Meanwhile, health service access, sanitation, and exclusive breastfeeding did not serve as the predictors of stunting based on the study findings. The dominant risk factors were the interval between pregnancies and pregnancy checks, highlighting the crucial role of considering the distance between births and the frequency of medical checks during pregnancy in mitigating stunting risk. Most of the respondents did less than 4 medical checks during their pregnancies. Most of the mothers showed a lack of understanding regarding the necessity of pregnancy checks, often assuming the checks were unnecessary unless they experienced illness.

Table 3. Step 1 Model Eligibility Test of Risk Factors for Stunting Incidents in the Highland Area (Tangse Sub-district) in 2024

Predictor	OR	p-value	< 0.25	Remarks	95% CI for EXP(B)	
					Lower	Upper
Socioeconomic status	1.944	0.146	14.6	Candidate	0.287	13.188
Health service access	0.128	0.227	22.7	Candidate	0.005	3.583
Parents' educational background	0.191	0.235	23.5	Candidate	0.012	2.935
Parenting patterns	0.667	0.627	62.7	Non-candidate	0.130	3.414
Interval between Pregnancies	1.122	0.079	7.9	Candidate	0.253	4.972
Sanitation	0.583	0.207	20.7	Candidate	0.225	1.510
Pregnancy checks	1.444	0.175	17.5	Candidate	0.116	18.035
Exclusive breastfeeding	0.524	0.132	13.2	Candidate	0.104	2.631
Infectious disease	0.625	0.544	54.4	Non-candidate	0.137	2.852
Nutritional intake	0.457	0.156	15.6	Candidate	0.155	1.347

There was a misconception about the purpose of pregnancy checks, as these checks are crucial for monitoring fetal weight, assessing the fetus's condition in the womb, and ensuring proper nutritional intake for both the mother and the baby. The recommended frequency of at least four checks was not well understood, particularly among mothers in the highland area. Additionally, the distant location of health centers from their homes contributed to the reluctance of pregnant women to seek medical attention. The variable presenting the highest risk of stunting in the highland area was the interval between pregnancies, with an odds ratio (OR) of 4.850, indicating a risk probability approximately 5 times higher for stunting. The data also highlights the impact of interval between pregnancy, with the pregnancy check variable having an OR of 1.750, signifying a twofold risk of stunting.

Table 4. Step 2 Model Eligibility Test of Risk Factors for Stunting Incidents in the Highland Area (Tangse Sub-district) in 2024

Predictor	OR	p-value	Remarks	95% CI for EXP(B)	
				Lower	Upper
Socioeconomic status	0.306	0.013	A risk factor for stunting incident	0.009	10.609
Health service access	119.319	0.999	NOT a risk factor	0.000	2.136.
Parents' educational background	3.170	0.036	A risk factor for stunting incident	0.695	14.460
Interval between pregnancies	4.850	0.001	A risk factor for stunting incident	0.593	39.683
Sanitation	0.432	0.508	NOT a risk factor	0.036	5.187
Pregnancy checks	1.750	0.005	A risk factor for stunting incident	0.104	5.416
Exclusive breastfeeding	0.000	0.999	NOT a risk factor	0.000	3.765.
Nutritional Intake	1.341	0.011	A risk factor for stunting incident	0.068	1.711

This situation arose because closely spaced pregnancies often hindered timely and sufficient pregnancy check-ups, compounded by the remote location of the health centers and the busy schedules of husbands engaged in farming or gardening. Many pregnant women usually lacked support and attention from their spouses during pregnancy, leading to a lack of motivation to attend medical check-ups. Consequently, nutritional intake suffered, with an associated risk value of OR: 1.341, suggesting a one-time increased likelihood of stunting. Pregnant women's limited awareness of the necessary nutritional intake during pregnancy and infancy further compounded the issue, as they often assumed that the absence of illness indicated the baby's health. Understanding the

complexity of stunting and its causes has remained a challenge for these mothers.

Table 5. Step 1 Model Eligibility Test of Risk Factors for Stunting Incidents in the Lowland Area (Mutiara Sub-district) in 2024

Predictor	OR	p-value	< 0.25	Remarks	95% CI for EXP(B)	
					Lower	Upper
Socioeconomic status	0.833	0.898	89	Non-candidate	0.051	13.633
Health service access	1.778	0.662	66	Non-candidate	0.135	23.399
Parents' educational background	7.204	0.181	18	Candidate	.398	130.282
Parenting pattern	3.987	0.240	24	Candidate	.378	42.117
Interval between Pregnancies	0.716	0.229	22	Candidate	0.034	14.880
Sanitation	0.582	0.160	16	Candidate	0.015	22.151
Pregnancy checks	6.911	0.000	0	Candidate	.000	11.633.
Exclusive breastfeeding	2.000	0.199	19	Candidate	.000	27.198.
Infectious disease	1.000	0.039	3.9	Candidate	.000	10.244.
Nutritional intake	3.982	0.012	1.2	Candidate	.257	15.297

Table 5 presents eight predictor variables that have been deemed eligible to be included in the Step 2 of the logistic regression model. These variables include parents' educational background, parenting pattern, interval between pregnancies, sanitation, pregnancy checks, exclusive breastfeeding, infectious disease, and nutritional intake. Detailed information can be found in the following Table 6.

