JURNAL STATISTIKA DAN APLIKASINYA

e-ISSN 2620 – 8369
VOLUME 8 (ISSUE 2) DECEMBER 2024: 152-163
https://doi.org/10.21009/JSA.08202

DETERMINANTS ANALYSIS OF STUNTING PREVALENCE AMONG TODDLERS IN CENTRAL JAVA PROVINCE IN 2022

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Article History:

Received: 12, December 2024
Revised: 17, December 2024
Accepted: 27, December 2024
Published: 31, December 2024
Available online.

Keywords:

Stunting; Indonesia Emas 2045; Central Java; Multiple Linear Regression

ABSTRACT

Stunting is a chronic malnutrition condition that results in toddlers being too short for their age. The World Bank (2020) reported that 54 percent of Indonesia's workforce comprises stunting survivors. This can pose a serious threat to the achievement of the 'Indonesia Emas 2045' vision. Central Java had the highest prevalence of stunting among toddlers in Java Island in 2022 (20.8 percent), exceeding the WHO threshold (20 percent). This study aims to provide a general overview of the prevalence of stunting among toddlers and to identify the variables influencing it. The data used are secondary data from the Ministry of Health of the Republic of Indonesia, Statistics Indonesia (BPS), and the Health Office of Central Java, and were analyzed using multiple linear regression analysis. The results show that the variables of water and food management, food expenditure, and consumption of iron tablets have a significant negative effect on the prevalence of stunting among toddlers, while the percentage of teenage pregnancies and the percentage of toddlers with helminth infections have a significant positive effect on the prevalence of stunting among toddlers.

How to cite this article:
D. Prayogi, R. Rahani, "DETERMINANTS ANALYSIS OF STUNTING PREVALENCE AMONG TODDLERS IN CENTRAL JAVA PROVINCE IN 2022", Jurnal Statistika dan Aplikasinya, vol. 8, iss. 2, pp. 151 – 162, December 2024

Journal e-mail: *jsa@unj.ac.id*
Research Article · Open Access

1. INTRODUCTION

Nutritional problems are health and welfare disturbances experienced by individuals, groups, or communities caused by an imbalance between food intake and the body's needs, as well as the influence of interactions with diseases (infections) [1]. Assessing the nutritional status of toddlers is a useful method for identifying nutritional problems in a specific area [2]. Nutritional issues in toddlers can lead to several conditions such as low weight for height (wasting), low weight for age (underweight), high weight for age (overweight), and low height for age (stunting). Among the four indicators of nutritional problems in Indonesia in 2022, the prevalence of stunting was the highest at 21.6 percent, followed by the prevalence of underweight (17.1 percent), wasting (7.7 percent), and overweight (3.6 percent) [3].

Stunting, a condition caused by chronic malnutrition, results in a toddler's height being significantly shorter than the standard for their age [4]. This malnutrition can begin in the womb and during the early stages after birth, but its symptoms only become apparent about 1,000 days after birth or around two years later [5]. Several factors contribute to stunting, including poverty, inadequate parenting and frequently repeated illness linked to sanitation and hygiene [6]. Individuals with stunting are usually more susceptible to various diseases, have below-average intelligence, and have relatively low productivity. It can potentially reduce the capacity and competence of Indonesia's human resources to compete in the global market. The World Bank reported that 54 percent of Indonesia's current workforce experienced stunting during infancy, which means 54 percent of the workforce are stunting survivors in 2020. This high prevalence indicates a critical problem that could threaten the realization of the *'Indonesia Emas 2045'* vision. Furthermore, Adolescent girls experiencing malnutrition are more vulnerable to becoming adult women who are also affected by malnutrition and giving birth to babies with low birth weight. Thus, she will pass on the Double Burden of Nutritional Problems intergeneration. The Double Burden of Nutritional Problems hinders human development, resulting in poverty intergenerational, and slowing economic growth [7]. That is why the high prevalence of stunting in the long term will result in economic losses for the country [5]. Stunting can cause economic losses for the country about 2 to 3 percent of the Gross Domestic Product (GDP) per year [5].

