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Trend Analysis of Stunting Prevalence in West Java (2019-2024) Using WHO Thresholds

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Abstract

This study aims to analyze the trend of stunting prevalence among children under five across various cities and regencies in West Java Province during the 2019–2024 period using a simple linear regression approach. The data utilized in this study are secondary data obtained from official local government sources, along with the stunting classification standards established by the World Health Organization (WHO). The results indicate that 40% of regions showed statistically significant declines, such as Indramayu Regency, Bekasi City, and Karawang Regency. Conversely, 60% of the regions showed a decrease in stunting rates that was not statistically significant, including Cirebon City and Garut Regency. The variation in the coefficient of determination (R^2) highlights differences in model strength across regions, while the p-value suggests that not all downward trends can be considered statistically significant. These findings are expected to serve as a basis for formulating more targeted and effective interventions to reduce stunting prevalence in West Java Province.

Keywords: Stunting, linear regression, prevalence trend

1. Introduction

Stunting is a condition in which children's body and brain growth fail due to malnutrition over a long period of time. As a result, children become shorter than healthy children of the same age and experience delays in thinking. Stunting is caused by chronic malnutrition, particularly during the first 1,000 days of life (Aramico et al.,2020). This period, which spans from conception to a child's second birthday, is critical for growth and brain development, making it especially vulnerable to the effects of inadequate nutrition and repeated infections.

Stunting in toddlers is characterized by a Z-score of less than -2SD or or in more severe cases, less than -3SD, which is calculated based on length or height for age (PB/U or TB/U). These measurements are compared to WHO standards to determine whether the child is classified as short (< -2SD) or very short (< -3SD). Growth failure in children under five years of age due to chronic malnutrition can start from the time the child is still in the womb until the early period after birth, although the signs are generally only visible after the child is two years old (Aminah & Saini, 2019)

According to the World Health Organization (WHO), stunting prevalence standards are classified into five levels. Stunting is considered to have very low significance if the prevalence is less than 2.5%, low if it is in the range of 2.5% to less than 10%, medium if it is between 10% and less than 20%, high if it is between 20% and less than 30%, and very high if the prevalence reaches or exceeds 30%. Therefore, these categories serve as guidelines to assess the severity of the stunting problem in an area.

This study aims to analyze trends in stunting prevalence among children under five across all cities and regencies in West Java from 2019 to 2024. By comparing changes between regions, the study seeks to identify regions with significant increases or decreases in stunting rates. The findings, based on descriptive and inferential analyses using simple linear regression and percentage change methods, are expected to inform targeted public health interventions in West Java.

2. Literature Review

Stunting remains a critical public health issue in West Java Province. Based on research by Mediyana Sofyan et al. (2022), the number of stunted toddlers in West Java increased from 226,117 cases in 2019 to 276,069 cases in 2020, or an increase of about 22%. Furthermore, according to the Ministry of Health (2024), West Java was listed as one of the five provinces with the highest number of stunting cases in Indonesia. This indicates that the issue of stunting is not merely technical but also deeply rooted in systemic challenges, such as the limited competence of the health volunteers (cadres) at Integrated Health Service Post, the shortage of professional health workers, and weak reporting and supervision mechanisms. (Rahmawati & Sarika, 2020)

In the following years, the prevalence of stunting in West Java began to decline. Arisara & Fahruzi (2024) mentioned that the prevalence of stunting in 2021 was at 24.5%, then decreased to 20.2% in 2022. While this reduction is promising, the overall trend and variation across districts still require further investigation.

Most of the previous research on stunting management in West Java used a qualitative approach, such as in-depth interviews with posyandu cadres, health officials and community leaders. This approach helps to explore the social, cultural and administrative factors that influence policy effectiveness. However, few studies have applied quantitative trend analysis using secondary data to evaluate annual changes in stunting prevalence across cities and regencies in West Java.

Based on this gap, this study employs simple linear regression and percentage change analysis to examine annual trends in stunting prevalence from 2019 to 2024. The data are assessed relative to the WHO thresholds for public health urgency. This approach is expected to provide a more measurable and systematic picture of the dynamics of stunting cases between regions in West Java and help identify areas that need further intervention priorities.

3. Materials and Methods

3.1. Materials

The object of this study is data on the percentage of stunting in children under five years of age in all cities and Regencies in West Java Province during the period 2019 to 2024. This data is sourced from official government publications, such as the West Java Provincial Health Office and national survey reports. The main focus of this research object is the stunting prevalence rate recorded each year, which is analyzed descriptively and inferentially to determine the trend of change and its significance compared to WHO standards.

This research uses two types of variables, namely the independent variable (The independent variable is the year of observation which consists of the range of 2019 to 2024, and the dependent variable is the percentage of under-fives who are stunted in each regency and city in West Java. The year variable (2019-2024) includes an interval scale because it has a fixed distance between values, for example, a difference of one year. However, year does not have absolute zero. Meanwhile, the stunting prevalence variable includes a ratio scale, because it has absolute zero, where 0% means there are no stunting cases.

The data processed are the results of secondary observations from 27 regions within a span of 6 years. Observations were made to see the relationship and movement of stunting data in West Java Province from 2019 to 2024. The data used in this study are secondary data obtained through two main sources, namely data on the percentage of stunting toddlers in each regency or city in West Java Province obtained from the official website of Open Data Jabar https://opendata.jabarprov.go.id/id/dataset/persentase-balita-stunting-berdasarkan-kabupatenkota-di-jawa-barat which contains annual data from various local government agencies. As well as the standard classification of stunting status based on the reference from World Health Organization (WHO) https://www.who.int/data/nutrition/nlis/info/malnutrition-in-children which serves as a comparison in data analysis.

3.2. Methods

Trend analysis and assumption tests were conducted using Microsoft Excel, which is used to automatically calculate the slope, calculate the coefficient of determination (R^2), p-value, and other statistical parameters based on available data. This study aims to examine whether there is a significant trend in stunting prevalence among children under five in various regencies and cities in West Java Province over time. A simple linear regression analysis was applied, with year as the independent variable and stunting prevalence as the dependent variable. The regression model is formulated as:

$$Y \approx \beta_0 + \beta_1 X \tag{1}$$

where Y represents the stunting percentage, X denotes the year, β_0 is the intercept, and β_1 is the slope or average percentage point change in stunting per year. The slope β_1 is calculated as follows (James et al., 2021):

$$\beta_1 = \frac{\sum_{n=1}^{n}(x_i - \underline{x})(y_i - \underline{y})}{\sum_{n=1}^{n}(x_i - \underline{x})^2} \quad (2)$$

The statistical hypotheses used in this study are as follows:

H_0: There is no downward trend in the percentage of stunting prevalence from 2019 to 2024

H_1: There is a downward trend in the percentage of stunting prevalence from 2019 to 2024.

