# Analysis Food Security of Cities in Bengkulu Province Pre and Post Pandemic

**Hariz Eko Wibowo¹, Ridha Rizki Novanda², Rihan Ifebri³, and Ariffatchur Fauzi⁴**

1Departement Of Socio-Economic of Agriculture, Faculty of Agriculture, Bengkulu University, Indonesia
2Departement Of Plant Protection, Faculty of Agriculture, Bengkulu University, Indonesia
*Corresponding author: hariz.ekowibowo@unib.ac.id

**ABSTRACT.** The percentage of the population living in poverty in Bengkulu Province was not affected by the pandemic and even tended to decrease. This is contrary to the findings of studies on the impact of the pandemic on income, poverty, and food security. One way to determine the impact of the pandemic on food security is by comparing the conditions before and after the pandemic. Based on the descriptive analysis results, the food Security Index in some districts increased steadily throughout the period, but others fluctuated. Some districts experiencing fluctuations include Rejang Lebong, Seluma, and Mukomuko. The Food Security Index of other districts, including Bengkulu City, tends to increase. Only the Food Security Index of Kepahiang and Bengkulu Tengah districts shows a tendency to decrease. The results of the paired sample t-test indicate a significant difference in the food security index among districts and cities in Bengkulu Province between before and after the pandemic. This finding aligns with the descriptive analysis results that show a difference in the food security index among districts and cities in Bengkulu Province. Further analysis was conducted by considering these three aspects. However, the three aspects yielded different results in the paired sample t-test. Only in terms of food quality, the paired sample t-test results showed a significant difference in quality index between before and after the pandemic, supported by a p-value of (0.032) < alpha 5%.

Keywords: Food security index, paired sample t-test, pre and post pandemic

## INTRODUCTION

Food security is one of the crucial issues, especially in developing countries. The standard approach to achieving food security is increasing productivity and ensuring sufficient domestic food supply. Particularly in developing countries, food self-sufficiency is a commitment of the government. The government plans and implements policies through programs to meet the target production of staple foods. Based on Law No. 18/2012 on food, food security is defined as the condition of fulfilling food needs from the state to individuals, reflected in the availability of sufficient, safe, diverse, nutritious, evenly distributed, affordable food that is not in conflict with the religion, beliefs, and culture of

the community, to enable healthy, active, and sustainable productive lives. The Food and Agriculture Organization (FAO) identifies four food security components: availability, affordability, quality, and stability.

Food availability refers to the ability to have adequate food for basic needs. Food availability is related to food supply through production, distribution, and exchange of food commodities. Food access is having the economic and physical resources to obtain nutritious food. There are two differences in food access: direct access and economic access. Direct access is when households produce their food. Economic access is when households purchase food produced elsewhere. Food quality or food security is utilising food appropriately and proportionally.

Food quality must be safe and meet the nutritional needs of each individual. Food utilisation is influenced by food safety and quality, which are affected by processing methods and processing capabilities down to the individual or household level. Food stability is the ability of an individual or household to access food over a certain period of time. Seasonal food production, natural disasters, and civil conflicts are some factors that can cause food instability.

Food insecurity is often associated with various problems. Failure to access nutritious food can lead to nutritional problems such as malnutrition in infants (Hackett et al., 2009; Motbainor et al., 2015). Food insecurity is also linked to the occurrence of obesity in women (Franklin et al., 2012; Pan et al., 2012) and chronic diseases (Gowda et al., 2012; Seligman et al., 2010). Food insecurity is also associated with risky sexual behaviour (Vogenthaler et al., 2013), anxiety and depression, risky coping strategies, and poor pregnancy outcomes in women (Ivers & Cullen, 2011). Food insecurity can have broader social impacts, such as impairments in children's mental development (Rose-Jacobs et al., 2008; Slopen et al., 2010).