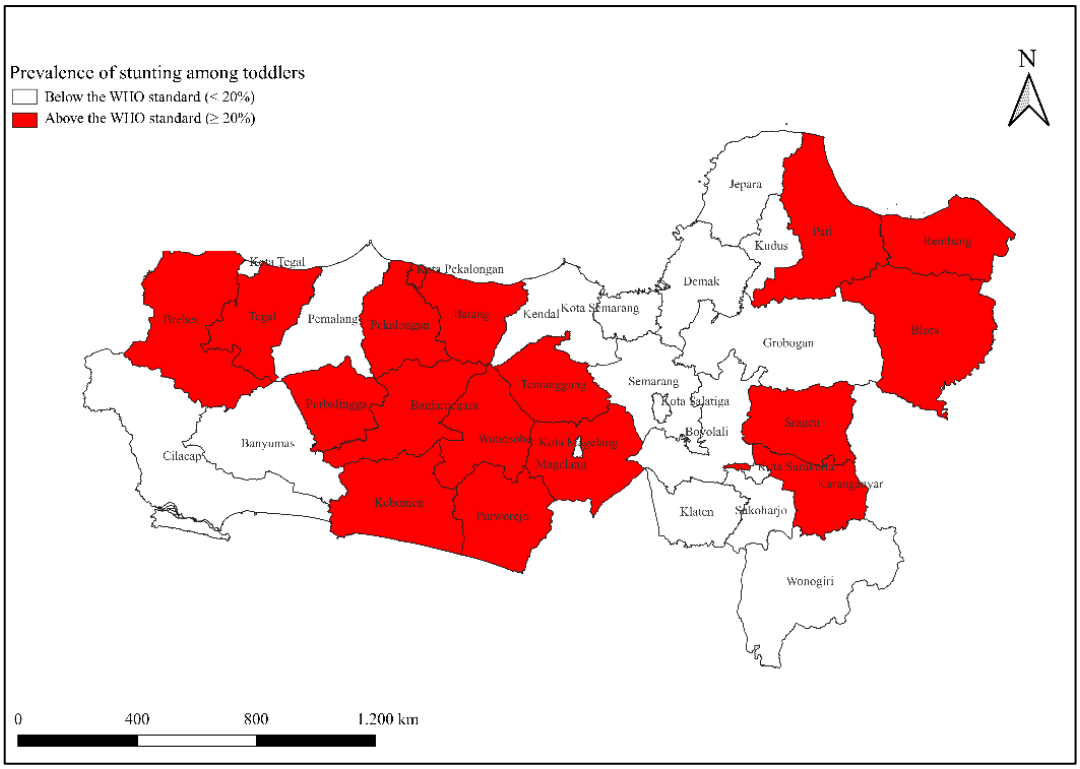
The importance of addressing stunting in toddlers makes it a target under SDG 2.2, which aims for a zero percent prevalence of stunting among toddlers by 2030. In line with achieving this SDG's target, the government has set a stunting prevalence target of 14 percent by 2024, as outlined in the National Medium-Term Development Plan 2020-2024. However, the 2022 Indonesian Nutritional Status Survey reveals that the prevalence of stunting among toddlers in Indonesia attained the value of 21.6 percent [3]. It indicates that the prevalence of stunting among toddlers in Indonesia remains significantly above the established target.

A public health issue is considered to be chronic when the prevalence of stunting is at least 20 percent [8]. One of the provinces in Indonesia that meets this criterion is Central Java. Central Java had the highest prevalence of stunting among toddlers in Java Island in 2022, at 20.8 percent. Moreover, the decrease in stunting prevalence in Central Java from 2021 to 2022 was only 0.1 percentage points, which is lower compared to the national decrease of 2.8 percentage points and is the lowest among provinces that experienced a reduction in stunting prevalence.

Stunting is a widespread issue across all provinces in Indonesia. From the perspective of factors influencing stunting in toddlers, such as exclusive breastfeeding practices, food insecurity, antenatal care, monitoring of toddler growth and development, and participation in family planning program [8], Central Java had good performance due to the indication that the percentage of infants under six months receiving exclusive breastfeeding in Central Java in 2022 (78.71 percent) was the second highest in Indonesia [9]. Additionally, the prevalence of moderate or severe food insecurity in Central Java in 2022 (3.0 percent) was the third lowest nationally [10]. The coverage of at least six antenatal care visits (K6) in Central Java in 2022 (82.9 percent) is the second highest nationally [3]. The percentage of toddlers whose growth and development were monitored in Central Java in 2022 (92.4 percent) is the second highest nationally [3]. The prevalence of family planning program participants among the fertile age population in Central Java in 2022 (65.5 percent) is the fifth highest nationally [3]. However, these conditions are still insufficient to accelerate the reduction of stunting prevalence in Central Java.

Based on Figure 1, it can be observed that 18 districts/cities with chronic nutritional problems in Central Java are shown in red. The tendency for data to cluster with similar characteristics indicates the presence of spatial autocorrelation in the prevalence of stunting among toddlers across districts/cities in

Central Java Province. Therefore, it is suspected that a spatial regression model may be applicable in this study.