Before conducting the regression analysis, classical assumptions were tested to ensure the validity of the regression model. Assumptions:

a. Linearity: Linearity test is a test to see whether the model built has a linear relationship or not. (Budi et al., 2024) The linearity test was conducted visually using a scatter plot between year and stunting prevalence in each regency or city, with the addition of a trendline and R^2 value. If the data points form a pattern that resembles a straight line and the R^2 value is high enough, then the linearity assumption is considered fulfilled.

b. Autocorrelation: The autocorrelation assumption in linear regression aims to ensure that there is no relationship or relationship between the residual values in one period (t) and the previous period $(t-1)$. This is important because the regression model assumes that each observation is independent, so there should be no influence from previous data on current results. (Budi et al., 2024). The Durbin-Watson test is used for this purpose, with the formula (Montgomery et al., 2021):

$$DW = \frac{\sum_{t=2}^{T}(e_t - e_{t-1})^2}{\sum_{t=1}^{T} e_t^2} = \frac{\sum_{t=2}^{T} e_t^2 + \sum_{t=2}^{T} e_{t-1}^2 - 2\sum_{t=2}^{T} e_t e_{t-1}}{\sum_{t=1}^{T} e_t^2} \quad (3)$$

c. Homoscedasticity: The success of meeting the stated requirements when there is uniformity in the variance of the residuals between observations in a regression model (Budi et al., 2024). The homoscedasticity test performed is the Glejser test. The Glejser test is performed by regressing the absolute value of the residual on the independent variable. If the variable is significant in explaining the size of the residual, then there is an indication of a violation of the homoscedasticity assumption. (Alabi, 2021)

d. Normality of Residuals: The normality of residuals assumption aims to see whether the residual values in the regression model are normally distributed or not. A good regression model is a model that has normally distributed residuals, not normality in each variable. The normality assumption is tested using the Lilliefors test. The Lilieforst test is used, calculated as (Goos & Meintrup, 2016):

$$D = max|F*(x) - F_X(x)| \quad (4)$$

where $F*(x)$ is the empirical cumulative distribution function and $F_X(x)$ is the theoretical cumulative distribution function.

The analysis was conducted individually for each regency or city. Once assumptions were met, simple linear regression was carried out, with year as the independent variable (X) and stunting percentage as the dependent variable (Y). The model strength test is conducted by finding the coefficient of determination (R^2) , which serves to measure how much variation in the Y (stunting) data can be explained by changes in X (years). The value of R^2 is obtained by (James et al., 2021).

$$R^2 = \frac{TSS - RSS}{TSS} \quad (5)$$

where TSS is the total sum of squares and RSS is the residual sum of squares. In this study, an R^2 value above 0.5 generally indicates that more than half of the variance in stunting prevalence can be explained by the trends over time, suggesting a moderate to strong relationship between the year and stunting rates in the study regions. To determine whether the slope (β_1) is statistically significant, the t-test is used. The t-statistic value is then compared with the t distribution to obtain the p-value. According to James et al. (2021), the t-test formula is as shown below:

$$t = \frac{\beta_1 - 0}{SE(\beta_1)} \quad (6)$$

The t-statistic value is then compared with the t distribution to obtain the p-value. In this study, the significance level (α) used is 0.1, thus:

If the $p - value < 0.1$, then H_0 is rejected and the trend is significant.
If the $p - value \geq 0.1$, then H_0 is not rejected, and the trend is considered insignificant.

4. Results and Discussion

The following data shows the percentage of stunting in children under five years of age in each regency and city in West Java Province during the period 2019 to 2024 obtained from Open Data Jabar of the West Java Provincial Health Office (2025).

Table 1: Prevalence of stunting during 2019-2024 and linear regression parameters (slope. R^2, error, t-statistic, p-value) in regencies/cities in West Java province

Regency/City	Stunting Prevalence (%)						Slope (% point /year)	R	R^2	t-statistic	p-value
	2019	2020	2021	2022	2023	2024					
Bandung Regency	7.32	15.77	8.85	9.06	5.71	8.87	-0.63486	-0.34544	0.11933	-0.73621	0.50244
West Bandung Regency	7.6	13.57	11.85	8.15	3.86	4.95	-1.31657	-0.64990	0.42237	-1.71021	0.16240
Bekasi Regency	3.42	4.27	3.92	1.6	1.29	1.7	-0.56743	-0.80617	0.64991	-2.72498	0.05271
Bogor Regency	4.06	11.47	9.59	4.78	1.59	1.91	-1.29143	-0.59260	0.35117	-1.47139	0.21515
Ciamis Regency	7.33	11.24	4.83	2.74	3.02	2.52	-1.45143	-0.78978	0.62376	-2.57517	0.06164
Cianjur Regency	6.61	6.4	4.23	3.87	2.81	2.51	-0.90371	-0.96670	0.93450	-7.55457	0.00165
Cirebon Regency	7.93	13.89	9.36	6.52	7.97	5.93	-0.87429	-0.57215	0.32735	-1.39523	0.23543
Garut Regency	4.8	6.39	4.78	15.11	9.62	11.67	1.55343	0.69806	0.48729	1.94979	0.12299
Indramayu Regency	15.39	10.23	4.83	3.49	3.4	2.49	-2.46657	-0.90370	0.81668	-4.22130	0.01346
Karawang Regency	4.17	2.54	2.3	1.63	1.54	1.81	-0.44200	-0.84263	0.71003	-3.12965	0.03520
Kuningan Regency	8.4	7.98	5.37	6.65	7.8	6.08	-0.31029	-0.48465	0.23488	-1.10813	0.32995
Majalengka Regency	5.27	5.29	3.52	3.84	2.43	3.1	-0.54600	-0.87866	0.77204	-3.68059	0.02119
Pangandaran Regency	21.67	5.87	4.2	2.21	1.88	1.95	-3.21600	-0.78194	0.61144	-2.50885	0.06614
Purwakarta Regency	4.6	12.69	5.58	2.05	1.38	1.77	-1.47457		0.41699	-1.69145	0.16601
Subang Regency	2.2	5.17	2.45	1.28	1.95	1.6	-0.39514	-0.52798	0.27876	-1.24340	0.28162
Sukabumi Regency	8.29	6.89	7.33	5.39	7.48	8.98	0.09371	0.14221	0.02022	0.28734	0.78813

Table 1: Cont.

Regency/City	Stunting Prevalence (%)	Slope (%	R	R^2	t-statistic	p-value

	2019	2020	2021	2022	2023	2024	point /year)				
Sumedang Regency	8.77	11.91	11.03	8.27	7.89	7.32	-0.63057	-0.63990	0.40948	-1.66543	0.17116
Tasikmalaya Regency	15.06	18.97	14.93	14.2	8.27	9.2	-1.77514	-0.82659	0.68325	-2.93739	0.04250
Banjar City	7.61	13.81	8.85	7.02	7.15	6.07	-0.84314	-0.56487	0.31908	-1.36910	0.24281
Bandung City	6.53	8.86	7.83	6.43	4.99	8.85	-0.04029	-0.04909	0.00241	-0.09829	0.92643
Bekasi City	10.69	10.35	7.87	3.44	2.33	2.89	-1.92829	-0.93963	0.88291	-5.49203	0.00536
Bogor City	4.54	7.65	5.4	2.4	1.92	2.32	-0.89400	-0.74391	0.55340	-2.22632	0.08998
Depok City	4.55	8.09	3.51	3.48	3.24	3.58	-0.55514	-0.55843	0.31184	-1.34634	0.24943
Sukabumi City	9.31	7.32	5.9	4.03	3.07	5.85	-0.91200	-0.76073	0.57871	-2.34406	0.07903
Tasikmalaya City	10.9	17.57	15.46	12.65	8.11	17.08	-0.00829	-0.00415	0.00002	-0.00831	0.99377
Cirebon City	11.21	13.75	13.39	12.83	12.12	13.04	0.10571	0.21415	0.04586	0.43848	0.68368
Cimahi City	9.06	11.52	9.94	9.7	9.42	2.76	-1.08686	-0.66736	0.44537	-1.79223	0.14757

All tests of the basic assumptions of linear regression (normality of residuals, linearity, autocorrelation, and homoscedasticity) have been conducted. The normality test using Lilliefors shows that the test statistic values are mostly smaller than the critical value at the 5% significance level, so the residuals are considered normally distributed. The linearity assumption was evaluated through scatter plots and trendlines, and the majority of the relationships between years and stunting prevalence formed a pattern close to a straight line, indicating linearity was met. The autocorrelation test was conducted using Durbin-Watson values, and most regencies showed values between 1.5 and 2.5, indicating no significant autocorrelation in the residuals. Meanwhile, the homoscedasticity test using the Glejser method showed the majority of the $p-values$ are above 0.05, meaning that the residual variance is considered constant and the homoscedasticity assumption is met.