Table 6. Step 2 Model Eligibility Test of Risk Factors for Stunting Incidents in the Lowland Area (Mutiara Sub-district) in 2024

Predictor	OR	p-value	Remarks	95% CI for EXP(B)	
				Lower	Upper
Parents' educational background	4.647	0.000	A risk factor for stunting incident	1.540	1293.973
Parenting pattern	8.679	0.002	A risk factor for stunting incident	0.000	2.380
Interval between Pregnancies	8.777	0.176	NOT a risk factor	0.087	17347.924
Sanitation	.199	0.173	NOT a risk factor	0.000	111.009
Pregnancy checks	8.000	0.607	NOT a risk factor	0.000	2.150
Exclusive breastfeeding	2.727	0.001	A risk factor for stunting incident	0.000	13.678
Infectious disease	7.973	0.129	NOT a risk factor	7.973	87.973
Nutritional intake	2.382	0.305	A risk factor for stunting incident	0.129	44.027

Table 6 shows the eligibility test results for the stunting risk model in the lowland area of Mutiara Sub-district resulting in the significant predictors after removing non-candidate variables in step 2. Among the identified eight predictors, there were four predictors with the highest risk of stunting incidents in the lowland area, Mutiara Sub-district, Pidie Regency. The analysis of predictors for stunting revealed that parents' educational background variable ($p = 0.000$) was the most significant predictor, with a p-value <0.05, indicating its high impact. This variable was followed by exclusive breastfeeding ($p = 0.001$), parenting pattern ($p = 0.002$), and nutritional intake ($p = 0.305$). On the other hand, the variables of interval between pregnancies, sanitation, pregnancy checks, and infectious diseases were not identified as the predictors of stunting incidents in this area. The results of the step 2 analysis pinpointed four predictors as the significant risk factors of stunting incidents, with parents' educational background being the most dominant factor. Notably, 26 individuals were high school graduates.

The odds ratio (OR) for this variable was 4.647, meaning that parents with low educational background had a 4.647 or approximately 5 times higher chance of influencing stunting incidents in children due to a lack of understanding of various nutritional needs from pregnancy to infancy. Following the parents' educational background variable, exclusive breastfeeding emerged as a significant predictor with an OR of 2.727, suggesting a threefold increased likelihood of stunting. The parenting pattern variable, with an OR of 8.679, indicated a ninefold chance of stunting incidents, and nutritional intake with an OR of 2.382, represented a twofold chance of the incidents of stunting. These results highlight the impact of parents' educational background on parenting patterns, emphasizing a lack of understanding among parents about the crucial aspects of child growth and development from pregnancy to infancy, including the

importance of exclusive breastfeeding and adequate nutrition to prevent stunting.

Table 7. Comparison of Risk Factors for Stunting Incidents in the Highland Area (Tangse Sub-district) and Lowland Area (Mutiara Sub-district) of Pidie Regency in 2024

Predictor	OR	p-value	Remarks	95% CI for EXP(B)	
				Lower	Upper
HIGHLAND AREA (TANGSE SUB-DISTRICT)					
Socioeconomic status	3.306	0.013	A risk factor for stunting incident	9.009	10.609
Parents' educational background	3.170	0.036	A risk factor for stunting incident	11.695	14.460
Pregnancy checks	5.750	0.005	A risk factor for stunting incident	4.104	5.416
Nutritional intake	7.341	0.011	A risk factor for stunting incident	10.068	1.711
LOWLAND AREA (MUTIARA SUB-DISTRICT)					
Parents' educational background	4.647	0.000	A risk factor for stunting incident	1.540	1293.973
Parenting pattern	8.679	0.002	A risk factor for stunting incident	0.000	2.380
Exclusive breastfeeding	2.727	0.001	A risk factor for stunting incident	0.000	13.678
Nutritional intake	2.382	0.305	A risk factor for stunting incident	0.129	44.027

The research findings, as presented in Table 7, indicate notable differences found in the predictors of stunting risk between the highland and lowland areas. In the highland area of Tangse Sub-district, with all villages situated far from urban areas, four predictors were found as significant contributors to stunting incidents. These include socioeconomic status ($p = 0.013$) with an odds ratio (OR) of 3.306, parents' educational background ($p = 0.036$) with an OR of 3.170, pregnancy checks ($p = 0.005$) with an OR of 5.750, and nutritional intake ($p = 0.011$) with an OR of 7.341. All these variables significantly influenced the incidents of stunting in children under five in this highland area.