Source: Ministry of Finance of the Republic of Indonesia, 2022

Figure 1. Map of Stunting Prevalence Distribution among Toddlers in Central Java in 2022

Research on the variables influencing stunting has been conducted previously. Syam & Sunuh [11] indicated that the management of drinking water and food has a significant negative effect on the incidence of stunting in toddlers. Additionally, Mustajab & Indriani [12] reported that teenage pregnancies have a significant positive effect on the incidence of stunting in toddlers. Priatmadani et al. [13] found that food expenditure has a significant negative effect on the prevalence of stunting among toddlers. Eldrian et al. [14] demonstrated that a history of helminth infections has a significant positive effect on the incidence of stunting in toddlers. Ardian & Utami [15] stated that a history of iron tablets consumption during pregnancy has a significant negative effect on the incidence of stunting in toddlers.

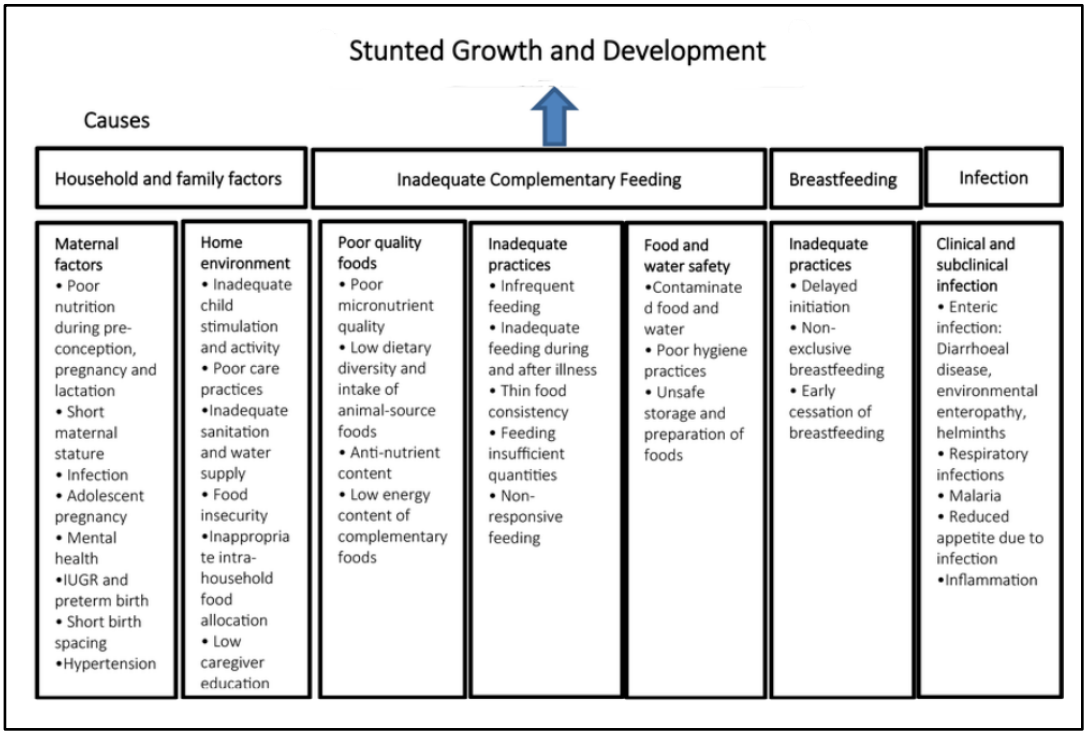
Based on the previous explanation, Central Java essentially has good health indicators. However, the prevalence of stunting among toddlers in Central Java in 2022 still exceeds the standards set by WHO and remains far from the target set for 2024. Several studies have explored the determinants of stunting in Central Java [16]–[18]. However, they did not explicitly include toddler's helminth infection (helminthiasis) as an independent variable. This omission is significant, as helminthiasis can lead to malnutrition by diverting essential nutrients to parasites, depriving children of the nutrients critical for growth. Consequently, helminthiasis hinders toddlers' physical and mental development, weakens their immune systems, and increases their susceptibility to illnesses [19]. Considering helminthiasis as one of the predictors, this study aimed to analyze the prevalence of stunting among toddlers in Central Java in 2022 and identify the variables influencing this prevalence. This will enable the formulation of effective policies to reduce stunting prevalence and achieve the established targets.

2. METHODS

Theoretical Foundation

Stunting is a condition where children experience long-term malnutrition, resulting in their height being lower than that of other children their age [4]. According to UNICEF [20], stunting reflects sustained malnutrition during critical growth and development periods in infancy. Based on the 2020 regulation of the Minister of Health of the Republic of Indonesia number 2 concerning Children's Anthropometric Standards, the criteria for determining stunting in Indonesia follow the WHO *Child Growth Standards* guidelines. According to the Kemenkes, children under five with a *z-score* less than -2 standard deviations are categorized as stunted, and those with a *z-score* below -3 standard deviations are categorized as severely stunted. Therefore, children are classified as stunted if they fall under either the stunted or severely stunted categories.

