



# Dynamics of household food security pre and post the COVID-19 pandemic in Bengkulu Province, Indonesia

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## ABSTRACT

After the COVID-19 pandemic, there have been changes in the Food Security Index in Bengkulu Province. One of the main challenges in supporting food security at the household level is the development of community capacity and self-reliance in addressing food issues. Information is needed factors that affect household food security in Bengkulu Province, including the impact of the COVID-19 pandemic. This research aims to analyze the factors that influencing household food security and understanding the dynamics before and after the COVID-19 pandemic regarding household food security in Bengkulu Province. This research can provide a basis for policy-making for the Government of Bengkulu Province. The analytical method used is multinomial logistic regression to identify the factors affecting household food security. The results of analysis show that influencing household food security include pre- and post-pandemic, home ownership status, lighting type, recipients of the Family Hope Program (PKH), adequate sanitation, and average household expenditure. There has been a decrease in energy consumption in self-owned households and households not receiving PKH after the COVID-19 pandemic. Significant changes also occurred in households with non-PLN lighting. Households with inadequate sanitation tend to be food insecure. The pandemic tends have a higher expenditures of household.

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## INTRODUCTION

The World Health Organization defines three main components of food security, namely food availability, food access and food utilization. Food availability is the ability to have sufficient food for basic needs. Food access is the ability to have the resources, economically and physically, to obtain nutritious food. Food utilization is the ability to use food ingredients correctly and proportionally. Conditions of food insecurity are often associated with the emergence of various problems. Failure to access nutritious food will

cause nutritional problems such as malnutrition in children under five (Hackett et al., 2009; Motbainor et al., 2015). Additionally, food insecurity is associated with the incidence of obesity in women (Franklin et al., 2011; Pan et al., 2012) and chronic diseases (Seligman et al., 2010; Gowda et al., 2012). Food insecurity is also linked to risky sexual behavior (Vogenthaler et al., 2013), anxiety and depression, as well as risky coping strategies and poor pregnancy outcomes in women (Ivers & Cullen, 2011). Moreover, food insecurity can have broader social impacts such as impaired mental

development in children (Rose-Jacobs et al., 2008; Slopen et al., 2010).

Food security index of Bengkulu Province underwent changes before and after the COVID-19 pandemic. The decline in the food security index was observed in Rejang Lebong Regency, Central Bengkulu, Kepahiang, with the most severe decline occurring in North Bengkulu Regency.

One indicator of food access is the percentage of population living in poverty. According to BPS data from 2018 to 2022, Bengkulu Province ranks second highest in terms of the number of people living below the poverty line among Sumatra's Provinces and second only to Aceh Province. This is illustrated in Figure 1, which depicts a decrease in the percentage of impoverished individuals in Bengkulu Province from 2018 to 2022, albeit it still holds the second-highest position in Sumatra with rate of 14.34% in second semester of 2022. This figure remains significantly higher than the national average of 9.57%. The percentage of impoverished individuals in Bengkulu Province increased in first and second semester of 2020. In second semester of 2019, the percentage of poverty rate in Bengkulu Province was 14.91% which then rose to 15.03% in first semester of 2020. The percentage increased again in second semester of 2020 to 15.30%, coinciding with the onset of the COVID-19 pandemic in Indonesia. However, the percentage of impoverished individuals in Bengkulu Province began to decline in first semester of 2021 and continued to decrease until second semester of 2022. The data on the number of impoverished individuals indicate that the COVID-19 pandemic has indeed impacted to poverty rate in Bengkulu Province.

