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DETERMINANTS INFLUENCING THE PREVALENCE OF STUNTING IN TODDLERS

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ABSTRACT
Stunting remains a significant public health issue with long-term effects on the growth and development of children, particularly in regions with limited access to health resources. Various factors such as economic status, parenting practices, and access to health facilities contribute to its prevalence. This study aims to analyze the determinants influencing stunting among children under five years old in Sambane Village, Langgudu District, Bima Regency. A cross-sectional approach was used with data collected from 50 respondents through questionnaires. Statistical analysis using the Chi-Square test was conducted to examine the relationship between independent variables—namely economic status, water source, toilet type, mother's body mass index (BMI), mother's education, mother's occupation, mother's age, child vaccination status, and frequency of posyandu visits—and the prevalence of stunting. The findings revealed that economic status ($\chi^2 = 36.11$, $p < 0.001$), water source ($\chi^2 = 29.17$, $p < 0.001$), toilet type ($\chi^2 = 34.38$, $p < 0.001$), maternal education ($\chi^2 = 36.11$, $p < 0.001$), and maternal occupation ($\chi^2 = 25.69$, $p < 0.001$) were significantly associated with stunting. These results highlight that strengthening socioeconomic conditions and improving access to basic health facilities are critical strategies in stunting prevention efforts.

Keywords: chi-square test; health factor; social determinants; stunting

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INTRODUCTION

Stunting is a chronic nutritional problem that remains a major challenge at the global, national and local levels. Stunting not only affects children's physical growth but also has long-term consequences for cognitive development, health, and future economic productivity (Aulia Sandra & Sudaryanti, 2023). According to the United Nations International Children's Emergency Fund (UNICEF), more than 149 million children under five in the world were stunted in 2020, with the highest prevalence found in developing countries. Stunting is categorized as a global public health problem because it can increase the risk of morbidity and mortality, inhibit children's brain development, and reduce intelligence levels which have an impact on low academic achievement and economic productivity in adulthood (Madanijah et al., 2016; Supiana et al., 2023). Therefore, in the Sustainable Development Goals (SDGs) agenda, global targets have been set to reduce stunting rates by 40% by 2025 and eliminate all forms of malnutrition by 2030 (Aulia Sandra & Sudaryanti, 2023); (Fahmida, n.d.; Id et al., 2021; Lumbantoruan et al., 2023).

At the national level, Indonesia still faces a high burden of stunting. Based on the results of the Indonesian Nutrition Status Survey (SSGI) in 2022, the national stunting prevalence reached 21.6%, which is still far from the target of 14% by 2024. This prevalence indicates that more than one in five children under five in Indonesia has impaired growth due to chronic malnutrition. This figure is still relatively high when compared to the World Health Organization (WHO) standard which targets stunting prevalence below 20% (Kemenkes, 2022).West Nusa Tenggara (NTB) Province is included in an area with a higher prevalence of

stunting than the national rate, reaching 32.7%. Bima district, as one of the regions in NTB, recorded a stunting rate of 31.2%, indicating that stunting remains a significant public health challenge (Ihromi & Saputrayadi, 2020).

Sambane Village in Langgudu District has the highest stunting prevalence rate, reaching 39.53%. This figure indicates that nearly four out of ten children under five in the village are stunted, significantly exceeding both national and provincial averages. This highlights that stunting remains a serious public health issue in Sambane Village and calls for more effective, evidence-based interventions. Several factors contribute to this high prevalence, including limited access to nutritious food in terms of both availability and economic affordability, suboptimal parenting practices such as a lack of maternal knowledge regarding appropriate complementary feeding and breastfeeding behaviors, limited access to health services such as antenatal care (ANC), maternal and child health services, and immunization, as well as poor environmental sanitation and hygiene, which increase the risk of infectious diseases like diarrhea and acute respiratory infections (ARI) that can impair nutrient absorption in children. Therefore, a deeper investigation into the factors influencing the high prevalence of stunting in Sambane Village is necessary to provide a more comprehensive understanding for the development of evidence-based policies and interventions.