Thus, all linear regression assumptions are met, and the model can be used for further analysis. Details of the test results can be accessed through the following attachment: https://osf.io/p27ny With the assumptions fulfilled, the regression model was then applied to analyze the stunting trend in each region.

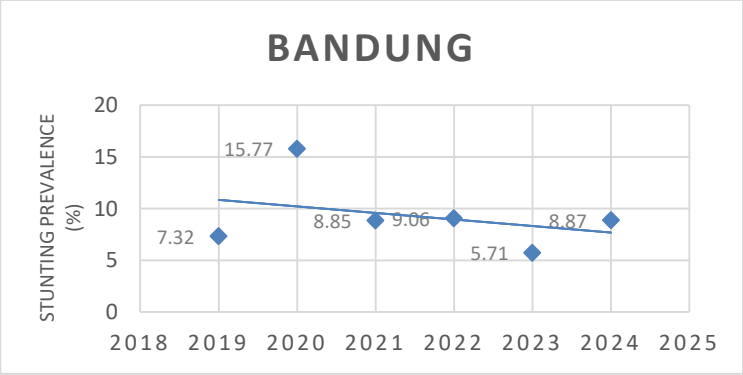

Figure 1: Stunting prevalence trend in Bandung Regency in 2019-2024, with linear regression line.

Figure 1 presents the trend of stunting prevalence in Bandung Regency over the 2019-2024 period. In 2019, the stunting rate in Bandung Regency was recorded at 7.32%, then experienced a sharp increase to 15.77% in 2020, before declining again to reach 8.87% in 2024. Although it had entered the medium urgency category in 2020, the prevalence then decreased to the low category, based on WHO standards. The linear regression results show a slope

of -0.63, indicating an average decrease of about 0.63 percentage points per year. However, the coefficient of determination (R^2) was only 0.119, indicating that only 11.9% of the variance in stunting prevalence can be explained by the trend over time. In addition, the *p-value* of 0.50 (>0.1) indicates that the downward trend is not statistically significant.

Conclusion: H_0 is not rejected

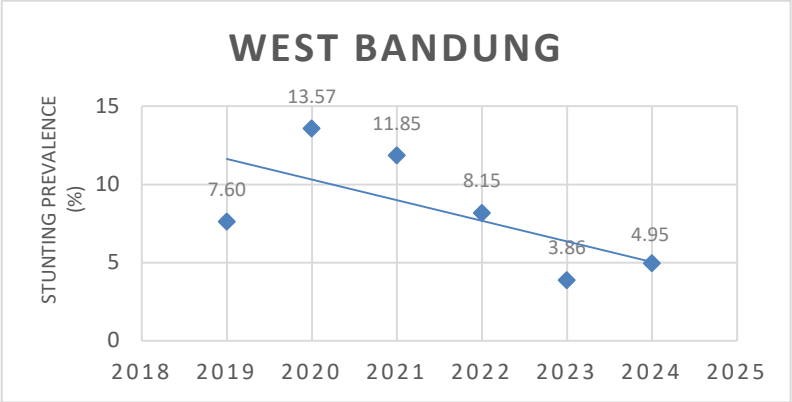

Figure 2: Stunting prevalence trend in West Bandung Regency in 2019-2024, with linear regression line

In 2019, the stunting rate in West Bandung Regency was 7.60%, increasing to 13.57% in 2020, then decreasing to 8.15% in 2024. Although it had entered the medium urgency category, the prevalence then decreased to the low category, based on WHO standards. The linear regression results show a slope of -1.32, which indicates an average decrease of 1.32 percentage points per year. The R^2 value was 0.42, indicating that the model was not good enough to explain the variation in the data. Furthermore, the *p-value* of 0.16 (>0.1) indicates that the decline is not statistically significant.

Conclusion: H_0 is not rejected

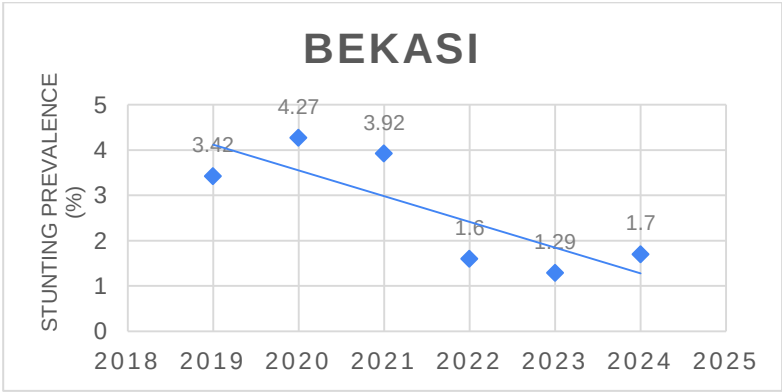

Figure 3: Stunting prevalence trend in Bekasi Regency in 2019-2024, with linear regression line

The stunting rate in Bekasi Regency decreased from 3.42% in 2019, increased slightly to 4.27% in 2020, then decreased to 1.70% in 2024. All are within the WHO low significance category. The slope was -0.567, indicating an average decrease of 0.567 percentage points per year. With an R^2 of 0.649 the model strongly explains the trend, and the *p-value* of 0.052 (<0.1) indicates that the decline is statistically significant.

Conclusion: H_0 is rejected

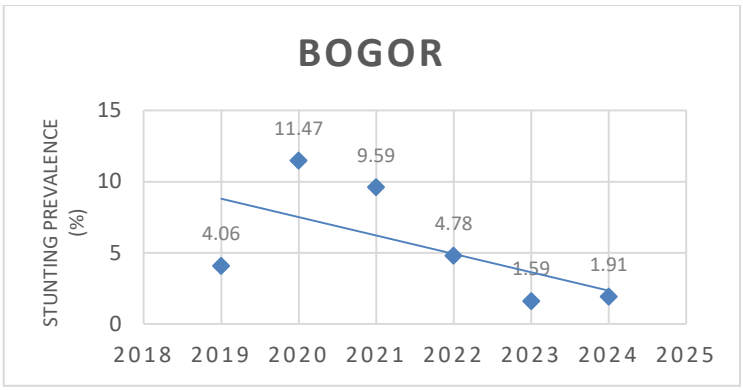

Figure 4: Stunting prevalence trend in Bogor Regency in 2019-2024, with linear regression line.

In Bogor Regency, the stunting rate rose sharply from 4.06% in 2019 to 11.47% in 2020, then dropped dramatically to 1.91% in 2024. Based on WHO standards, the prevalence is categorized as low urgency, although it had entered medium. Although the slope of -1.29 shows a sharp downward trend, the R^2 value of only 0.351 indicates that the model is not good enough to explain the variation in the data, and *the p-value* of 0.215 (>0.1) indicates that the trend is not statistically significant.

Conclusion: H_0 is not rejected.