Table 1. Presentation of the Impoverished Individuals in Sumatra, 2018-2022

Province	2018	2019	2020	2021	2022
	..... % .....				
Aceh	15.83	15.17	15.21	15.43	14.70
Sumatera Utara	9.08	8.73	8.95	8.75	8.38
Sumatera Barat	6.60	6.36	6.42	6.34	5.98
Riau	7.30	6.99	6.93	7.06	6.81
Jambi	7.89	7.56	7.78	7.88	7.66
Sumatera Selatan	12.81	12.64	12.82	12.82	11.93
Bengkulu	15.42	15.07	15.17	14.83	14.48
Lampung	13.08	12.46	12.55	12.15	11.51
Kep. Bangka Belitung	5.01	4.56	4.71	4.79	4.53
Kep. Riau	6.02	5.85	6.03	5.94	6.14
Indonesia	9.74	9.32	9.99	9.93	9.56

The primary challenge in advancing food security at the household level is the need to enhance

community capacity and self-reliance in addressing food-related issues both within homes and across communities. Individuals with lower incomes are more susceptible to experiencing food insecurity due to limited purchasing power, restricted access to food, and insufficient resources initiate small and micro businesses. The Independent Food Village Program, initiated by the Food Security Agency of the Ministry of Agriculture, is a government initiative aimed at alleviating food insecurity and poverty. This program aims to empower rural communities by enhancing their capacity to establish profitable businesses utilizing local resources. By bolstering food availability, increasing people's purchasing power, and facilitating access to nutritionally adequate food, the program seeks to mitigate food insecurity dan poverty within this community.

Conceptually, food security is multifaceted issue that encompasses four main domains: availability, accessibility, utilization, and stability. Moreover, it operates at various hierarchical levels, including the macro level (global, regional, national), community (province, district), and micro level (household and individual) (Purwaningsih, 2008; Pinsturp-Andersen, 2009; Adriani & Wirtjatmadi, 2012; Jones et al., 2013). At the macro level, food availability alone does not ensure optimal individual nutritional status (Barrett, 2010). While an area may have sufficient quantities of food available, it may not be accessible to every household. Therefore, the household plays a pivotal role in ensuring access to food of adequate quantity and quality for each member.

The ratio of net availability per capita to normative consumption serves as an indicator of food availability. FAO (2006) emphasizes that food security in households cannot guaranteed solely by food availability on a national and global scale. Regional food security is essential for achieving food security at the household level, although Lantarsih et al. (2011) argue that it does not necessarily ensure household food security formation.

Indicators of the food access subsystem are the percentage of people living in poverty, the percentage of households spends more than 65% of their total consumption on food, and the percentage of households lacking access to electricity. Income plays a significant role in determining household expenditure, particularly food consumption patterns. As income rises, consumption patterns tend to diversify, leading to an increase in the consumption of

food nutritious foods (Yudaningrum, 2011). In impoverished households, food expenditure typically exceeds non-food expenditure, impacting nutritional intake and household food security. The nutritional content of consumed food directly influences consumption level. Higher nutritional value, such as energy and protein content, corresponds to increased consumption level. A village cannot be deemed self-sufficient if resilience issues persist, as evidenced by stagnant income and welfare levels (Purwaningsih, 2008).

The connection between current income (disposable income) and current consumption is explained by Keynes's consumption theory in his book "The General Theory of Employment, Interest, and Money". In essence, the income individuals possessed at a given moment influences the level of consumption they engage in during that period. Consumption tends to increase or decrease in line with income fluctuation (Pujoharso, 2013).

Differences in income levels lead to income distribution pattern, which in turn affect patterns of household consumption. Individuals with limited financial resources tend to prioritize meeting their food needs, allocating a significant portion of their income to food expenditures. The degree of social welfare increases with a decreasing share of expenditure on food (Ariani et al., 2007).

In Indonesia, rice stands out as the most consumed energy source among the population, while most non-rice energy comes from cassava (Yudaningrum, 2011). The main discrepancy in food consumption lies in the consumption pattern between rural and urban communities.