Problem Justification and Research Gaps

Several previous studies have discussed the determinants of stunting, from the aspects of nutrition, socioeconomics, environment, and access to health services. Several studies have shown that nutrition and parenting during the first 1,000 days of life play a significant role in determining children's nutritional status, while recurrent infections and poor sanitation worsen stunting conditions by inhibiting the absorption of nutrients in the body. In addition, the socioeconomic status of the family is also an important factor in determining the adequacy of nutritional intake and health services received by children. However, studies that specifically identify the dominant factors influencing the prevalence of stunting in Sambane Village, Langgudu Sub-district, Bima District are still very limited. Most existing studies only cover national or provincial scale data without delving deeper into how these factors operate in the social and economic context of local communities. These research gaps include the lack of locally-based studies examining the determinants of stunting in Sambane Village, the lack of empirical data showing the relationship between socio-economic factors, parenting, access to health services, and stunting in rural areas of NTB, and the absence of in-depth studies integrating the multidimensional factors (nutrition, socio-economics, health, and environment) that contribute to stunting at the village level. Therefore, a more specific and local data-based study is needed to understand the dominant factors contributing to the high stunting rate in Sambane Village. The objective of this study is to identify and analyze the key determinants influencing the prevalence of stunting among children under five in the village. The results of this study are expected to serve as recommendations for local governments and policy makers in formulating more effective, targeted, and evidence-based intervention strategies to address stunting comprehensively.

METHOD

This study used a quantitative approach with a cross-sectional research design, which allows analysis of the relationship between various determinant factors and the prevalence of stunting in children under five years of age at a single point in time. This approach was chosen because it provides a picture of actual conditions and allows the identification of risk factors that contribute to the incidence of stunting. By using this design, data is collected simultaneously from predetermined respondents, without intervention or special treatment of research subjects (Nur Husnul Khatimah, 2024). This aims to obtain information on factors that potentially affect children's nutritional status, such as family socioeconomic conditions, parenting patterns,

environment, and access to health services, to provide a basis for more effective interventions in stunting prevention in Sambane Village, Langgudu Sub-district, Bima District.

The population in this study included all toddlers aged 6-59 months who lived in Sambane Village, Langgudu District, Bima Regency. The sample selection was done by Random sampling method, which is a sampling technique that considers certain characteristics relevant to the research objectives. Inclusion criteria in this study included toddlers aged 6-59 months who had health records at Posyandu and mothers/guardians who were willing to participate in the study. Meanwhile, the exclusion criteria included toddlers with a history of chronic diseases that could affect growth and toddlers who did not have complete anthropometric data. The sample size was determined based on the minimum epidemiological sample calculation for cross-sectional research, so that the sample size obtained can accurately represent the population and allow analysis of the relationship between determinant factors and the prevalence of stunting in toddlers in the study area.

Data collection in this study was conducted through interviews using structured questionnaires and anthropometric measurements including body weight and height of children under five. Interviews with mothers or guardians of toddlers aimed to obtain information on determinant factors such as economic status, water source, toilet type, mother's body mass index, mother's education, mother's occupation, mother's age, child vaccination status, and frequency of visits to the posyandu. Meanwhile, anthropometric measurements were taken to assess the nutritional status of the toddlers, which was then categorized based on the WHO Growth Chart standards to determine whether the toddlers were stunted or not. The entire measurement process is carried out by trained personnel using standardized tools to ensure the accuracy and validity of the data obtained.

The variables in this study consisted of dependent and independent variables. The dependent variable in this study is the prevalence of stunting in children under five years old, which is measured based on the Height-for-Age (TB/U) index with a cut-off point of < -2 SD according to the WHO Growth Chart standard (Madanijah et al., 2016). Meanwhile, the independent variables include various factors that are thought to influence the prevalence of stunting, including: family economic status, categorized by income level; clean water source, categorized as proper or improper; toilet type, categorized as healthy or unhealthy; mother's Body Mass Index (BMI), categorized as thin, normal, overweight, and obese; mother's education, categorized by the last level of education attained, namely no school, elementary school, junior high school, high school, and college; Maternal occupation, which consisted of housewife, laborer, employee, and entrepreneur; maternal age at delivery, categorized into <20 years, 20-35 years, and >35 years; child vaccination status, categorized into complete and incomplete; and frequency of posyandu visits, categorized into routine and non-routine (Id et al., 2021), (Rizal & Hariandy, 2022), (Aulia Sandra & Sudaryanti, 2023). All these variables were used to analyze the relationship between these factors and the incidence of stunting among children under five in Sambane Village. Data were collected using a structured questionnaire that had been tested for validity and reliability prior to the study. The validity of the questionnaire was tested by involving nutrition experts from Muhammadiyah University of Bima to ensure that the questions in the questionnaire covered all relevant aspects of the variables being studied. Meanwhile, reliability was tested using Cronbach's Alpha to measure the internal consistency of the questionnaire, resulting in a reliability value above the acceptable threshold (e.g., >0.7), indicating that the research instrument can produce consistent results.