The conceptual framework for addressing stunting, issued by WHO in 2013, aims to define the problem's context, its causes, and the effects of stunting. Stunting is caused by various factors, including household and family conditions, inadequate complementary feeding, breastfeeding practices, and infections [8]. Several elements that influence stunting in the household and family factors include poor nutritional status during pregnancy, adolescent pregnancies, and improper food allocation within households. One subfactor affecting stunting related to inadequate complementary feeding is poor food and water safety. Additionally, one element contributing to stunting under the infection factor is diseases caused by parasitic worms.



Source: WHO 2013

Figure 2. The WHO Conceptual Framework for Addressing Stunting

Material and Data

This study covers the province of Central Java in 2022. The units of analysis include all regencies and cities in the province, totaling 35 units, consisting of 29 regencies and 6 cities. The dependent variable in this study is the prevalence of stunting among children under the age of five. The independent variables used are water and food management, percentage of teenage pregnancies, food expenditure, percentage of toddlers with helminth infections, and consumption of iron tablets. The following section outlines the operational definitions and data sources used in this research.

Table 1. Operational definitions and data sources for each research variable

Variable Name	Operational Definition	Unit	Data Source
Prevalence of stunting among toddlers (Y)	The percentage of children aged 0 to 59 months who experience stunting (with a z-score less than -2 standard deviations).	Percent	Publication of 'Buku Saku' from Indonesian Nutritional Status Survey (SSGI) 2022, Ministry of Health of Indonesia
Water and food management (X_1)	The percentage of household heads who practice safe water treatment and storage, safe storage of food preparation equipment, maintain cleanliness, and serve food and beverages in a proper manner.	Percent	Publication of Health Profile of Central Java, 2022, Health Office of Central Java
Percentage of teenage pregnancies (X_2)	The percentage of women aged 15-49 who have been pregnant, with their first pregnancy occurring before the age of 19.	Percent	Publication from Statistics Indonesia of Central Java, 2020. Citizen Welfare Statistics of Central Java 2022.
Food expenditure (X_3)	The total cost incurred for food needs by all households in a month, including expenses from purchases, gifts, or self-production, divided by the total population.	Hundred thousand rupiahs	2020 Publication of Expenditure for Resident Consumption in Central Java Province, Statistics Indonesia
Percentage of toddlers with helminth infection (X_4)	The percentage of children under five who have been diagnosed with intestinal worms by healthcare professionals or who have experienced symptoms of intestinal worm infection, such as the presence of worms in stool or around the anus, or who frequently scratch or complain of itching in the anal area, especially at night, within the past 12 months.	Percent	Indonesian Nutritional Status Survey (SSGI) 2022, Ministry of Health of Indonesia
Consumption of iron tablets (X_5)	The percentage of children aged 0-23 months whose mothers consumed at least ninety iron supplement tablets during pregnancy.	Percent	Indonesian Nutritional Status Survey (SSGI) 2022, Ministry of Health of Indonesia

Research Method

The research analysis methods include descriptive analysis and inferential analysis. Descriptive analysis is presented using graphs and tables to provide an overview of the prevalence of stunting among children under five in Central Java in 2022. Meanwhile, inferential analysis is used to identify the variables that influence the prevalence of stunting among children under five in Central Java in 2022 using multiple linear regression analysis. The significance level (α) is set at 5 percent. The procedures for conducting multiple linear regression analysis are as follows:

1. Estimation of model parameters that include all independent variables
   Multiple linear regression is an extension of the simple linear regression method. This method is used to explain the relationship between a dependent variable and more than one independent variable. The estimation method applied in this model is *Ordinary Least Squares* (OLS) [21]. Generally, the form of the multiple linear regression model is as follows:

$$Y_i = \beta_0 + \beta_1 X_{i1} + \ldots + \beta_j X_{ij} + \cdots + \beta_k X_{ik} + \varepsilon_i \quad (1)$$

   where:
   Y_i : the dependent variable for observation *i*
   $\beta_0, \beta_1, \ldots, \beta_j, \ldots, \beta_k$: model parameters
   $X_{i1}, \ldots, X_{ij}, \ldots, X_{ik}$: independent variables

ε_i : error for observation *i*
i : 1,2,…,*n*; *n*=35
j : 1,2,...*k*; *k*=5
n : number of observations