Indicators of the food utilization subsystem encompass the percentage of households lacking access to clean water, the average number of years of schooling for women aged 15 years and older, the ratio of population per health worker to population density, life expectancy, and the percentage of toddlers experiencing stunting (Yuliantini et al., 2022). According to Yuliantini et al. (2022), consistent risk factors for stunting among children in coastal areas include family socio-economic status (such as family income), maternal education, low birth weight, premature birth, non-exclusive breastfeeding, birth time, as well as macronutrient and micronutrient deficiencies. These factors collectively contribute to the complexity of stunting risk. In coastal areas, according to Sukiyono et al. (2015), Fishermen's and

farmers' demands also set limits on food security. Consequently, food types are categorized based on their essentiality for carrying out tasks. Vegetables, side dishes, and staple foods are among the types of food that must be readily available, as discussed in the preceding section. Depending on the farming and fishing community, different key indicators may be utilized to determine these limits. The sustainability of healthy eating patterns, entrenched in social institutions and capable of individual development, is another crucial indicator to consider. Furthermore, whether the household has borrowed money for basic necessities determines the presence of food insecurity.

Therefore, there is a need for information about food security in Bengkulu Province, both in general and the factors that influence it, including the impact of the COVID-19 pandemic. The aim of this research is to identify the variables influencing household food security in Bengkulu Province and to understand the dynamics pre and post the COVID-19 pandemic on household food security.

## RESEARCH METHOD

This research uses descriptive research, both incorporating quantitative and explanatory methodologies. Quantitative research is research that focuses on numerical data and is processed using statistical methods. Explanatory research is research that is used to reflect the level of delves into the depth of analysis of research data, which aims to find the uncover connections between a certain specific phenomenon and economic conditions. This research will more specifically analyze the measurement of household food security in Bengkulu Province in 2022.

Due to this research aims to look at dynamics and the response variable is a categorical data type, the appropriate method is multinomial logistic regression (Agresti, 2012). The first initial step is to involve calculating and categorizing the response variable, namely household food security, using an expenditure approach (Maxwell et al., 2000). This response variable is measured based on the proportion of food expenditure and level of energy consumption. The proportion of food expenditure is the proportion between determined by dividing household food expenditure to by total household expenditure, which can be calculated using the following formula:

$$PF = \frac{PP}{TP} \times 100$$

The Proportion of Food Expenditure (PF) is calculated based on by dividing PP divided by TP and then multiplied by 100%. PP means Household Food Expenditures (Rp/Month) and TP means Total Household Expenditures (Rp/Month) (Ilham and Sinaga, 2008). Energy consumption levels or food consumption levels are calculated from the volume of food consumed and the consumption of nutrients contained in food using the formula:

$$TKE = \frac{(\Sigma \text{Energy Consumption})}{(\text{Recommended AKE})} \times 100\%$$

The Energy Consumption Rate (%) or TKE is calculated based on by dividing  $\Sigma$ Energy Consumption divided by recommended AKE and then multiplied by 100%.  $\Sigma$  Energy Consumption means Total Energy Consumption (kcal/capita/day) and Recommended AKE means Recommended Energy Adequacy Rate (kcal/capita/day). To measure the degree of food security at the household level, a cross-classification of these two indicators is used and can be seen in the table below.

Table 2. Measuring the Degree of Household Food Security

Energy Consumption	Proportion of Food Expenditure (Proportion of Food Expenditures to Total Expenditures)	
	Low (<60% Total Expenditures)	High (≥60% Total Expenditures)
Sufficiently (>80% recommended energy consumption)	I (Food Security)	II (Food Vulnerable)
Less (≤80% recommended energy consumption)	III (Lack of Food)	IV (Food Insecurity)

In the table provided, the response variable, household food security, represents ordinal data with four categories, each defined as follows:

Food security, this category appertains to households where the proportion of food expenditure is less than 60% of total expenditure and the level of energy consumption exceeds 80% of the recommended Energy Adequacy Rate (sufficient). Households in this category have adequate access to food and their food needs are met satisfactorily.

Food vulnerable, household failing into category have a proportion of food expenditure is greater than or equal to 60% of total expenditure, while theirthe level of energy consumption is surpasses 80% of the recommended Energy Adequacy Figure (sufficient). Despite having access to food, these household prioritize food needs in their expenditure, ensuring adequate energy consumption.