The Covid-19 pandemic has affected various sectors, including food security. The COVID-19 pandemic can lead to a global food crisis and chronic hunger due to increased poverty and can impact changes in society's behavioural and economic activities (Syakirotin et al., 2022). During the pandemic, the agricultural sector is considered one of the economy's mainstays. However, the agricultural sector has also been affected during the pandemic. Mobility restrictions have impacted farming activities and reduced agricultural productivity (van den Berg et al., 2020).

The risk of a decline in the performance of the agricultural sector needs to be mitigated by reorienting agricultural policies and development programs (Khairad, 2020). Some aspects affecting the agricultural sector during the pandemic, viewed from the agribusiness perspective, include the upstream agribusiness subsystem, on-farm agribusiness subsystem, downstream agribusiness subsystem, and supporting agribusiness subsystem. In line with this, the sustainability of supply chains and food security depends on trade capacity, food provision processes and other factors such as GDP per capita, natural resources, infrastructure, and investment (Fan et al., 2021).

On the other hand, the pandemic has also led to a decline in household income (Kurniasih, 2020; Saraswati, 2019). One of the changes in people's behaviour due to the pandemic is altering eating patterns, such as substituting certain dishes and changing household expenditure patterns (Ouoba & Sawadogo, 2022). Along with this, the food security indicator most affected is accessibility, with substantial evidence showing that financial and physical access to food has been disrupted (Béné et al., 2021).

Table 4. The percentage of impoverished individuals in Sumatra in 2018-2023

| Province | 2018 | 2019 | 2020 | 2021 | 2022 | 2023 |
|---|---|---|---|---|---|---|
| Aceh | 15.68 | 15.01 | 15.43 | 15.53 | 14.75 | 14.45 |
| Sumatera Utara | 8.94 | 8.63 | 9.14 | 8.49 | 8.33 | 8.15 |
| Sumatera Barat | 6.55 | 6.29 | 6.56 | 6.04 | 6.04 | 5.95 |
| Riau | 7.21 | 6.90 | 7.04 | 7.00 | 6.84 | 6.68 |
| Jambi | 7.85 | 7.51 | 7.97 | 7.67 | 7.70 | 7.58 |
| Sumatera Selatan | 12.82 | 12.56 | 12.98 | 12.79 | 11.95 | 11.78 |
| Bengkulu | 15.41 | 14.91 | 15.30 | 14.43 | 14.34 | 14.04 |
| Lampung | 13.01 | 12.30 | 12.76 | 11.67 | 11.44 | 11.11 |
| Kep. Bangka Belitung | 4.77 | 4.50 | 4.89 | 4.67 | 4.61 | 4.52 |
| Kep. Riau | 5.83 | 5.80 | 6.13 | 5.75 | 6.03 | 5.69 |

Source: The Central Bureau of Statistics (BPS)

Food security is closely related to poverty because one aspect of food security is affordability. Bengkulu Province is the second-largest province in Sumatra in terms of the percentage of the impoverished population. Interestingly, it can be observed that the percentage of the population living in poverty in Bengkulu Province was not affected by the pandemic and even tended to decrease. This is contrary to the findings of studies on the impact of the pandemic on income, poverty, and food security. One way to determine the impact of the pandemic on food security is by comparing the conditions before and after the pandemic. Therefore, it is necessary to research changes in food security before and after the pandemic in cities and districts in Bengkulu Province.

## MATERIAL AND METHODS

This study examines changes in food security before and after the COVID-19 pandemic in districts and cities in Bengkulu Province. The districts and cities selected for analysis in Bengkulu Province are Bengkulu Selatan Regency, Rejang Lebong Regency, Bengkulu Utara Regency, Kaur Regency, Seluma Regency, Mukomuko Regency, Lebong Regency, Kepahiang Regency, Bengkulu Tengah Regency, and Bengkulu City.

The data source used is secondary data, namely the Food Security and Vulnerability Atlas (FSVA) report from 2018 to 2019, which serves as data before COVID-19, and data from 2021 to 2023, which serves as data after the pandemic. The year 2020 can be categorised as the pandemic year. Therefore, data from 2020 is not included in either the pre-pandemic or post-pandemic categories.