2. Best regression model selection
The best regression model is one that can effectively explain the behavior of the dependent variable by selecting independent variables from a wide range of available options in the data. This aligns with the principle of parsimony, which states that a model should be as simple as possible, containing the fewest parameters necessary, thereby ensuring greater stability without losing significant information. There are several methods available for selecting the best regression model, including forward selection, backward elimination, and stepwise regression.
3. Simultaneous testing (F test for regression relation)
Simultaneous testing is used to examine the effect of independent variables on the dependent variable collectively [21]. The hypotheses used are as follows:
$H_0 : \beta_1 = \cdots = \beta_j = \cdots = \beta_k = 0$ (there are no independent variables that have an effect on the dependent variable)
H_1 : at least one $\beta_j \neq 0; j = 1,2, \ldots, k$ (at least one independent variable has an effect on the dependent variable)
The statistical test used is as follows:

$$F = \frac{MSR}{MSE} = \frac{SSR/k}{SSE/(n-k-1)} \quad (2)$$

This simultaneous testing will reject H_0 if $p - value < \alpha$ or $F > F_{(1-\alpha;k,n-k-1)}$. This means that at least one independent variable has a significant effect on the dependent variable.
4. Partial testing
Partial testing is used to examine the effect of each independent variable on the dependent variable. In partial tests, hypotheses can be two-tailed, one-tailed right, or one-tailed left. In this study, partial testing is conducted using one-tailed right and one-tailed left hypotheses. The hypotheses used are as follows:

Right one-tailed hypothesis
$H_0 : \beta_j = 0; j = 1,2, \ldots, k$ (the independent variable *j* does not have an effect on the dependent variable)
$H_1 : \beta_j > 0; j = 1,2, \ldots, k$ (the independent variable *j* has a positive effect on the dependent variable)
Left one-tailed hypothesis
$H_0 : \beta_j = 0; j = 1,2, \ldots, k$ (the independent variable *j* does not have an effect on the dependent variable)
$H_1 : \beta_j < 0; j = 1,2, \ldots, k$ (the independent variable *j* has a negative effect on the dependent variable)
The statistical test used is as follows:

$$t = \frac{b_j}{s(b_j)} \quad (3)$$

This partial testing will provide a decision:
Right one-tailed hypothesis
- Reject H_0 if $p - value < \alpha$ or $t > t_{(1-\alpha;n-k-1)}$. This means that the independent variable *j* has a significant positive effect on the dependent variable.

Left one-tailed hypothesis
- Reject H_0 if $p - value < \alpha$ or $t < -t_{(1-\alpha;n-k-1)}$. This means that the independent variable *j* has a significant negative effect on the dependent variable.

5. Testing of classical assumptions
Classical assumption testing is one of the requirements that must be met in multiple linear regression analysis. This testing is conducted to produce a regression model that fulfills the criteria of the *Best Linear Unbiased Estimator* (BLUE). Therefore, a regression model that meets

the BLUE criteria can be used as an accurate and reliable estimator. The tests involved include the normality test of errors using the *Shapiro-Wilk test*, detection of multicollinearity using the *Variance Inflation Factor* (*VIF*), and the homoscedasticity test using the *Glejser test*. A regression model satisfies classical assumptions if the errors are normally distributed, the variance of the errors is constant (homoscedasticity), and there is no strong correlation among the independent variables (non-multicollinearity).

6. Regression specification error test
   The regression specification error test is used to determine whether the formed model has specification errors or not [22]. The hypotheses used are as follows:

   H_0 : No specification error occurs in the regression model
   H_1 : A specification error occurs in the regression model
   The statistical test used is as follows [19]:

$$F_{calculated} = \frac{\left(R^2_{new} - R^2_{old}\right)/p}{\left(1 - R^2_{new}\right)/(n-q)} \tag{4}$$

   This regression specification error testing will reject H_0 if $F_{calculated} > F_{(\alpha,p,n-q)}$ or *p-value* < α. This means that a specification error occurs in the regression model, or in other words, the linear regression model is not suitable for use.
7. Spatial weighting matrix and spatial autocorrelation test
   Spatial weights are calculated using the weight matrix $\boldsymbol{W}$. The spatial weight matrix is obtained by considering information about the distance or proximity between regions. The main purpose of using the spatial weight matrix is to determine which location *j* can influence the variable values at location *i* [23]. In this study, a spatial weight matrix based on neighborhood information is used, employing the *queen contiguity* method. The spatial autocorrelation test is used to determine the relationship of the dependent variable across locations. Spatial autocorrelation can be identified using *Global Moran's I*. If significant results are found, the OLS regression model is no longer appropriate, as the estimates produced will be inefficient, making the application of spatial regression models more suitable.
8. Coefficient of determination
   The coefficient of determination (R^2) is a measure that evaluates the quality and goodness of fit of a regression model. R^2 is used to assess how well the independent variables in the model explain the variation in the dependent variable. The value of R^2 ranges from 0 to 1. A higher R^2 value indicates a better-fitting model. Generally, including more independent variables in the model will increase the value of the coefficient of determination. Therefore, in multiple linear regression, it is advisable to use the adjusted R^2 ($R^2_{adjusted}$).