Data were analyzed using Python software with the Anaconda environment through several stages. Descriptive analysis was conducted to see the distribution of respondent characteristics based on the research variables using the pandas and seaborn libraries. Furthermore, the Chi-

Square test was used to test the relationship between the independent variables and the prevalence of stunting using the scipy.stats library. To identify the determinant factors that have the most influence on the incidence of stunting, logistic regression analysis was conducted with the statsmodels library.

RESULT

Data Description

Table 1 presents a description of the variables used in this study. Data were collected from 50 respondents and covered a range of demographic, socioeconomic and health factors thought to be associated with the incidence of stunting.

Table 1.
Data description

Variable	Description	Respondent Answer Code
Economic Status	Family economic condition	1 = Low 2 = Medium 3 = High
Water Source	Type of drinking water used	1 = Well, 2 = Drill Well, 3 = PDAM
Toilet Type	Sanitation facilities used	1 = Squat toilet, 2 = Sitting toilet, 3 = Built-in toilet
Mother's IMT	Maternal body mass index	1 = <18.5 (Skinny), 2 = 18.5-24.9 (Normal), 3 = ≥25 (Fat)
Mother's Education	Mother's education level	1 = Elementary School, 2 = Junior High School, 3 = Senior High School, 4 = D3/S1
Mother's Occupation	Type of maternal employment	1 = housewife, 2 = laborer, 3 = farmer, 4 = trader, 5 = civil servant / private sector
Mother's age	Mother's age group	1 = <20 years old, 2 = 20-35 years old, 3 = >35 years old
Child Vaccination	Whether the child is fully vaccinated	1 = Yes, 2 = No
Frequency of Posyandu	How often does the mother bring the child to the Posyandu	1 = Every month, 2 = Sometimes, 3 = Never
Prevalence of Stunting	Nutritional status of the child (dependent)	1 = Stunting, 2 = Not Stunting

Table 1 presents the variables used in the study on the determinants affecting the prevalence of stunting among under-fives in Sambane Village, Langgudu Sub-district, Bima District. Independent variables include family economic status, categorized as low, medium, and high; the source of drinking water used by the family, namely wells, boreholes, or PDAM; and the type of toilet used, including squat toilets, sitting toilets, or planting toilets. Maternal Body Mass Index (BMI) as an indicator of nutritional status was categorized into underweight (<18.5), normal (18.5-24.9), and obese (≥25). Maternal education was classified based on the last level of education, ranging from elementary school, junior high school, senior high school, to D3 / S1, while maternal employment was divided into several categories, namely housewives, laborers, farmers, traders, and civil servants / private sector. Maternal age was grouped into <20 years, 20-35 years, and >35 years, while child vaccination was categorized based on the status of receiving complete vaccination (yes or no). In addition, posyandu frequency reflected how often mothers brought their children to the posyandu, categorized as every month, sometimes, or never. The dependent variable in this study is the prevalence of stunting, which is categorized into stunting and non-stunting. Using these variables, the study aimed to analyze the factors contributing to stunting in Sambane Village, in order to understand the relationship between socio-economic, health and environmental aspects on children's nutritional status.

Chi-Square Test for the Association of Economic Factors with Prevalence of Stunting

Based on the Chi-Square test analysis, a Chi-Square statistic value of 36.111 was obtained, with a P-Value = 0.00000 and degrees of freedom (df) = 2. Since the P-Value is much smaller than 0.05 (α = 5%), the null hypothesis (H_0) is rejected, indicating that there is a significant relationship between Economic Status and Stunting Prevalence among children in Sambane Village, Langgudu District, Bima Regency. From the contingency table, it is shown that in Economic Status 1 (likely representing higher economic status), there were 25 children who were not stunted and 0 children who were stunted. Meanwhile, in Economic Status 2 (middle level), there were 5 children without stunting and 10 children with stunting. In Economic Status 3 (low economic status), all 10 children were stunted.When compared to the expected value table, the observed distribution shows a significant deviation from the expected distribution if there were no association between economic status and stunting prevalence. This difference further supports the statistical finding of a strong relationship between the two variables.