The researcher used a literature study technique by examining relevant theoretical references on the food security of a region. The variables used are indicators in calculating the food security status, consisting of three aspects: food availability, accessibility or affordability, and food quality.

For the Food Security Index (IKP) data, the three aspects have several indicators. The availability aspect is measured using indicators such as the ratio of normative consumption to net production of rice, corn, sweet potatoes, cassava, and sago, as well as the rice stock held by local governments. Food accessibility is measured using three indicators: the percentage of the population below the poverty line, households spending more than 65% of their total expenditure on food, and households without access to electricity. Food quality is measured using five indicators:

1. Average years of schooling for women aged over 15
2. Percentage of households without access to clean water
3. Ratio of population per healthcare worker to population density
4. Percentage of stunting
5. Life expectancy at birth

The design used in this research is quantitative descriptive (Ishtiaq, 2019). Descriptive analysis uses food security index data from 2018 to 2023 to provide an overview of changes in the food security index.

The hypothesis to be tested is whether there is a significant difference between before and after the pandemic in districts and cities in Bengkulu Province. Therefore, the following appropriate method is an analysis using paired sample t-tests. Paired sample t-test is a method used to assess the effectiveness of treatment or the impact of an event, characterised by differences in means before and after treatment or differences in means of indices before and after an event (Widiyanto, 2013). In this case, it is the Covid-19 pandemic. The assumption in paired sample t-tests is that the data must be normally distributed.

## RESULT AND DISCUSSION

Several results, including descriptive analysis and comparison tests, utilise paired sample t-tests in this part. The table below illustrates the food security index of districts and cities between 2018 and 2023 in Bengkulu Province. Overall, the Food Security Index in some districts increased steadily throughout the period, but others fluctuated. Some districts experiencing fluctuations include Rejang Lebong, Seluma, and Mukomuko. The Food Security Index of other districts, including Bengkulu City, tends to increase. Only the Food Security Index of Kepahiang and Bengkulu Tengah districts shows a tendency to decrease. This descriptive data indicates that changes and differences occurred

between 2018 and 2023 or can be interpreted as differences before and after the COVID-19 pandemic.

Table 5. Food Security Index of Districts and Cities in Bengkulu Province 2018-2023

| District/City in Bengkulu Province | 2018 | 2019 | 2020 | 2021 | 2022 | 2023 |
|---|---|---|---|---|---|---|
| Bengkulu Selatan | 71.55 | 72.44 | 74.54 | 72.30 | 73.67 | 74.63 |
| Rejang Lebong | 71.35 | 70.93 | 70.64 | 67.54 | 66.68 | 72.67 |
| Bengkulu Utara | 72.92 | 66.85 | 68.15 | 68.21 | 58.31 | 70.74 |
| Kaur | 67.68 | 70.06 | 70.68 | 72.12 | 71.51 | 73.90 |
| Seluma | 69.74 | 67.55 | 67.72 | 67.29 | 68.54 | 71.64 |
| Mukomuko | 74.60 | 70.84 | 71.46 | 76.17 | 71.78 | 76.63 |
| Lebong | 69.17 | 72.19 | 76.09 | 74.38 | 74.86 | 75.84 |
| Kepahiang | 73.44 | 72.36 | 68.99 | 68.68 | 67.14 | 69.41 |
| Bengkulu Tengah | 72.63 | 73.03 | 67.24 | 68.63 | 62.12 | 61.54 |
| Bengkulu City | 64.58 | 66.48 | 67.24 | 67.82 | 65.29 | 75.68 |

The next step is to conduct a paired sample t-test. However, before using this analytical tool, it is necessary to conduct an assumption test, namely the normality test. The food security index data for districts and cities in Bengkulu Province follows a normal distribution. This is evidenced by the Kolmogorov-Smirnov normality test results with p-values > alpha 5% for both the pre-pandemic food security index (IKP pre) and the post-pandemic food security index (IKP post) datasets. If the p-value in the Kolmogorov-Smirnov normality test is > alpha 5%, then the null hypothesis (H0) is accepted, indicating that the data is usually distributed.