Lack of food, this category describes where the proportion of food expenditure is less than 60% of total expenditure and the level of energy consumption is less than or equal to 80% of the recommended Energy Adequacy Figure (less). These households prioritize non-food needs on their expenditure, resulting unsatisfied food needs.

Food insecurity, households categorized as food insecure have a proportion of food expenditure is greater than or equal to 60% of total expenditure, with the level of energy consumption being less than or equal to 80% of the recommended Energy Adequacy Rate (less). In this category, households lack adequate access to food and their food needs remain unmet.

The next stage involves multinomial logistic regression analysis to identify the factors influencing household food security. It is imperative to validate the model by testing whether the assumptions are met. The final stage aims to validate the model formed.

Multinomial logistic regression analysis is a regression technique when the response variable is categorical with more than two categories. The process typically involves several stages, outlined as follows: The independence test is carried out to determine whether there exists a relationship between each predictor variable and the response variable (Argesti, 2012). The chi-square test ( $\chi^2$ ) is commonly used for this purpose:

$$\chi^2 = \sum_{i=1}^a \sum_{j=1}^b \frac{(n_{ij} - m_{ij})^2}{m_{ij}}$$

$n_{ij}$  are observation value in row  $i$  column  $j$  and  $m_{ij}$  are expected value in row  $i$  column  $j$  with hypothesis  $H_0$  and  $H_1$ .  $H_0$  means "there is no relationship between household food security in Bengkulu Province and each of the factors that influence it" and  $H_1$  means "there is a relationship between household food security in Bengkulu Province and each of the factors that influence it".  $H_0$  rejection criteria: if  $\chi^2 > \chi^2_{\alpha}$ ,

(i-1)(j-1) or p-value <  $\alpha$  then  $H_0$  is rejected. or in other words, the model is deemed suitable for use.

Next, simultaneous testing is conducted to assess the collective influence of the predictor variables on the response variable (Agresti, 2012). Testing using the likelihood test with the following equation:

$$G^2 = -2 \ln \left[ \frac{\left(\frac{n_1}{n}\right)^{n_1} \left(\frac{n_2}{n}\right)^{n_2} \dots}{\prod_{j=1}^b \pi_1(x)^{y_{1j}} \pi_2(x)^{y_{2j}} \dots} \right]$$

The hypothesis used employed in this context are  $H_0$  and  $H_1$ .  $H_0$  means "there is no single factor that significantly influences household food security in Bengkulu Province" and  $H_1$  means "there is at least one factor that significantly influences household food security". The decision-making procedure entails rejecting  $H_0$  if  $\chi^2 > \chi^2_{0.05}$  or p-value <  $\alpha$ .

For partial testing to evaluate the influence of each the predictor variable on the response variable (Fargherland and Horner, 2012). The test statistics for partial testing utilize the Wald test, represented by the following equation:

$$W^2 = \frac{\beta_j^2}{SE(\beta_j^2)}$$

$SE(\beta_j^2)$  explains coefficient standard error and  $\beta_j^2$  is coefficient value of estimated predictor variable  $W_2$ . Determining the decision result, if the p-value <  $\alpha$  or  $W_2 > \chi^2_{(\alpha, v)}$  then reject  $H_0$ . Hypotheses for partial testing are  $H_0$  and  $H_1$ .  $H_0$  means  $\beta_j = 0$  and  $H_1$  means  $\beta_j \neq 0$ ,  $j = 1, 2, \dots, 13$ .