These results indicate that the lower the family's economic status, the higher the likelihood of stunting among children. Conversely, children from families with higher economic status have a much lower risk of being stunted. Therefore, economic status is a critical determinant that must be addressed in efforts to prevent stunting in this area.

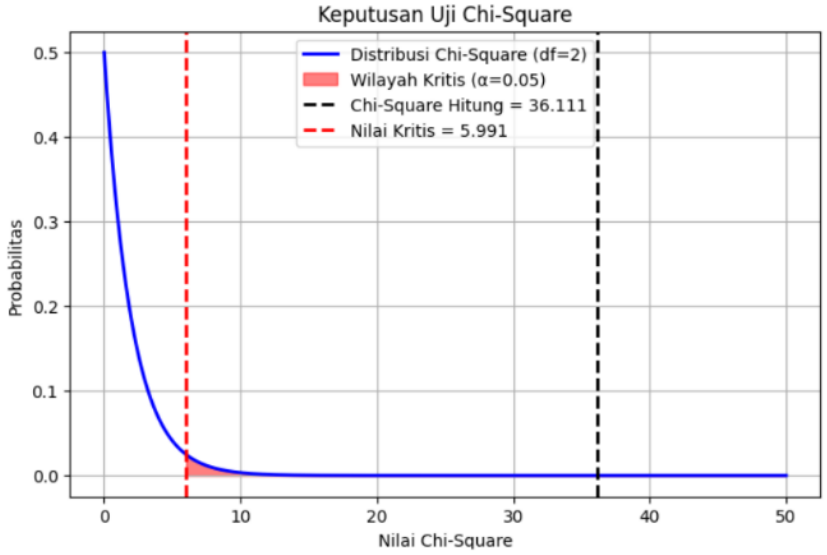

Figure 2. Chi-Square Test Decision Chart

Based on Figures 1 and 2, Chi-Square test results show a significant relationship between Economic Status and Stunting Prevalence. The contingency table shows that children with Economic Status 1 had the highest number of stunting cases (25 children), while Economic Status 3 had no stunting cases at all. Based on the Chi-Square Statistic value of 36.111 and P-Value = 0.00000, which is smaller than 0.05, the null hypothesis (H_0) that there is no relationship between Economic Status and Stunting Prevalence is rejected. The expectation value shows an ideal distribution if there is no relationship between these two variables, but the significant difference between the observed and expected values proves that Economic Status has an effect on the incidence of stunting. Therefore, children from families with low economic status tend to be more at risk of stunting than children from families with better economic status. These results can serve as a basis for the government or health institutions to design stunting intervention policies based on economic factors, in order to reduce stunting rates in the community.

Chi-Square Test for Factor Associations in all variables with Stunting Prevalence

Table 3.
Chi-Square Test Results for Factor Associations in all variables with Stunting Prevalence

Variable	Chi-Square Statistic	P-Value	Degrees of Freedom
Water Source	29.167	4.64e-07	2
Type_Toilet	34.375	3.43e-08	2
BMI_Mother	14.583	0.000681	2
Education_Mother	36.111	7.09e-08	3
Occupation_Mother	25.694	3.65e-05	4
Age_Mother	8.333	0.0155	2
Vaccination_Child	2.17	0.1407	1
Frequency_Posyandu	8.333	0.0155	2

The Chi-Square test results table shows the relationship between various variables and the prevalence of stunting. Each variable is tested using the Chi-Square Statistic value to see how far the actual data distribution deviates from the expected distribution, with the P-Value as an indicator of whether or not the relationship is significant. If the P-Value <0.05, the null hypothesis (H_0) is rejected, meaning there is a significant relationship between the variable and the prevalence of stunting. From the test results, the variables of Water Source (p = 4.64e-07), Toilet Type (p = 3.43e-08), Mother's BMI (p = 0.00068), Mother's Education (p = 7.09e-08), Mother's Occupation (p = 3.65e-05), Mother's Age (p = 0.0155), and Frequency of Posyandu (p = 0.0155) have a significant association with the prevalence of stunting. Meanwhile, the Childhood Vaccination variable (p = 0.1407) did not have a significant association with the prevalence of stunting. These results indicate that social factors and maternal health have an influence on the prevalence of stunting, while child vaccination based on this test does not show a significant relationship.