Table 6. Normality Test Result of Food Security Index (IKP) Pre and Post-Pandemic

| | Kolmogorov-Smirnov[a] | | | Shapiro-Wilk | | |
|---|---|---|---|---|---|---|
| | Statistic | Df | Sig. | Statistic | df | Sig. |
| IKP_pre | ,186 | 10 | **,200*** | ,952 | 10 | ,687 |
| IKP_post | ,224 | 10 | **,168** | ,913 | 10 | ,301 |

Table 2. illustrates that the p-value (Sig.) in the Kolmogorov-Smirnov normality test is > alpha 5%, then indicating that the data of Food Security Index (IKP) Pre- and Post-Pandemic is usually distributed.

Table 7. Paired Samples T Test Result of Food Security Index (IKP) Pre- and Post-Pandemic

| | Paired Differences | | | | | T | Df | Sig. (2-tailed) |
|---|---|---|---|---|---|---|---|---|
| | Mean | Std. Deviation | Std. Error Mean | 95% Confidence Interval of the Difference | | | | |
| | | | | Lower | Upper | | | |
| IKP_pre - IKP_post | 8,29300 | 7,13127 | 2,25510 | 3,19160 | 13,39440 | 3,677 | 9 | **,005** |

The paired sample t-test utilises data defined as follows: 2018 to 2019 represents pre-pandemic data, while data from 2021 to 2023 represents post-pandemic data. The results of the paired sample t-test indicate a significant difference in the food security index among districts and cities in Bengkulu Province between before and after the pandemic. This is evidenced

by a p-value of 0.005, less than the alpha level of 5%. This finding aligns with the descriptive analysis results from the Food Security Index table previously examined, which shows a difference in the food security index among districts and cities in Bengkulu Province.

Table 8. Normality Test Result of Food Availability Pre- and Post-Pandemic

| | Kolmogorov-Smirnov[a] | | | Shapiro-Wilk | | |
|---|---|---|---|---|---|---|
| | Statistic | Df | Sig. | Statistic | df | Sig. |
| Food Availability Pre | ,160 | 9 | **,200*** | ,962 | 9 | ,823 |
| Food Availability Post | ,168 | 9 | **,200*** | ,913 | 9 | ,337 |

Table 4. illustrates that the p-value (Sig.) in the Kolmogorov-Smirnov normality test is > alpha 5%, indicating that the data of Food Availability pre- and post-pandemic is usually distributed.

Table 9. Paired Samples T-Test Result of Food Availability Pre- and Post-Pandemic

| | Paired Differences | | | | | t | df | Sig. (2-tailed) |
|---|---|---|---|---|---|---|---|---|
| | Mean | Std. Dev. | Std. Error Mean | 95% Confidence Interval of the Difference | | | | |
| | | | | Lower | Upper | | | |
| Food Availability Pre– Food Availability Post | 5,24111 | 11,13769 | 3,71256 | -3,32008 | 13,80230 | 1,412 | 8 | **,196** |

Table 5. shows that the paired sample t-test results indicate no significant difference in food availability before and after the pandemic. A p-value proves this is more than the alpha level of 5%.

Table 10. Normality Test Result of Food Affordability Pre- and Post-Pandemic

| | Kolmogorov-Smirnov[a] | | | Shapiro-Wilk | | |
|---|---|---|---|---|---|---|
| | Statistic | Df | Sig. | Statistic | df | Sig. |
| Food Affordability Pre | ,155 | 10 | **.200*** | ,944 | 10 | ,595 |
| Food Affordability Post | ,164 | 10 | **.200*** | ,951 | 10 | ,678 |

Table 6. illustrates that the p-value (Sig.) in the Kolmogorov-Smirnov normality test is > alpha 5%, indicating that the Food Affordability Pre- and Post-Pandemic data is usually distributed.