To assess the suitability of the multinomial logistic regression analysis, a model suitability test is conducted using Goodness of Fit. This test helps evaluate how well the predicted results align with the observed results. The Goodness of Fit can be represented by the following equation:

$$C = \sum_{i=1}^n \frac{(O_i - n_i \pi_i)^2}{n_i \pi_i (1 - \pi_i)}$$

There are several information of goodness of fit formula.  $O_i$  are Observations in the group-i.  $\pi_i$  means probability of observing the group-i and  $n_i$  are the number of observations in the group-i. Determining the decision result, if the p-value >  $\alpha$  or  $C > \chi^2_{(\alpha, v)}$  then Accept  $H_0$  and the model is suitable for use. Hypotheses for partial testing are the model feasible for  $H_0$  and unfeasible for  $H_1$ . If the model is found to be unfeasible, the best model can be selected using

the Stepwise method, which combines forward and backward methods (Idman et. al., 2022).

## RESULT AND DISCUSSION

### Characteristics of Respondents

Using secondary data from the National Socio-Economic Survey (SUSENAS) spanning from 2018 to 2022 and created by the Central Bureau of Statistics (BPS) of Bengkulu Province. This data incorporates individual, household and community data at the provincial and district/city levels. This research uses the assumption that the COVID-19 pandemic occurred in 2020 and the years 2018 and 2019 are considered pre-pandemic, while 2021 and 2022 are categorized as post-pandemic.

Table 3. Characteristics of Respondents

Variable	Frequency	Proportion %
Household Food Security		
Food Security	9504	43.5
Food Vulnerable	8168	37.4
Lack of Food	2640	12.1
Food Insecurity	1544	7.1
Pre-Post Pandemic		
Pre Pandemic	10367	47.4
Post Pandemic	11489	52.6
Home Ownership Status		
Private Property	18743	85.8
Contract/Rent	1174	5.4
Free Rent	1568	7.2
Official Residence	357	1.6
Others	14	.1
Type of Lighting		
PLN Metered	19671	90.0
PLN Non Metered	1681	7.7
Non PLN	249	1.1
Others	255	1.2
PKH		
Yes	3204	14.7
No	18652	85.3
Adequate Sanitation		
Yes	6439	29.5
No	15417	70.5
Average Household Expenditure	21856	100.0

### Statistical Significance

Based on the independence test, where the significance value less than  $\alpha$  (0.05) for all independent variables, we reject  $H_0$ . This suggests a relationship between household food security in Bengkulu Province and the six factors that influence it. Therefore, we can conclude that there is sufficient evidence to support the existence of a relationship between six factors and household food security in

Bengkulu Province at a significant level  $\alpha=0.05$ . The six factors are pre-post the pandemic, home ownership status, type of lighting, recipients of the Family Hope Program (PKH Program), adequate sanitation, and average household expenditure.

Table 4. Independence Test

Effect	Model Fitting Criteria	Likelihood Ratio Tests	
	-2 Log Likelihood of Reduced Model	Chi-Square	Sig.
Intercept	47595.920	0.000	
Average household expenditure	49848.328	2252.408	0.000
Pre-post the pandemic	47641.421	45.501	0.000
Home ownership status	47726.918	130.998	0.000
Type of lighting	47776.530	180.610	0.000
Recipients of the PKH Program	47872.611	276.691	0.000
Adequate sanitation	47632.605	36.685	0.000

Indeed, the results of simultaneous testing confirm the findings from the independence test where the significance value or p-value  $< \alpha$  (0.05). The conclusion is that there is at least one factor that significantly influences household food security.

Table 5. Simultaneous Test

Model	Model Fitting Criteria	Likelihood Ratio Tests		
	-2 Log Likelihood	Chi-Square	Df	Sig.
Intercept Only	51250.322			
Final	41952.863	9297.459	102	0.000