Conversely, in the lowland area of Mutiara Sub-district with many villages located far from urban areas and residents primarily engaged in farming, gardening, and trading, the findings revealed two common predictors of stunting inbcidents in the highlands area. These are parents' educational background ($p = 0.000$) with an OR of 4.647 and nutritional intake ($p = 0.305$) with an OR of 2.382. Additionally, two unique predictors were also identified: parenting style ($p = 0.002$) with an OR of 8.679 and exclusive breastfeeding ($p = 0.001$) with an OR of 2.272. These results highlight the regional variations in predictors influencing stunting risk, emphasizing the importance of considering local and specific factors in addressing stunting in diverse geographical areas.

Discussion

Stunting is a condition that characterizes the nutritional status of toddlers, where their body length or height falls below the child growth standards determined by the World Health Organization (WHO) (Khadilkar et al., 2021; Oliveira et al., 2022). This phenomenon in toddlers can result from various factors, including socioeconomic status, parents' educational background, nutritional intake, and various other causes. Typically, the causes of stunting are chronic in nature, indicating that these factors have a long-lasting impact on the growth and development of the child (Putra et al., 2025; Soliman et al., 2021).

The research results revealed that in the highland area of Tangse Sub-district, the prevalence of stunting was notably high, reaching 60%. This issue can be attributed to various socio-economic factors, including a significant portion of the population having below-average income levels and a considerable number of parents possessing low levels of educational background. The reluctance to pursue higher education was evident, with a limited desire for further knowledge, particularly among girls who usually transitioned to becoming housewives immediately after completing junior or senior high school. Conversely, boys, after completing junior or senior high school, often engaged in trading or farming. The perpetuation of traditional thinking usually played a role, where the belief persisted that education was costly and could not guarantee a secure job. There was also a prevailing perception that pursuing higher education was challenging and stressful, contributing to the reluctance to attend high school. Additionally, cultural norms also had a role, as there was a paradigm that, even if women pursued college education, they were still expected to assume traditional roles in the kitchen (Thania, 2024). These challenges were deeply rooted in the cultural fabric of highland society, posing barriers to educational advancement and contributing to the high prevalence of stunting incidents in the region. Addressing these issues would likely require various approaches considering both economic and cultural factors to promote educational opportunities and improve overall well-being.

The reluctance of mothers to attend pregnancy checks was influenced by several factors, including the

burden of household responsibilities, the demands of caring for existing children, insufficient support from husbands during pregnancy, and the distant location of the health centers (Otiso et al., 2024). Despite being accessible by motorbike, the lack of understanding about the nutritional needs of mothers and babies, coupled with a traditional mindset that pregnancy can still proceed without regular health monitoring, has contibuted to this hesitancy (Hsu et al., 2022). This lack of awareness regarding stunting and a belief that pregnancy requires minimal intervention impacted the child's growth and development. Economic challenges further compounded this issue, as families with limited means struggled to maintain a balanced nutritional intake for pregnant women and their children. The highland area's geographical remoteness, coupled with unstable incomes and a lack of complete markets, impeded access to essential resources. Actually, there was potential for improvement if individuals in the highland area could acquire knowledge about nutritional intake and utilize locally available agricultural products. With increased awareness and interest in incorporating fruits and vegetables into daily diets, pregnant women's nutritional needs could be better fulfilled. Addressing the root causes of stunting in the highland area should involve fostering awareness and knowledge of healthy lifestyles (Firdaus & Maulana, 2025). Leveraging existing resources and promoting education on nutritional intake could have played a crucial role in preventing stunting at an early stage.

The findings of this study align with a study conducted by Maeharan et al. in 2019, which focused on the interventions based on educational outcomes and high socio-economic status to reduce the incidents of stunting. This cross-sectional survey, carried out in 2017 on 2,160 girls and boys in Klaten and West Lombok Regencies, encompassed various aspects such as adolescent nutritional status, socio-demographic characteristics, morbidity, food intake, physical activity, and others. The results of Maeharan's study revealed that approximately a quarter of adolescent girls (25%) and boys (21%) experienced stunting. Additionally, around 5% of girls and 11% of boys were underweight, while 11% of both girls and boys were overweight. These findings indicated a complex nutritional landscape among adolescents in the regions. Importantly, the study underscored the relationship between higher socioeconomic status and parents' educational background with a reduction in the incidents of stunting (Maehara et al., 2019).