Table 11. Paired Samples T-Test Result of Food Affordability Pre- and Post-Pandemic

| | Paired Differences | | | | | t | df | Sig. (2-tailed) |
|---|---|---|---|---|---|---|---|---|
| | Mean | Std. Deviation | Std. Error Mean | 95% Confidence Interval of the Difference | | | | |
| | | | | Lower | Upper | | | |
| Food Affordability Pre – Food Affordability Post | -,72800 | 2,18279 | ,69026 | -2,28947 | ,83347 | -1,055 | 9 | **,319** |

Table 7. shows that the results of the paired sample t-test indicate no significant difference in food affordability between before and after the pandemic. A p-value proves this is more than the alpha level of 5%.

Table 12. Normality Test Result of Food Quality Pre and Post Pandemic

| | Kolmogorov-Smirnov[a] | | | Shapiro-Wilk | | |
|---|---|---|---|---|---|---|
| | Statistic | df | Sig. | Statistic | Df | Sig. |
| Food Quality Pre | ,221 | 10 | **,181** | ,890 | 10 | ,168 |
| Food Quality Post | ,215 | 10 | **.200***  | ,907 | 10 | ,259 |

Table 8. illustrates that the p-value (Sig.) in the Kolmogorov-Smirnov normality test is > alpha 5%, indicating that the data of Food Quality pre- and post-pandemic is usually distributed.

Table 13. Paired Samples T-Test Result of Food Quality Pre and Post Pandemic

| | Paired Differences | | | | | t | df | Sig. (2-tailed) |
|---|---|---|---|---|---|---|---|---|
| | Mean | Std. Deviation | Std. Error Mean | 95% Confidence Interval of the Difference | | | | |
| | | | | Lower | Upper | | | |
| Food Quality Pre – Food Quality Post | -2,53900 | 3,16789 | 1,00177 | -4,80517 | -,27283 | -2,535 | 9 | **,032** |

Further analysis was conducted by considering these three aspects. Data testing on all three aspects also yielded the same result: a normal distribution. This is evidenced by the Kolmogorov-Smirnov test results showing p-values > alpha 5%. However, the three aspects yielded different results in the paired sample t-test.

In terms of food availability, the paired sample t-test results showed no significant difference in availability index between before and after the pandemic. The same trend was observed for food accessibility, where the paired sample t-test results indicated no significant difference in accessibility index between before and after the pandemic. Both results were supported by p-values > alpha 5%. In paired sample t-test, if the p-value is > alpha 5%, then the conclusion is that there is not enough evidence to show a significant difference between before and after the Covid-19 pandemic. However, regarding food quality, the paired sample t-test results showed a significant difference in quality index between before and after the pandemic, supported by a p-value of (0.032) < alpha 5%.

The research findings indicate a significant difference between before and after the pandemic in the food security index of districts and cities in Bengkulu Province. This is supported by both descriptive analysis and paired sample t-test results. However, a deeper analysis of food availability and accessibility yielded different results.

**CONCLUSION**

Our investigation concludes that There is a difference in the food security index before and after the COVID-19 pandemic. Based on the descriptive analysis results, the food Security Index in some districts increased steadily throughout the period, but others fluctuated. Some districts experiencing fluctuations include Rejang Lebong, Seluma, and Mukomuko. The Food Security Index of other districts, including Bengkulu City, tends to increase. Only the Food Security Index of Kepahiang and Bengkulu Tengah districts shows a tendency to decrease.

The results of the paired sample t-test indicate a significant difference in the food security index among districts and cities in

Bengkulu Province between before and after the pandemic. This is evidenced by a p-value of 0.005, less than the alpha level of 5%. This finding aligns with the descriptive analysis results from the Food Security Index table previously examined, which shows a difference in the food security index among districts and cities in Bengkulu Province.

Further analysis was conducted by considering these three aspects. However, the three aspects yielded different results in the paired sample t-test. In terms of food availability, the paired sample t-test results showed no significant difference in availability index between before and after the pandemic. The same trend was observed for food accessibility, where the paired sample t-test results indicated no significant difference in accessibility index between before and after the pandemic. However, regarding food quality, the paired sample t-test results showed a significant difference in quality index between before and after the pandemic, supported by a p-value of (0.032) < alpha 5%.

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