$$R^2_{adjusted} = 1 - \frac{SSE}{SST}\left(\frac{n-1}{n-k-1}\right) \tag{5}$$

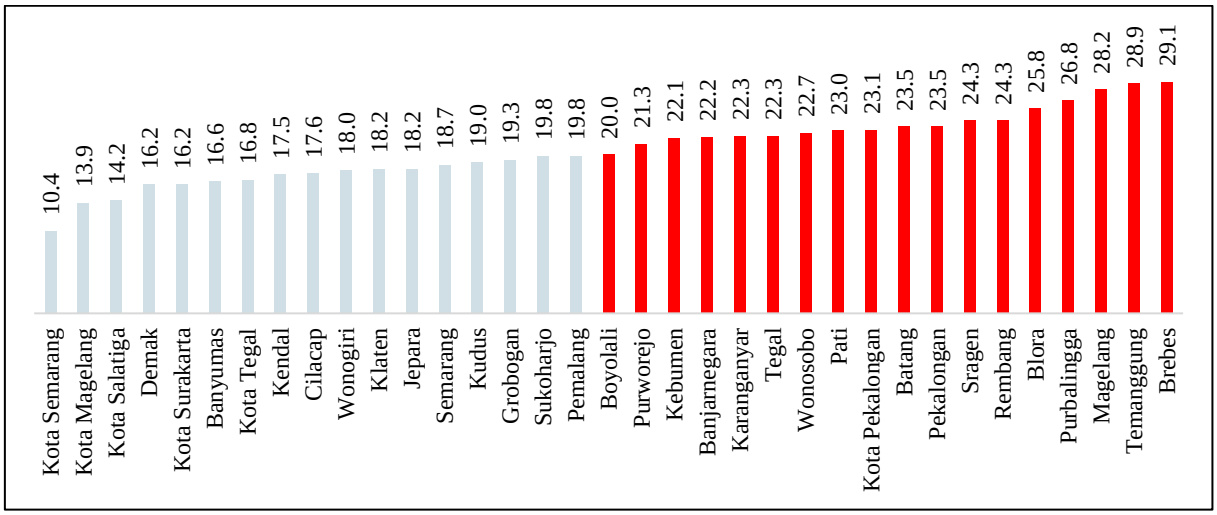
   Subsequently, model interpretation is the final stage, which involves providing explanations for the regression coefficients obtained from the appropriate model.

3. RESULTS

Overview of Stunting Prevalence Among Toddlers in Central Java in 2022

As previously explained, the prevalence of stunting among toddlers in Central Java in 2022 was 20.8 percent, reflecting a decrease of 0.1 percentage points from the previous year. This condition indicates that the prevalence of stunting in Central Java remains above the threshold set by the WHO, and the rate of reduction is lower than the national decrease of 2.8 percentage points. At the district/city level, 20 districts/cities in Central Java experienced an increase in stunting prevalence from 2021 to 2022, with the largest increase recorded in Purbalingga Regency at 10.0 percentage points. Meanwhile, the area with the highest decrease in stunting prevalence was Semarang City, with a reduction of 10.9 percentage points.

The districts/cities in Central Java in 2022 showed a considerable variation in the prevalence of stunting among toddlers. As shown in Figure 3, the lowest prevalence of stunting was 10.4 percent in Semarang City, while the highest reached 29.1 percent in Brebes Regency. The variation in stunting prevalence among districts/cities in Central Java reflects the disparities in efforts to address the stunting issue in the region. This indicates that each area faces different challenges in tackling stunting among toddlers. Additionally, out of the 35 districts/cities in Central Java, 17 districts and 1 city are classified as areas facing chronic public health issues, as the prevalence of stunting in those areas is $\geq$ 20 percent.



Source: Ministry of Health of Republic of Indonesia, 2022

Figure 3. Prevalence of Stunting in Children Under Five by District/City in Central Java 2022 (percent)

The overview of the variables suspected to influence the prevalence of stunting among toddlers in the districts/cities of Central Java in 2022 is presented at Table 2.