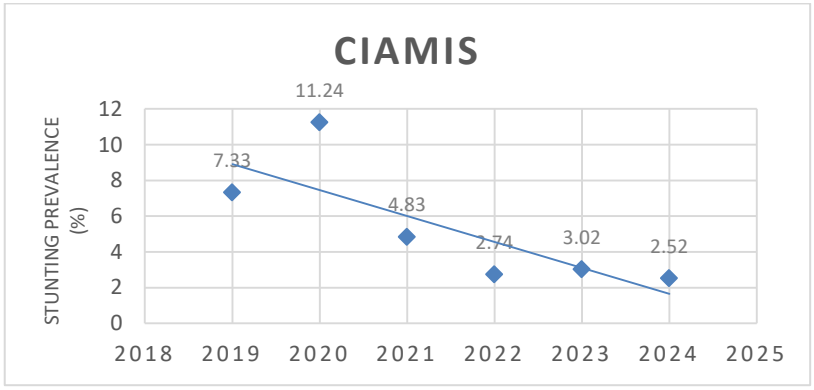

Figure 5: Stunting prevalence trend in Ciamis Regency in 2019-2024, with linear regression line.

In Ciamis Regency, the stunting rate decreased significantly from 7.33% (2019) to 2.52% (2024). Although it rose to 11.24% in 2020, all prevalences are still below the WHO medium significance category. The model produced a slope of -1.45, R^2 of 0.623, which indicates a strong explanatory power for the trend. The *p-value* of 0.0616 (<0.1) indicates that the decline is statistically significant.

Conclusion: H_0 is rejected

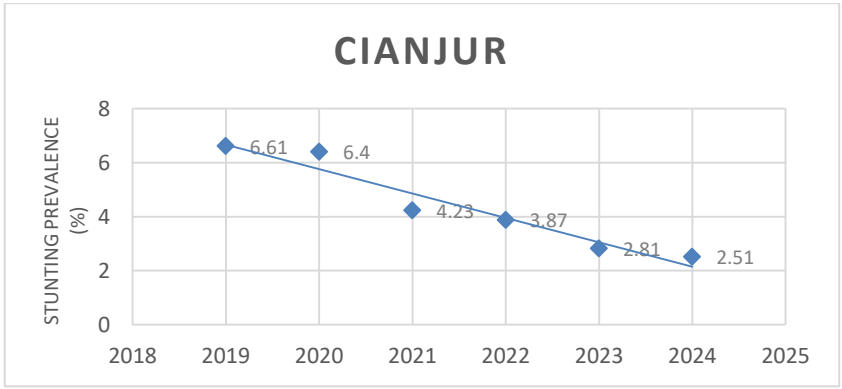

Figure 6: Stunting prevalence trend in Cianjur Regency 2019-2024, with linear regression line.

In Cianjur Regency, the stunting rate decreased from 6.61% (2019) to 2.51% (2024) consistently. As evidenced by the slope of -0.90, R^2 of 0.934, and *p-value* of 0.0016 (<0.1) this downward trend is statistically significant and the model is very robust.

Conclusion: H_0 is rejected

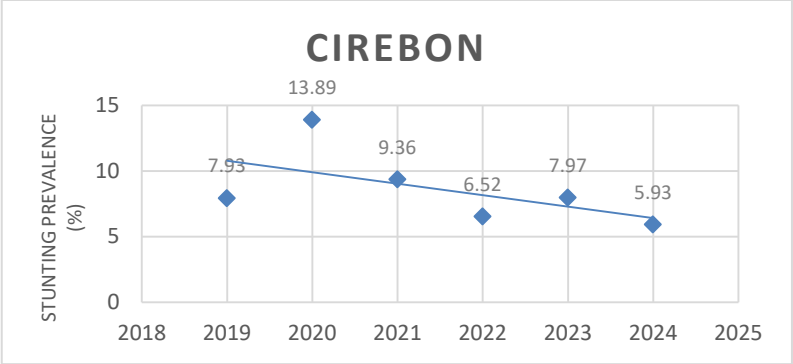

Figure 7: Stunting prevalence trend in Cirebon Regency in 2019-2024, with linear regression line.

The stunting rate in Cirebon Regency increased from 7.93% (2019) to 13.89% (2020), then decreased to 5.93% (2024). The slope is -0.87, indicating a downward trend. However, the R^2 of 0.327 is not strong enough to explain the variation in the data, and *the p-value of* 0.235 (>0.1) indicates an insignificant result. Despite entering the medium urgency category, prevalence then decreased to the low category based on WHO standards.

Conclusion: H_0 is not rejected

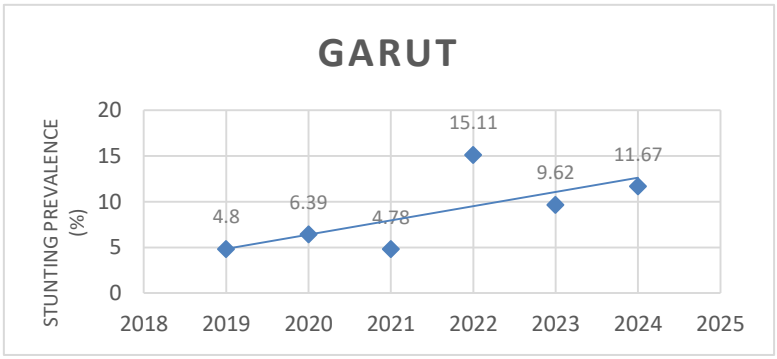

Figure 8: Stunting prevalence trend in Garut Regency in 2019-2024, with linear regression line.

The stunting rate in Garut Regency increased from 4.80% (2019) to 11.67% (2024) and peaked in 2022 with a prevalence of 15.11%. Positive slope of +1.55, with an R^2 of 48.8% and a *p-value* of 0.122 (>0.1) signaling an insignificant result. In 2019, the prevalence was categorized as low urgency according to WHO, but in 2024 it will be categorized as medium urgency. Garut Regency needs attention because the direction of the trend is increasing.

Conclusion: H_0 is not rejected

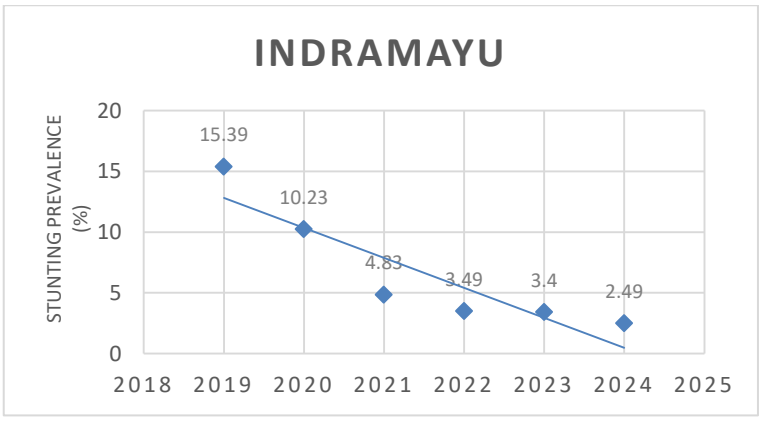

Figure 9: Stunting prevalence trend in Indramayu Regency in 2019-2024, with linear regression line.

The stunting rate in the Indramayu Regency has decreased significantly from 15.39% (2019) to 2.49% (2024). The slope is -2.47, indicating a sharp reduction rate. R^2 0.817, meaning 81.7% of the variation is explained by the model. P-value of 0.012 (<0.1) indicates a strong and significant decline. Indramayu experienced one of the sharpest and most significant declines. This suggests that their efforts in reducing stunting are reaping positive results.

Conclusion: H_0 is rejected.