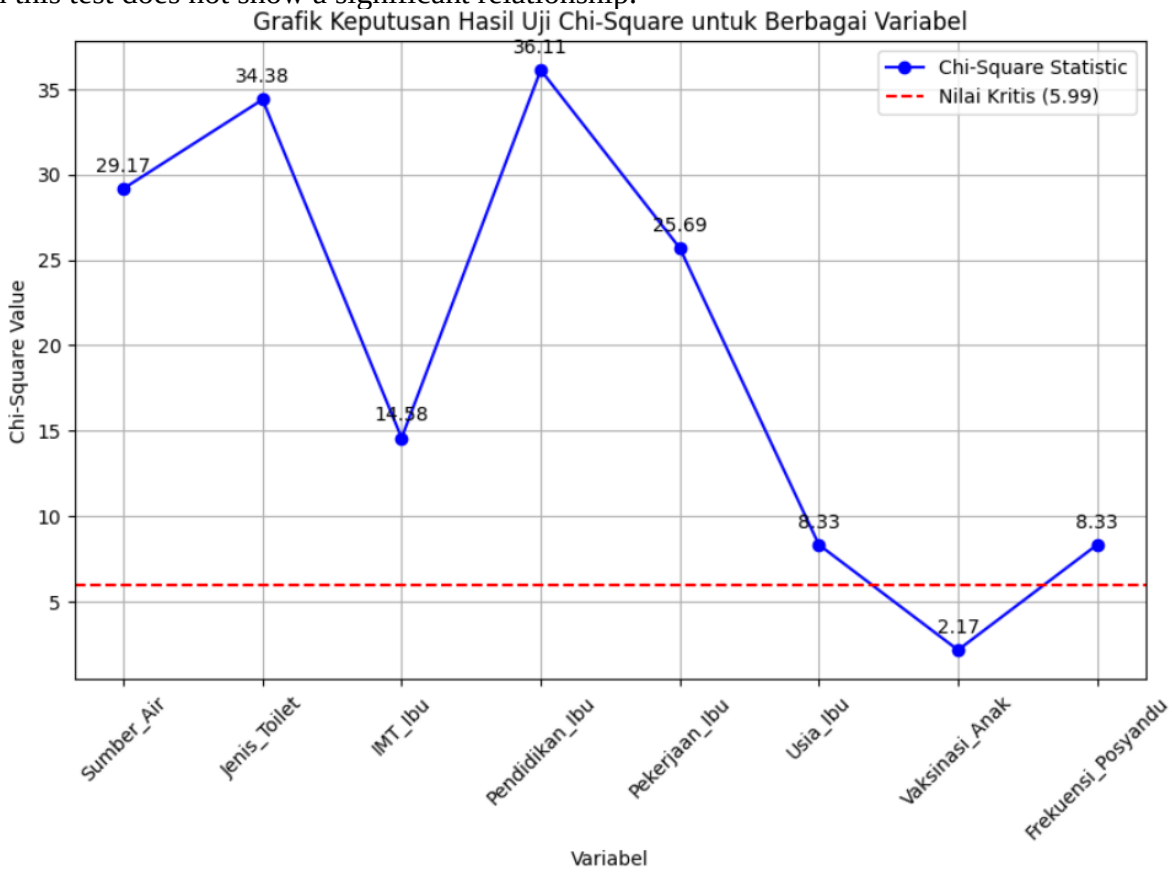

Figure 3. Decision Graph of Chi-Square Test Results for various variables

Figure 3 shows the relationship between various variables and the prevalence of stunting based on the results of the Chi-Square test, where on the X-axis are the variables tested, such as Water Source, Toilet Type, Mother's BMI, Mother's Education, Mother's Occupation, Mother's Age, Child Vaccination, and Frequency of Posyandu, while the Y-axis displays the

Chi-Square Statistic value. The results of the analysis show that the Mother's Education variable has the highest Chi-Square value of 36.11, followed by Toilet Type at 34.38 and Water Source at 29.17, indicating a very strong association with stunting prevalence. Furthermore, the Mother's Occupation variable has a Chi-Square value of 25.69, followed by Mother's BMI with 14.58, and Mother's Age and Frequency of Posyandu which both have a value of 8.33. Meanwhile, the Childhood Vaccination variable has the lowest Chi-Square value of 2.17, indicating that based on this test, the variable does not have a significant relationship with the prevalence of stunting. Thus, this graph provides a visual representation of the contribution of each factor to the likelihood of stunting in children based on the results of statistical analysis.