On the other hand, another study conducted in South Sulawesi, particularly in the highland and lowland areas of Jeneponto Regency, investigated and found that the economic status of family members did not significantly impact the incidents of stunting among children. The key factor contributing to stunting incidents appeared to be the knowledge and educational background of parents (Fadmi et al., 2023; Mediani et al., 2022; Rahayuwati et al., 2023). Even in families with good economic status and capability to fulfill the needs of their children, specifically infants and toddlers, optimal care was not guaranteed if parents lacked understanding and knowledge of proper nutritional practices for their children (Danapriatna et al., 2023). This result is in line with the result of this study conducted in Tangse and Mutiara Sub-district in Pidie Regency, where parents' educational background emerged as the most influential variable associated with stunting.

The findings emphasize the pivotal role of parents' educational background in shaping a healthy society. The indication that parents' educational background was strongly linked to the incidents of stunting has urged the need for initiatives aimed at enhancing the knowledge and education of prospective parents. This suggests a potential discourse for government intervention through early education improvement programs, possibly starting from high schools. By preparing prospective parents with adequate knowledge, there's an opportunity to instill healthy practices in raising the next generation. Good academic background of parents has been seen as a pathway to adopting healthier lifestyles, including providing children with a nutritious diet (Purwanti et al., 2019). As outlined by Harahap et al. (2024), socio-demographic determinants of stunting encompassed various factors, such as place of residence, family economic status, parents' academic background (both father and mother), and interactions with other cultures, including birth orders, living arrangements with grandparents, and the presence of polygamy in the family diet (dos Santos et al., 2022).

The research conducted in the lowland area of Mutiara sub-district in Pidie Regency, indicated a stunting incidence rate of 20%, indicating a notable prevalence of this issue. The study found four predictors significantly associated with the risk of stunting: parents' educational background, nutritional intake, parenting patterns, and exclusive breastfeeding. The impact of low level of parents' educational background was particularly emphasized, as it influenced the knowledge of fathers and mothers in caring for babies from the womb to toddlerhood. The community in the lowland area had lack of motivation in practicing exclusive breastfeeding, potentially influenced by societal trends of the practices of career women. A shift in parenting patterns from the traditional pattern inherited from previous generations to the modern one,

could have implications for the healthy growth and development of children. However, despite efforts by health workers to provide counseling on child growth and development, there was resistance to adopting new parenting styles. The deeply ingrained traditional practices persisted, impacting the well-being of infants and toddlers. The prevailing mindset in Pidie, which devalues education and perceives high school as unnecessary, contributes to the perpetuation of unhealthy lifestyle choices (De Schutter et al., 2023). This underscores the need for government intervention to motivate the community in Pidie to improve their education, at least until senior high school level, possibly through scholarship programs. In addition, short training sessions covering various aspects of knowledge, funded by village funds obtained from the government, could engage the community in compelling and informative activities. This approach is expected to increase knowledge and awareness among the community in Pidie Regency, fostering the birth of a healthier and more intelligent generation.

The local governments of the areas are suggested to allocate the budget to establish healthy and smart villages. This can be achieved by collaborating with human resources from various fields of science to empower communities in ensuring food security, creating healthy living environments, and implementing intelligent practices that make use of natural resources for community welfare. The primary goal is to eradicate stunting cases by 2030.

Conclusion

In the highland area of Tangse Sub-district, there were four identified risk factors for stunting. These included socioeconomic status with a p-value of 0.013, presenting a risk of 3.306 times; parents' educational background with a p-value of 0.036, indicating a risk of 3.170 times; pregnancy checks with a p-value of 0.005, associated with a risk of 5.750 times; and nutritional intake with a p-value of 0.011, carrying a risk of 7.341 times. All these factors significantly contributed to the risk of stunting in children under the age of five in the area. Regarding the lowland area of Mutiara Sub-district, the research findings showed two common risk factors with the highland area: parental education with a p-value of 0.000, posing a risk of 4.647 times; and nutritional intake with a p-value of 0.305, indicating a risk of 2.382. Additionally, two other risk factors were identified: parenting pattern with a p-value of 0.002, associated with a risk of 8.679 times; and exclusive breastfeeding with a p-value of 0.001, carrying a risk of 2.272. These four factors collectively contribute to the incidents of stunting in children under five in the area. The prevalence of stunting cases was notably higher in the highland area of Tangse Sub-district, that reached the percentage of 60%, compared to the lowland area in Mutiara Sub-district with 20% of stunting incidents.

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Conflict of Interest

During the research process and preparation of this research report, there was no personal conflict of interest that influenced the research results, either in data collection, data presentation or interpretation of research data. Each author has agreed to publish the results of this research at his/her own expense so that no one can interfere with the process of publishing this research

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