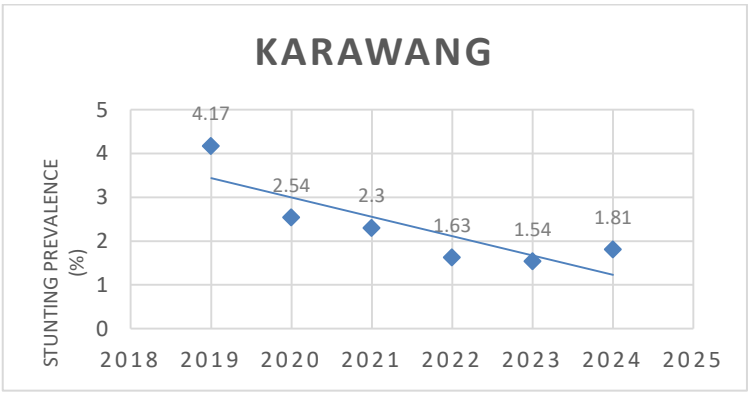

Figure 10: Stunting prevalence trend in Karawang Regency in 2019-2024, with linear regression line.

In 2019, the stunting rate in Karawang Regency was 4.17%, decreasing to 1.81% in 2024. The linear regression results show a slope of -0.44, indicating an average decrease of 0.44 percentage points per year. With an R^2 of 0.71, the model does a good job of explaining the variation in the data, and the *p-value* of 0.035 (<0.1) indicates that the decline is statistically significant. A significant decline from an already low figure indicates continued positive performance.

Conclusion: H_0 is rejected.

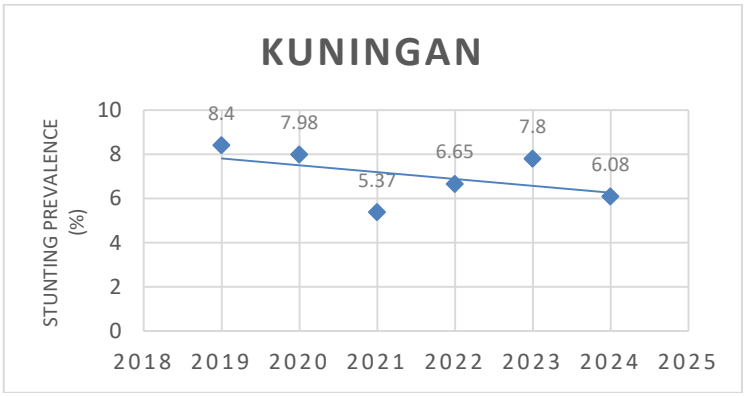

Figure 11: Stunting prevalence trend in Kuningan Regency 2019-2024, with linear regression line

In 2019, the prevalence of stunting in Kuningan Regency was 8.40%, and decreased to 6.08% in 2024. The model produced a slope of -0.31, with an R^2 of 0.118 and a p-value of 0.329 (>0.1) indicating that the downward trend was not statistically significant and the variation in data was not well explained by the model. Included in the WHO category of low urgency.

Conclusion: H_0 is not rejected.

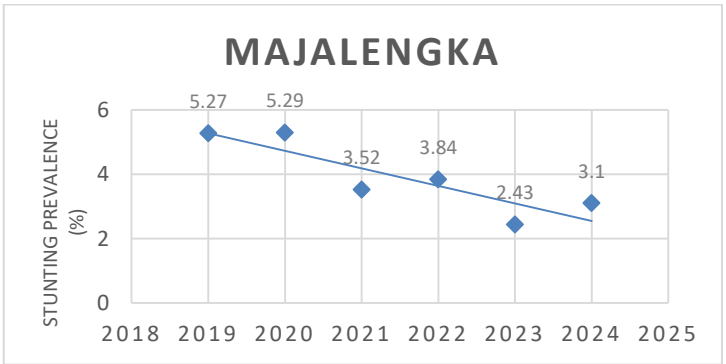

Figure 12: Stunting prevalence trend in Majalengka Regency 2019-2024, with linear regression line

The stunting rate in Majalengka Regency decreased from 5.27% (2019) to 3.10% (2024). The slope is -0.546, with an R^2 of 0.772, so the model does a good job of explaining the variation in the data, and the *p-value of* 0.021 (<0.1) indicates a statistically significant and robust downward trend.

Conclusion: H_0 is rejected.

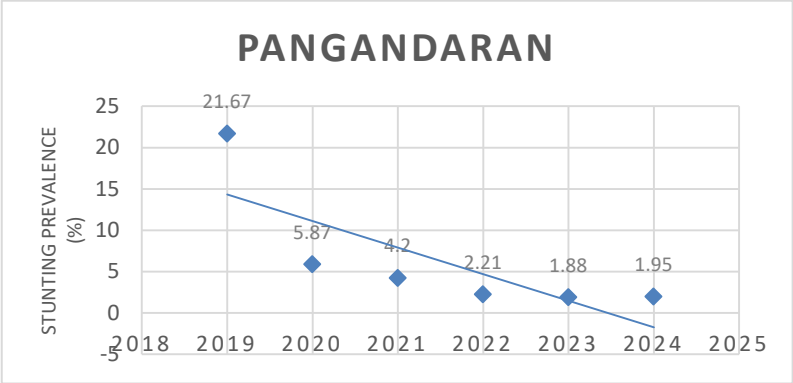

Figure 13: Stunting prevalence trend in Pangandaran Regency 2019-2024, with linear regression line.

In 2019, the stunting rate in Pangandaran Regency was very high at 21.67%, but was reduced to only 1.95% by 2024. With a slope of -3.22, a large reduction rate and an R^2 of 0.611, the model does a good job of explaining the variation in the data. The *p-value* of 0.066 (<0.1) makes this reduction statistically significant.

Conclusion: H_0 is rejected.

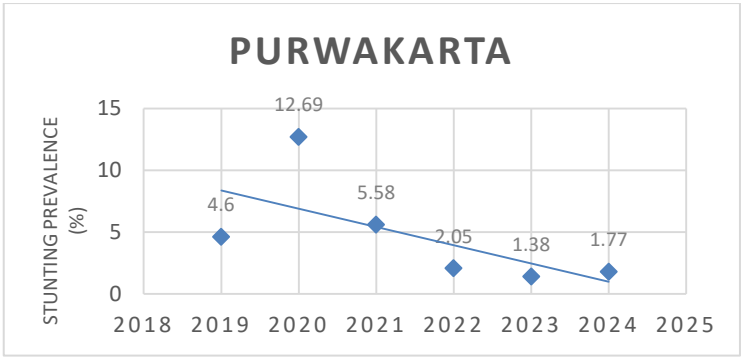

Figure 14: Stunting prevalence trend in Purwakarta Regency 2019-2024, with linear regression line

In 2019, the stunting rate in Purwakarta Regency was 4.6%, increased to 12.69% in 2020, and then decreased again to 1.77% in 2024. The linear regression results show a slope of -1.47, which indicates a fairly large decrease. With an R^2 of 0.416, the model does not explain the variation in the data well, and *the p-value* of 0.166 (>0.1) indicates that this decline is not statistically significant. In 2019, the prevalence fell into the low WHO urgency category, rising to the medium category in 2020, then back down to the very low category in 2024.

Conclusion: H_0 is not rejected.

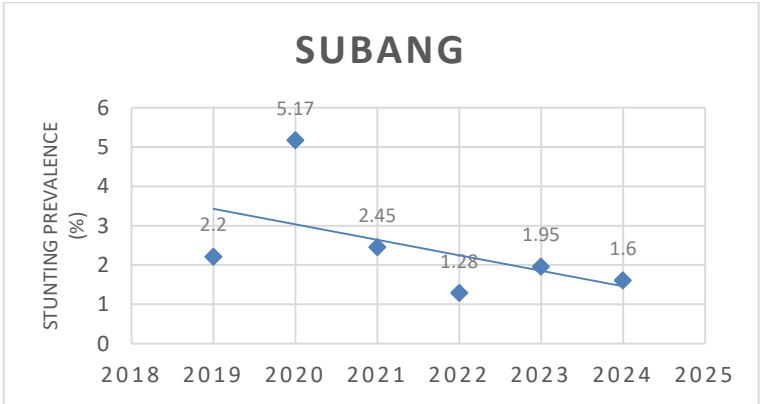

Figure 15: Stunting prevalence trend in Subang Regency 2019-2024, with linear regression line

The stunting rate in Subang Regency has decreased from 2.20% (2019) to 1.96% (2024). The slope of -0.395 indicates a slow downward trend. The R^2 of 0.278 means the model is weak in explaining the trend, and *the p-value* of 0.281 (>0.1) indicates the decline is not statistically significant. Prevalence is categorized as very low urgency by WHO, except in 2020, when prevalence is categorized as low.