Correlation Analysis of Variables on Stunting Prevalence

Stunting is a complex health problem that is influenced by various factors, including economic status, environment, and maternal and child health conditions. To understand the factors that contribute to the prevalence of stunting, a correlation analysis was conducted between variables that could potentially influence the condition. Using a correlation heatmap, the relationship between variables such as economic status, water source, toilet type, mother's body mass index (BMI), mother's education, mother's occupation, mother's age, child vaccination, and frequency of posyandu were analyzed against the prevalence of stunting.

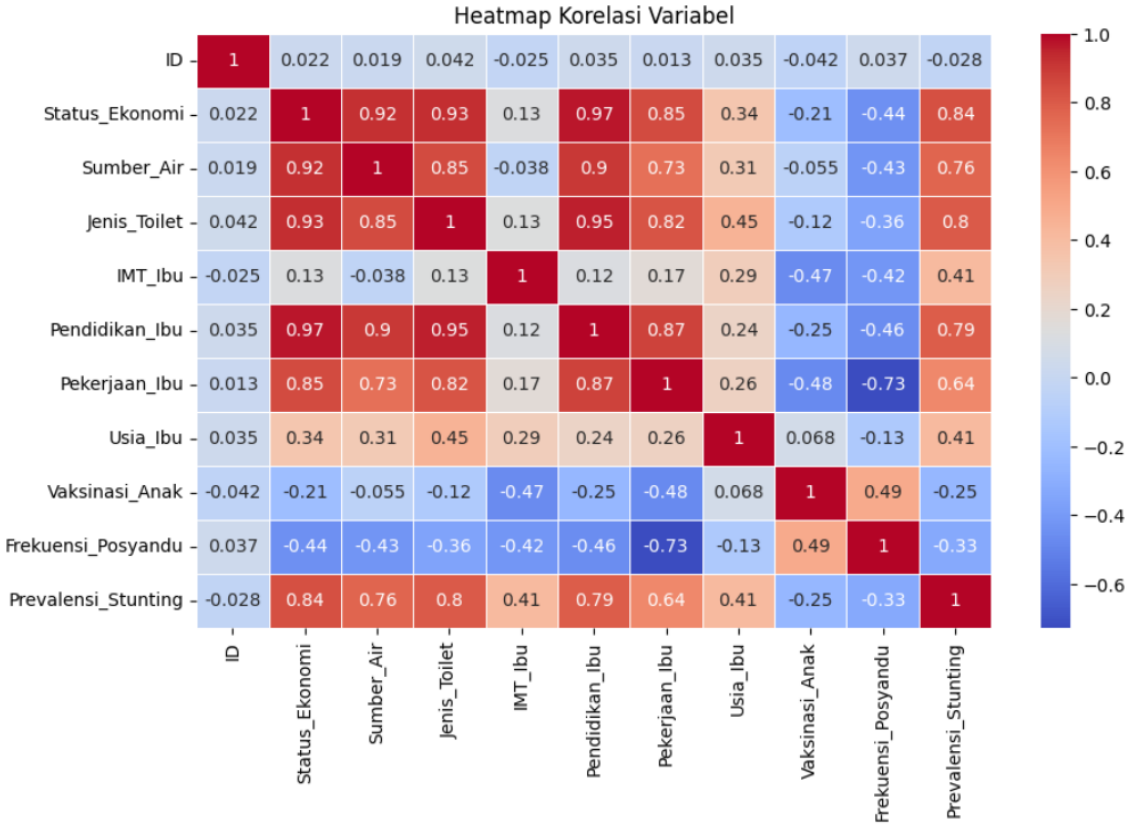

Figure 4. Correlation between variables

Based on Figure 4, it shows the relationship between various variables and the prevalence of stunting, where getting closer to 1 means a strong positive relationship, while getting closer to -1 means a strong negative relationship. From these results, Economic Status (0.84), Toilet Type (0.80), Water Source (0.76), and Maternal Education (0.79) have a high positive correlation with Stunting Prevalence, indicating that these factors have a strong relationship with the incidence of stunting. The better the economic status, access to clean water sources, and mother's education level, the lower the likelihood of stunting. In contrast, Posyandu Frequency (-0.33) has a negative correlation with stunting, indicating that the more frequently children attend posyandu, the less likely they are to be stunted. Maternal BMI (0.41) and

Maternal Age (0.41) also show a positive correlation with stunting, although weaker than other factors. Meanwhile, Childhood Vaccination (-0.25) has a negative correlation, but lower than Posyandu Frequency. This means that vaccination alone may not be enough to reduce stunting prevalence without the support of other factors. From this analysis, it can be concluded that economic, environmental and maternal education factors have a significant impact on the prevalence of stunting, while health factors such as frequency of posyandu and vaccination also contribute but with a lesser influence.