Table 6. Factors Affecting Household Food Security

Variable	Food Vulnerable		Lack of Food		Food Insecurity	
	Exp(B)	Sig.	Exp(B)	Sig.	Exp(B)	Sig.
Intercept		0.00		0.00		0.00
Average Household Expenditure	1.00	0.00	1.00	0.00	1.00	0.00
Pre-Post Pandemic=Pre Pandemic	0.89	0.00	0.78	0.00	0.76	0.00
Pre-Post Pandemic=Post Pandemic						
Home Ownership Status=Private Property	0.50	0.24	7356319.49	0.00	4735436.21	0.00
Home Ownership Status=Contract/Rent	0.38	0.10	13372938.10	0.00	6485496.48	0.00
Home Ownership Status=Rent Free	0.54	0.29	11048326.13	0.00	6067523.58	0.00
Home Ownership Status=Official Residence	0.37	0.10	8292894.05		3742802.16	
Home Ownership Status=Others						
Type of Lighting=PLN Metered	0.23	0.00	0.97	0.93	0.29	0.00
Type of Lighting=PLN Non Metered	0.39	0.00	1.02	0.95	0.40	0.00
Type of Lighting= Non PLN	0.46	0.00	0.47	0.11	0.34	0.01
Type of Lighting= Others						
PKH=Yes	1.87	0.00	1.77	0.00	2.74	0.00
PKH=No						
Adequate Sanitation=Yes	0.82	0.00	1.04	0.39	0.92	0.26
Adequate Sanitation=No						

Based on the Interpretation of the odds ratio from the multinomial logistic regression analysis:

For the "food vulnerable" category: The odds of being classified as "food vulnerable" post-pandemic are approximately 1.12 times greater than pre-pandemic. For the "lack of food" category: The odds of experiencing "lack of food" post-pandemic are approximately 1.29 times greater than pre-pandemic. For the "food insecurity" category: The odds of facing "food insecurity" post-pandemic are approximately 1.31 times greater than pre-pandemic.

These findings reinforce the conclusion drawn from both of the descriptive analysis and the multinomial logistic regression analysis, indicating that all the variables used have a significant effect on household food security at  $\alpha=0.05$ . However, if we refer to the model suitability requirements, the variables that have a significant effect on household food security at  $\alpha=0.05$  are pre post pandemic, home ownership status, type of lighting, recipients of the PKH Program, adequate sanitation, and average household expenditure.

The results of the model suitability test using the goodness of fit test showed a p-value of 0.141 ( $> \alpha=0.05$ ). We concluded that the model is suitable for use.

Table 7. Goodness-of-Fit

	Chi-Square	df	Sig.
Pearson	65836.577	65448	0.141
Deviance	47568.194	65448	1.000



### Factors Affecting Household Food Security

Analyzing the dynamics of household food security before and after the pandemic involves examining changes in six variables that have been identified as significant influencers on household food security.

Table 8. Household Food Security Pre and Post the Pandemic in Bengkulu Province

Household Food Security	Pre	Post	Shift
	..... % .....		
Food Security	44.67	42.41	-2.26
Food Vulnerable	37.53	37.23	-0.31
Lack of Food	10.98	13.07	2.10
Food Insecurity	6.82	7.29	0.47
Total	100.00	100.00	

Table 9. Home Ownership Status on Household Food Security Pre and Post the Pandemic in Bengkulu Province

Home Ownership Status	Pre	Post	Shift
	..... % .....		
Private Property			
Food Security	45.42	43.16	-2.27
Food Vulnerable	37.64	37.57	-0.08
Lack of Food	10.29	12.33	2.04
Food Insecurity	6.64	6.94	0.30
Contract/Rent			
Food Security	47.42	33.46	-13.96
Food Vulnerable	27.70	31.96	4.26
Lack of Food	17.06	23.18	6.12
Food Insecurity	7.82	11.40	3.58
Rent Free			
Food Security	32.98	36.87	3.90
Food Vulnerable	44.46	37.73	-6.73
Lack of Food	13.62	16.12	2.50
Food Insecurity	8.95	9.28	0.33
Official Residence			
Food Security	47.09	52.97	5.88
Food Vulnerable	36.63	31.89	-4.74
Lack of Food	12.79	10.27	-2.52
Food Insecurity	3.49	4.86	1.38
Others			
Food Security	42.86		
Food Vulnerable	57.14		
Total	100.00	100.00	100.00

The analysis indicates changes in the proportion of household food security before and after the pandemic (Table 8). The proportion of food security and food vulnerable group decreased by 2.26% and 0.31%, while lack of food and food insecurity increased by 2.1% and 0.47%. Furthermore, the analysis indicates a decline in the level of energy consumption after the COVID-19 pandemic across all expenditure categories, whether dominated by food or non-food expenditure.