Conclusion: H_0 is not rejected.

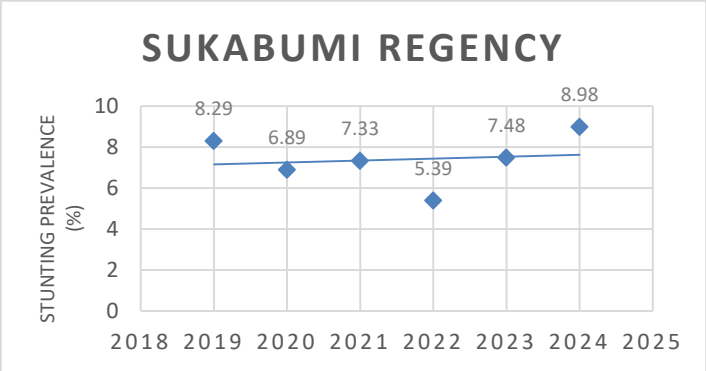

Figure 16: Stunting prevalence trend in Sukabumi Regency 2019-2024, with linear regression line.

The stunting rate in Sukabumi Regency experienced a slight decrease from 8.29% (2019) to 8.45% (2024), which actually shows a slight increase at the end. Slope +0.093, with a very low R^2 of only 0.02 or 2%, and p-value of 0.788 (>0.1) indicate an insignificant and almost stagnant trend. Including the low urgency category based on WHO.

Conclusion: H_0 is not rejected.

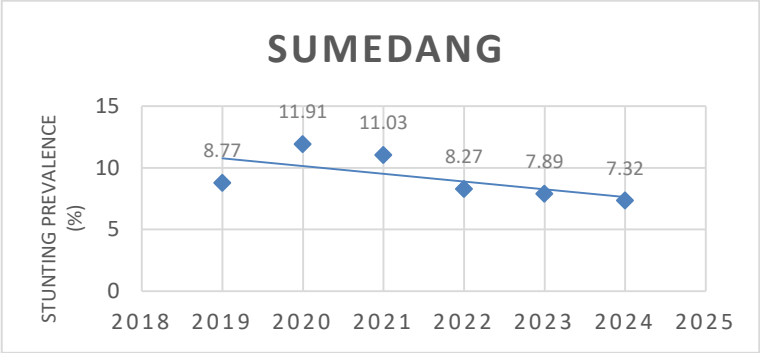

Figure 17: Stunting prevalence trend in Sumedang Regency in 2019-2024, with linear regression line

The stunting rate in Sumedang Regency decreased from 8.77% (2019) to 7.32% (2024). The slope of -0.63 indicates a moderate rate of decline. R^2 of 0.409 and *p-value of* 0.1718 (>0.1) indicate the trend is not statistically significant although the direction is good. According to WHO, prevalence is categorized as low urgency, although it rose to medium in 2020 and 2021.

Conclusion: H_0 is not rejected.

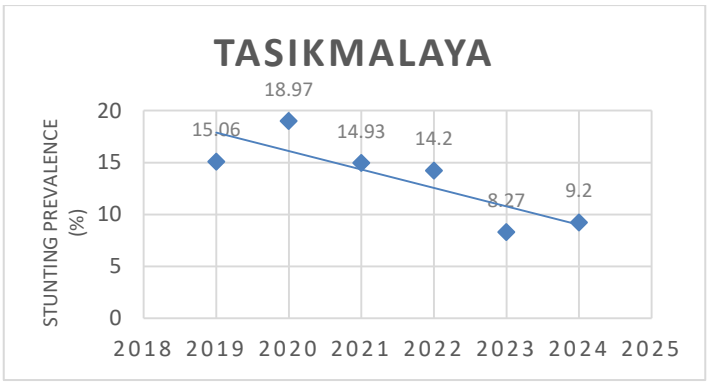

Figure 18: Stunting prevalence trend in Tasikmalaya Regency 2019-2024, with linear regression line.

The stunting rate in Tasikmalaya Regency decreased from 15.06% (2019) to 9.22% (2024). The slope of -1.775 reflects the sharp decline. The R^2 of 0.683 indicates good model power, and the *p-value of* 0.0425 (<0.1) indicates that the decrease is significant.

Conclusion: H_0 is rejected.

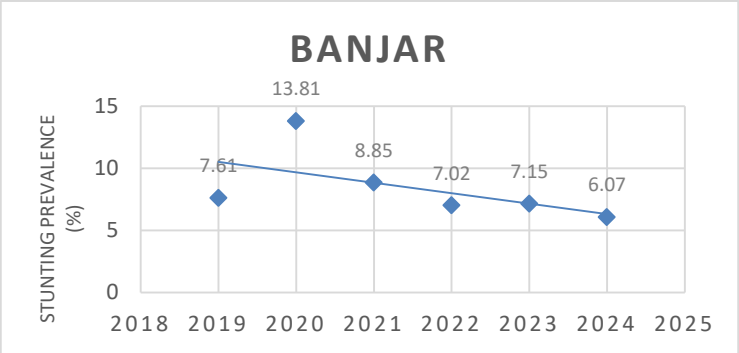

Figure 19: Stunting prevalence trend in Banjar City for 2019-2024, with linear regression line.

The stunting rate in Banjar City has decreased from 7.61% (2019) to 6.07% (2024). The slope is -0.843, the R^2 is 0.31 indicating that only 31% of the variation is explained by the model, making the model less robust. *P-value* 0.2426 (>0.1) indicates the trend is not significant. Prevalence is categorized as low urgency according to WHO, although it increased to medium category in 2020 (13.81%).

Conclusion: H_0 is not rejected.

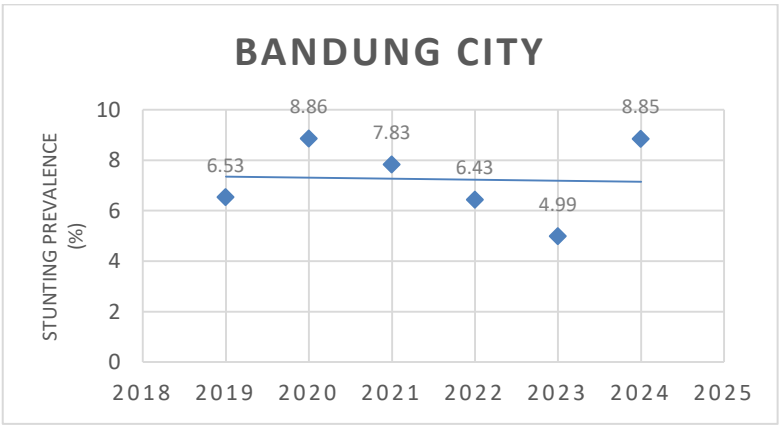

Figure 20: Stunting prevalence trend in Bandung City in 2019-2024, with linear regression line

The stunting rate in Bandung City shows a fluctuating trend, from 6.53% in 2019, to 8.86% in 2020, then down to 4.99% in 2023, and back up to 8.95% in 2024. Slope is -0.04, R^2 is 0.002 and a *p-value* of 0.9264 (>0.1), indicating an insignificant upward trend. Concern is needed as the direction of the trend is worsening, although it is still in the low urgency category based on WHO.