Table 2. Summary of Descriptive Analysis of Independent Variables

Variable	Unit	Provincial Figures	Minimum	Maximum	Correlation Coefficient to Y
X_1: water and food management	Percent	87.39	51.90	100	-0.215
X_2: teenage pregnancies	Percent	21.42	5.75	38.57	0.559*
X_3: food expenditure	Rupiah	572,808	437,931	858,244	-0.577*
X_4: toddlers with helminth infection	Percent	2.62	0.17	10.34	0.298
X_5: consumption of iron tablets	Percent	43.75	11.46	78.10	-0.390*

*) Significant at a significance level of 5 percent

Based on Table 2, there is an indication of a negative relationship between water and food management, food expenditure, and consumption of iron tablets with the prevalence of stunting among toddlers, as indicated by negative correlation coefficients. Meanwhile, there is a positive relationship between the percentage of teenage pregnancies and the percentage of toddlers with helminth infection with the prevalence of stunting among toddlers, as indicated by positive correlation coefficients. This means that when water and food management increases, the percentage of teenage pregnancies decreases, food expenditure increases, the percentage of toddlers with helminth infection increases, and consumption of iron tablets increases, the prevalence of stunting among toddlers will decrease, and vice versa.

Variables Affecting the Prevalence of Stunting in Toddlers in Central Java in 2022

The regression equation obtained by including all independent variables is as follows:

$$\hat{Y}_i = 35.273 - 0.080X_{i1} + 0.181X_{i2} - 1.590X_{i3} + 0.472X_{i4} - 0.074X_{i5}$$

Next, independent variable selection was conducted using forward selection, backward selection, and stepwise regression methods. A summary of the results of the independent variable selection can be seen in Table 3.

Table 3. Results of the Best Regression Model Selection

Method	Model	Independent Variable	*AIC*	*SBC*	$R^2_{adjusted}$	*Cp-Mallow*	*MSE*
Forward Selection	1	X_3	91.615	94.725	0.313	21.622	12.963
	2	X_3, X_2	88.190	92.856	0.393	16.067	11.449
	3	X_3, X_2, X_5	84.646	90.867	0.465	11.465	10.087
	4	X_3, X_2, X_5, X_4	81.518	89.294	0.523	8.223	9.003
	5	$\boldsymbol{X_3, X_2, X_5, X_4, X_1}$	**78.760**	**88.092**	**0.569**	**6.000**	**8.129**
Backward Elimination	**1**	$\boldsymbol{X_1, X_2, X_3, X_4, X_5}$	**78.760**	**88.092**	**0.569**	**6.000**	**8.129**
Stepwise Regression	1	X_3	91.615	94.725	0.313	21.622	12.963
	2	X_3, X_2	88.190	92.856	0.393	16.067	11.449
	3	X_3, X_2, X_5	84.646	90.867	0.465	11.465	10.087
	4	X_3, X_2, X_5, X_4	81.518	89.294	0.523	8.223	9.003
	5	$\boldsymbol{X_3, X_2, X_5, X_4, X_1}$	**78.760**	**88.092**	**0.569**	**6.000**	**8.129**

In this case, all three methods resulted in the same conclusion that the best model is the one that includes all independent variables. This is evidenced by the smallest *AIC* value, the smallest *SBC* value, the largest $R^2_{adjusted}$, the smallest *Cp-Mallow*, and the smallest *MSE*.

Next, a simultaneous test was conducted, resulting in a *p-value* of < 0.001, which is less than α (0.05), leading to the decision to reject H_0. This is further supported by an F=9.977, which is greater than $F_{(0.95;5,29)}$=2.545. This means it can be concluded that at least one independent variable has a significant effect on the prevalence of stunting in children under five in Central Java in 2022. Subsequently, a partial test was conducted to determine whether the variables of water and food management, food expenditure, and consumption of iron tablets have a significant negative effect on the prevalence of stunting in children under five in Central Java in 2022. Additionally, it was assessed whether the percentage of teenage pregnancies and the percentage of toddlers with helminth infection have a significant positive effect on the prevalence of stunting in children under five in Central Java in 2022.

Based on Table 4, the results of the partial test indicate that all independent variables have p-values smaller than α (0.05), leading to the decision to reject H_0. This means that the variables of water and food management, food expenditure, and consumption of iron tablets have a significant negative effect on the prevalence of stunting in children under five in Central Java in 2022. Additionally, the percentage of teenage pregnancies and the percentage of toddlers with helminths have a significant positive effect on the prevalence of stunting in children under five in Central Java in 2022.

Table 4. Results of the Partial Test

Variable	t	*P-value*
Constant	6.461	< 0.001
X_1: water and food management	-2.055	0.024
X_2: teenage pregnancies	2.779	0.005
X_3: food expenditure	-2.734	0.005
X_4: toddlers with helminth infection	2.067	0.024
X_5: consumption of iron tablets	-2.153	0.020

The results of the normality assumption test yielded a *p-value* of 0.058, leading to the conclusion that the normality assumption is satisfied. Next, multicollinearity detection using the *VIF* value concluded that there is no multicollinearity among the independent variables used, as indicated by *VIF* values for all independent variables being less than 10. Following that, the homoscedasticity assumption was examined, with a *p-value* of 0.229, confirming that the homoscedasticity assumption is met. Finally, the

regression specification error test resulted in a *p-value* of 0.867, leading to the conclusion that there is no specification error, indicating that the linear regression model is appropriate for this study.