DISCUSSION

The results of this study provide significant insights into the factors contributing to the high prevalence of stunting in Sambane Village, Langgudu District, Bima Regency. Based on the Chi-Square test and correlation analysis, several variables have been found to have a strong association with stunting prevalence, while others show weaker associations.Economic Status emerged as one of the most influential factors in the incidence of stunting. The Chi-Square test revealed a significant relationship between economic status and stunting prevalence, with children from lower economic backgrounds being at a much higher risk. This aligns with previous studies which have shown that poverty is a major determinant of stunting, as it limits access to nutritious food, health services, and proper living conditions. Children in families with lower economic status often face food insecurity and are more likely to experience inadequate maternal care, which exacerbates the risk of malnutrition and stunting.Water Source and Toilet Type also showed significant associations with stunting. These variables reflect environmental factors that impact children's health, particularly in terms of sanitation and hygiene. Poor water quality and inadequate sanitation facilities contribute to the spread of infectious diseases, such as diarrhea and respiratory infections, which impair nutrient absorption and overall child growth. The findings highlight the need for improvements in water supply and sanitation infrastructure in Sambane Village, which could play a crucial role in reducing stunting by preventing health conditions that interfere with children's nutritional intake.

Mother's Education was another significant factor linked to stunting prevalence. Higher levels of maternal education were associated with a lower likelihood of stunting in children. Educated mothers are more likely to have better knowledge of nutrition, child care practices, and the importance of early childhood development. This finding supports existing research that emphasizes the role of maternal education in improving child health outcomes. Educational programs targeting mothers could be an effective strategy to combat stunting in the community.Mother's Occupation, mothers who are employed or have a source of income are more likely to provide their children with better nutrition and access to healthcare. Employment not only provides economic benefits but also increases the mother's capacity to access and apply health-related knowledge, thus reducing the risk of stunting.Child Vaccination did not show a significant relationship with stunting in this study. This could be due to the fact that vaccination, while crucial for preventing infectious diseases, may not directly address the underlying nutritional deficiencies that contribute to stunting. However, vaccination remains an important part of a comprehensive approach to improving child health and preventing diseases that could exacerbate stunting. Posyandu Frequency also demonstrated a negative correlation with stunting, suggesting that increased visits to community health posts (Posyandu) may help reduce stunting prevalence. Regular monitoring of child growth, immunizations, and health education at Posyandu can play an important role in detecting early signs of malnutrition and providing interventions. This supports the idea that strengthening community-based health services is essential in the fight against stunting.

CONCLUSION

Based on the analysis conducted on the factors affecting the prevalence of stunting, it was found that there was a significant relationship between several variables and the incidence of stunting in toddlers. Chi-Square test results showed that economic status, water source, toilet type, mother's body mass index (BMI), mother's education, mother's occupation, mother's age, and frequency of posyandu had a p-value smaller than 0.05, indicating a significant association with the prevalence of stunting. Meanwhile, the child vaccination variable did not show a significant association with stunting as it had a p-value greater than 0.05.The results of the correlation analysis also showed that economic status, water source, toilet type, and maternal education had a strong correlation with the prevalence of stunting, with correlation values ranging from 0.76 to 0.84. This indicates that socioeconomic factors and access to sanitation facilities play an important role in determining the nutritional status of children. In contrast, the frequency of posyandu and childhood vaccination had lower negative correlations with stunting prevalence, suggesting that while important, these factors may not be the only major determinants of stunting.Overall, this study confirms that socioeconomic conditions, sanitation, and maternal education are factors that strongly influence the prevalence of stunting. Therefore, stunting prevention efforts should focus on improving economic welfare, improving access to clean water and sanitation, and increasing education for mothers about child nutrition and health. With the right intervention, it is expected that the stunting rate can be significantly reduced in the future.

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