Conclusion: H_0 is not rejected .

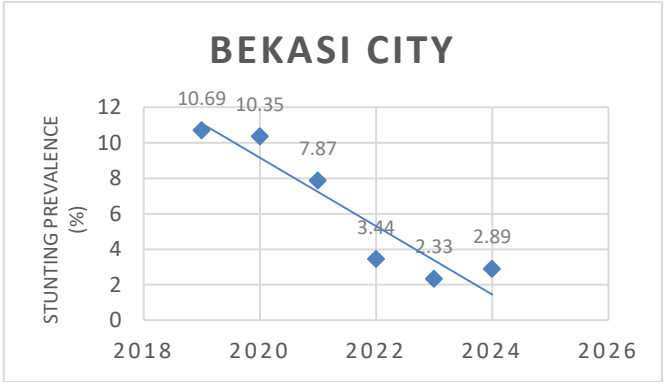

Figure 21: Stunting prevalence trend in Bekasi City in 2019-2024, with linear regression line

The stunting rate in Bekasi City shows a significant decrease from 10.69% (2019) to 2.89% (2024). Slope -1.92, high R^2 of 0.882 (88.2%) indicates the model is very strong, and the p-value of 0.005 (<0.1) indicates a very significant result.

Conclusion: H_0 is rejected.

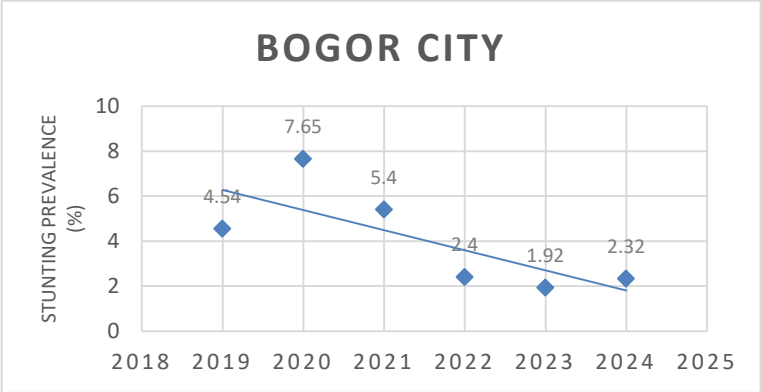

Figure 22: Stunting prevalence trend in Bogor City for 2019-2024, with linear regression line

The prevalence of stunting in Bogor City increased from 4.54% in 2019 to 7.65% in 2020, then decline to 2.32% in 2024. Slope -0.89, R^2 0.553 indicates the model can explain variation well and *p-value* 0.089 (<0.1) indicates a statistically significant decrease.

Conclusion: H_0 is rejected.

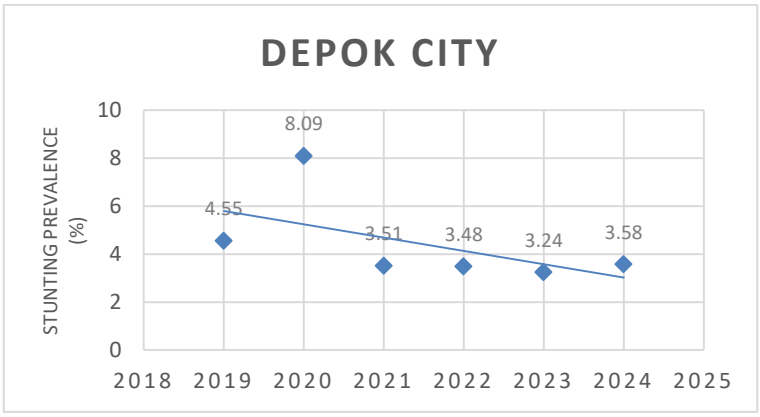

Figure 23: Stunting prevalence trend in Depok City 2019-2024, with linear regression line

The stunting rate in Depok City decreased from 4.55% (2019) to 3.58% (2024), and rose to 8.09% in 2020. Slope -0.555 and R^2 only 0.311, and a p-value of 0.2494 (>0.1) indicates a downward trend that is not statistically significantDepok City is categorized as low urgency according to WHO.

Conclusion: H_0 is not rejected.

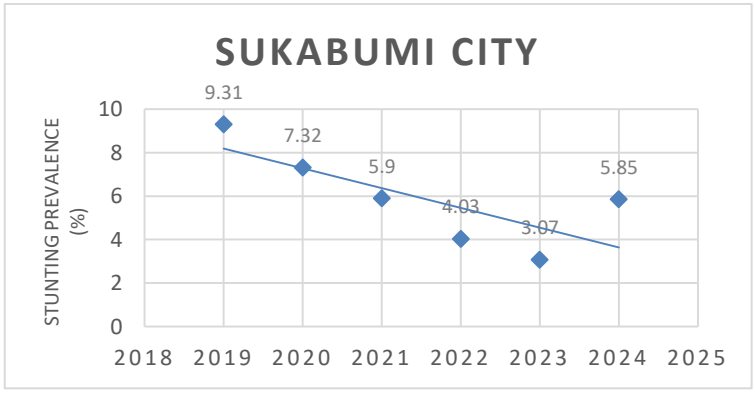

Figure 24: Stunting prevalence trend in Sukabumi City 2019-2024, with linear regression line

In 2019, the stunting rate in Sukabumi City was 9.31%, decreased to 3.07% in 2023, and increased to 5.85% in 2024. The linear regression results showed a slope of -0.912 indicating an average decrease of 0.912 percentage points per year. With an R^2 of 0.578, the model does a good job of explaining the variation in the data, and *the p-value* of 0.079 (<0.1) indicates that the decline is statistically significant.

Conclusion: H_0 is rejected.

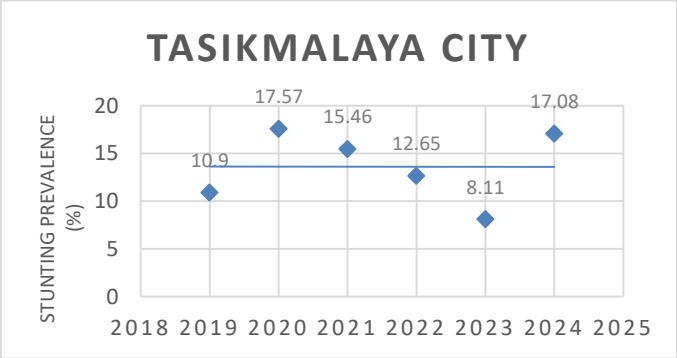

Figure 25: Stunting prevalence trend in Tasikmalaya City 2019-2024, with linear regression line.

In 2019, the stunting rate in Tasikmalaya City was 10.9%, rising to 17.57% in 2020 and falling to 8.11 in 2023, then rising again to 17.08% in 2024. The linear regression results show a slope of -0.00829, indicating an almost stagnant rate of change. With an R^2 of 0.00002, the model cannot explain the variation in the data, and *the p-value* of 0.993 (>0.1) indicates that the decline is not statistically significant. Prevalence falls into the WHO medium urgency category, although it did fall into the low category in 2023.

Conclusion: H_0 is not rejected.