The spatial weighting matrix used in this study is based on neighborhood information using the *queen contiguity* method. In the observed area, the minimum number of neighbors is 1, and the maximum number of neighbors is 8, with an average number of neighbors of 4.23. Furthermore, the spatial autocorrelation test yielded a *p-value* of 0.345, which is greater than α (0.05), leading to the decision to fail to reject H_0. Thus, the conclusion is that there is no spatial autocorrelation in the prevalence of stunting in children under five in Central Java in 2022. This result indicates that the application of spatial regression in this study is not appropriate, making the use of multiple linear regression sufficient.

In the regression model, the adjusted $R^2_{adjusted}$ value is 0.569. This means that the variables water and food management, the percentage of teenage pregnancies, food expenditure, the percentage of toddlers with helminth infection, and consumption of iron tablet can explain 56.9 percent of the variation in the prevalence of stunting in children under five. Meanwhile, the remaining 43.1 percent is explained by other variables not included in the model.

4. DISCUSSIONS

Water and food management have a significant negative effect on stunting prevalence among children under five in Central Java, with a coefficient of -0.080. This indicates that one percent improvement in water and food management reduces stunting prevalence by 0.080 percent, assuming other variables remain constant. Inadequate drinking water quality, proximity of water sources to latrines, and insufficient water treatment can lead to nutritional disorders through the presence of pathogenic microorganisms and chemicals in water. These contaminants may cause diarrhea and Environmental Enteric Dysfunction (EED), increasing the risk of stunting if diarrhea persists for more than two weeks [11], [24], [25].

Percentage of teenage pregnancies has a significant positive effect on stunting prevalence, with a coefficient of 0.181. One percent increase in teenage pregnancies raises stunting prevalence by 0.181 percent, assuming other variables remain constant. Adolescent mothers face nutritional competition between their growing bodies and the developing fetus, which can impair fetal growth and increase the risk of stunting. This finding aligns with the research by Mustajab & Indriani [12].

Food expenditure has a significant negative effect on stunting prevalence, with a coefficient of -1.590. An increase in food expenditure by 100,000 rupiahs reduces stunting prevalence by 1.590 percent, assuming other variables remain constant. This result supports the notion that higher food expenditure improves dietary diversity and nutritional intake among children under five. Families with low income may have limited purchasing power for quality food, which can affect the nutritional status of children [26], [27].

Percentage of toddlers with helminth infection has a significant positive effect on the prevalence of stunting among children under five in Central Java, with a coefficient of 0.472. This means that every 1 percent increase in the percentage of toddlers with helminth infection will increase the prevalence of stunting by 0.472 percent, assuming other variables remain constant. This finding is consistent with the research by Salma & Siagian [28]. Worm infections typically do not directly cause death in sufferers, but they can lead to loss of appetite and impaired nutrient absorption, resulting in malnutrition. Every 20 adult worms can consume 2.8 grams of carbohydrates and 0.7 grams of protein per day. As a result, children often experience bloating, lethargy, and weight loss due to nutritional deficiencies.

Consumption of iron tablets has a significant negative effect on the prevalence of stunting among children under five in Central Java, with a coefficient of -0.074. This means that for every 1 percent increase in consumption of iron tablets, the prevalence of stunting among children under five decreases by 0.074 percent, assuming other variables remain constant. This result is consistent with the findings of Fentiana [29]. Hemoglobin levels in pregnant women are crucial for both the fetus and the mother herself. Low hemoglobin levels (anemia) can increase the risk of infection, antepartum hemorrhage, miscarriage, premature rupture of membranes, impaired fetal growth and development in the womb, and reduced breast milk production [30].

5. CONCLUSION

Based on the results and discussion from the previous sections, several conclusions can be drawn. The variables of water and food management, percentage of teenage pregnancies, food expenditure, percentage of toddlers with helminth infection, and consumption of iron tablets significantly impact the prevalence of stunting among toddlers in Central Java in 2022. Water and food management, food expenditure, and consumption of iron tablets negatively affect the prevalence of stunting, while percentage of teenage pregnancies and percentage of toddlers with helminth infection positively affect it. Regarding the distribution patterns of stunting prevalence among toddlers and the influencing variables, the government needs to implement effective programs to reduce stunting by improving household sanitation, especially regarding drinking water and food management; preventing diseases such as worm infections that can interfere with nutrient absorption in toddlers; providing food assistance to households with low food expenditures to increase access to diverse and nutritious foods; preventing anemia by increasing the adherence of pregnant women to consuming at least 90 iron tablets during pregnancy; and educating the adolescent about ideal age for marriage and pregnancy.

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