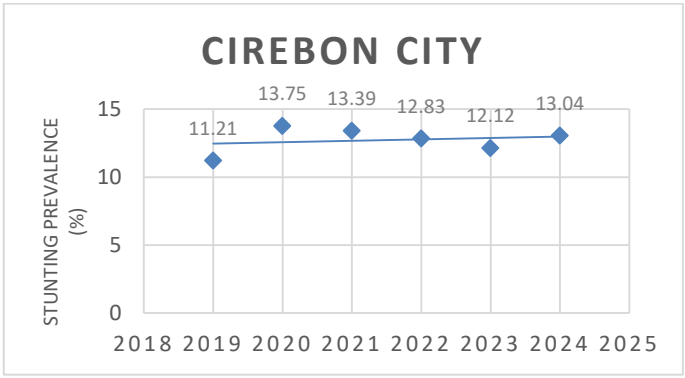

Figure 26: Stunting prevalence trend in Cirebon City 2019-2024, with trend line from linear regression.

In 2019, the stunting rate in Cirebon City was 11.21%, increasing to 13.04 in 2024. The linear regression results show a slope of +0.105, indicating an average increase of 1.05 percentage points per year. With an R^2 of 0.04, the model cannot explain the variation in the data, and *the p-value* of 0.683 (>0.1) indicates that the decrease is not statistically significant. In 2019, the prevalence falls into the WHO medium urgency category.

Conclusion: H_0 is not rejected.

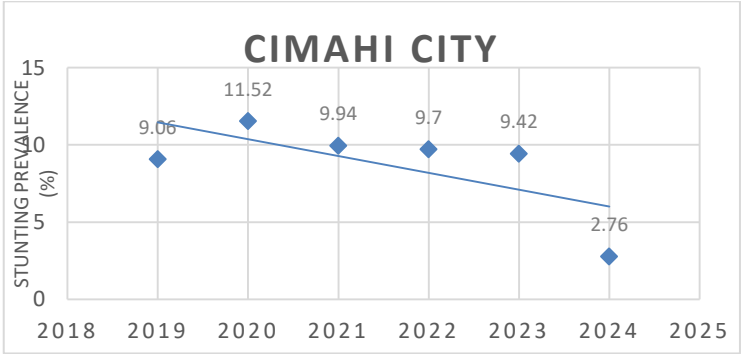

Figure 27: Stunting prevalence trend in Cimahi City in 2019-2024, with linear regression line

In 2019, the stunting rate in Cimahi City was 9.06%, increased to 11.52% in 2020, then decreased to 9.42 in 2023, and dropped dramatically to 2.76% in 2024. The linear regression results show a slope of -1.08. With an R^2 of 0.44, the model does not explain the variation in the data well. The *p-value* of 0.147 (>0.1) indicates that the decline is not statistically significant. Prevalence falls into the low WHO urgency category, although it briefly touched the medium category in 2020.

Conclusion: H_0 is not rejected.

The results showed clear differences in the trends of stunting prevalence across regencies and cities in West Java. From the 27 regions analyzed, only around 40% regencies or cities, such as Indramayu Regency, Pangandaran Regency, and Bekasi City, showed a statistically significant decrease in stunting over the six-year period from 2019 to 2024. In contrast, the remaining 60% of regions either did not experience a significant decline or continued to show increasing trends, albeit not statistically significant. This indicates that progress in reducing stunting remains uneven, and improvements in some areas have not been consistently replicated across the province. It also suggests that successful interventions in certain periods or regions have not always translated into sustained results elsewhere.

Such inconsistent outcomes point to the need for a deeper understanding of the underlying causes of stunting, which are often rooted in chronic malnutrition, inadequate healthcare, and repeated infections during early childhood. Chronic malnutrition affects the synthesis of DNA and RNA needed for the growth and differentiation of bone-forming cells like chondrocytes and osteoblasts, while also weakening the immune system. Inadequate energy intake can also inhibit growth hormone (GH) secretion and suppress insulin-like growth factor 1 (IGF-1), both essential for linear growth, ultimately resulting in short stature. Recurrent infections further worsen nutritional status through mechanisms like chronic diarrhea and intestinal inflammation (Mulyani et al., 2025).

5. Conclusion

This study shows that the prevalence of stunting in children under five years of age in West Java Province is still a serious public health issue, although on average it has decreased during the 2019-2024 period. Through simple linear regression trend analysis of data from 27 regions, it was found that 40% of regions such as Indramayu Regency and Bekasi City showed a fairly consistent and significant downward trend, while 60% of regions such as Garut Regency and Cirebon City continue to record relatively high or stagnant prevalence rates through 2024. The difference in the effectiveness of this reduction reflects variations in local factors, policies, and the quality of interventions in each region.

The analysis also emphasizes the importance of a spatial and contextual approach in developing stunting prevention policies, considering that each region has different demographic, social, economic, and environmental characteristics. Thus, the results of this study are expected to serve as a foundation for more targeted, data-driven, and sustainable public health intervention planning to accelerate stunting reduction in West Java.

References

Alabi, O. O. (2021). Type I error rates on some methods of heteroscedasticity detection in linear regression models without multicollinearity problem. Journal of Sustainable Technology, 11(2), 78-85. https://journals.futa.edu.ng/home/paperd/1397/80/10

Aminah, S., & Saini, S. (2019). Analysis of risk factors of stunting in kindergarten in Borong Pa'lala, Gowa Regency. Interprofessional Proceedings Collaboration on Urban Health, 2(1), 155–166. https://jurnal.poltekkes-mks.ac.id/ojs2/index.php/Prosiding/article/view/1194

Aramico, B., Huriyati, E., & Dewi, F. S. T. (2020). Determinant factors of stunting and effectiveness of nutrition, information, education interventions to prevent stunting in the first 1000 days of life: A systematic review. The International Conference on Public Health Proceeding, 5(1), 285–300. https://doi.org/10.26911/the7thicph-FP.03.30

Goos, P., Meintrup, D. (2016). Statistics with JMP: Hypothesis Tests, ANOVA and Regression. Germany: Wiley.

James, G., Witten, D., Hastie, T., & Tibshirani, R. (2021). An introduction to statistical learning: With applications in R (2nd ed.). Springer.

Kementerian Kesehatan RI. (2024). Stunting in Indonesia and Its Determinants. Badan Kebijakan Pembangunan Kesehatan. Retrieved from https://repository.badankebijakan.kemkes.go.id/id/eprint/5530

Mediyana Sofyan, M., Fauziyah, G., & Rahardian, R. (2024). Collaborative governance on handling stunting in West Java Province of Indonesia. IAPA Proceedings Conference, 2024, 674–689. https://www.journal.iapa.or.id/proceedings/article/view/1148

Montgomery, D. C., Peck, E. A., Vining, G. G. (2021). Introduction to Linear Regression Analysis. United States: Wiley.

Mulyani, A., Khairinisa, M., Khatib, A., & Chaerunisaa, A. (2025). Understanding Stunting: Impact, Causes, and Strategy to Accelerate Stunting Reduction-A Narrative Review. Nutrients, 17. https://doi.org/10.3390/nu17091493

Rahmawati, N. D., & Sartika, R. A. D. (2020). Cadres' role in Posyandu revitalization as stunting early detection in Babakan Madang Sub-District, Bogor District. ASEAN Journal of Community Engagement, 4(2), Article 11. https://doi.org/10.7454/ajce.v4i2.1055

Wan Taib, W. R., & Ismail, I. (2021). Evidence of stunting genes in Asian countries: A review. Meta Gene, 30, 100970. https://doi.org/10.1016/j.mgene.2021.100970

World Health Organization. (2020). Levels and trends in child malnutrition: UNICEF/WHO/World Bank Group joint child malnutrition estimates - Key findings of the 2020 edition. Geneva: WHO. https://www.who.int/publications/i/item/9789240025257

Yan, X., Su, X. (2009). Linear Regression Analysis: Theory and Computing. Singapore: World Scientific Publishing Company.