The proportion of household food security based on home ownership status has changed before and after the pandemic. In households with private property status, both the proportion of food security and food vulnerable category have decreased, while lack of food and food insecurity have increased. It can be concluded that there has been a decrease in the level of energy consumption after the COVID-19 pandemic in whether dominated by food or non-food expenditure. The pandemic has had more significant impact on households with contract or rent housing status, where the proportion of food security category has decreased by 13%, while the proportion of food vulnerable, lack of food, and food insecurity category have all increased (Table 9).

Table 10. Type of Lighting on Household Food Security Pre and Post the Pandemic in Bengkulu Province

Type of Lighting	Pre	Post	Shift
	..... % .....		
PLN Metered			
Food Security	47.44	43.49	-3.95
Food Vulnerable	34.90	36.21	1.31
Lack of Food	11.27	13.35	2.08
Food Insecurity	6.39	6.95	0.56
PLN Non Metered			
Food Security	28.25	28.41	0.16
Food Vulnerable	51.86	49.37	-2.49
Lack of Food	10.62	10.55	-0.07
Food Insecurity	9.28	11.67	2.40
Non PLN			
Food Security	29.78	50.70	20.93
Food Vulnerable	59.55	36.62	-22.93
Lack of Food	3.93	8.45	4.52
Food Insecurity	6.74	4.23	-2.52
Others			
Food Security	9.73	12.86	3.13
Food Vulnerable	69.73	68.57	-1.16
Lack of Food	5.41	1.43	-3.98
Food Insecurity	15.14	17.14	2.01
Total	100.00	100.00	100.00

The proportion of household food security depending on the type of lighting has changed before and after the pandemic (Table 10). In households with PLN metered lighting, the proportion of food security categories has decreased, while the proportion of food vulnerability, lack of food and food insecurity have increased. Conversely, households with types of lighting other than PLN metered where the proportion of the food security category has increased while the proportion of the food vulnerable has decreased. Significant changes occurred in households with non-PLN lighting types, where the proportion of food

security increased significantly by 20.93% and the proportion of food vulnerable decreased significantly by 22.93%. This shows that households with sufficient energy consumption per capita have experienced a shift from previously being dominated by food expenditure to being dominated by non-food expenditure.

Table 11. Recipients of PKH Program on Household Food Security Pre and Post the Pandemic in Bengkulu Province

PKH Program	Pre	Post	Shift
	..... % .....		
Recipients			
Food Security	26.26	27.65	1.40
Food Vulnerable	48.46	46.56	-1.91
Lack of Food	12.57	14.50	1.93
Food Insecurity	12.71	11.29	-1.42
Non Recipients			
Food Security	47.62	45.11	-2.52
Food Vulnerable	35.78	35.53	-0.26
Lack of Food	10.72	12.81	2.09
Food Insecurity	5.88	6.56	0.68
Total	100.00	100.00	0.00

Table 12. Adequate Sanitation on Pre and Post the Pandemic in Bengkulu Province

Sanitation Condition	Pre	Post	Shift
	..... % .....		
Adequate			
Food Security	50.92	45.83	-5.09
Food Vulnerable	33.89	34.37	0.48
Lack of Food	10.93	13.35	2.43
Food Insecurity	4.27	6.45	2.18
Non Adequate			
Food Security	42.07	40.61	-1.46
Food Vulnerable	39.05	38.74	-0.31
Lack of Food	11.00	12.93	1.93
Food Insecurity	7.88	7.73	-0.16
Total	100.00	100.00	100.00

The proportion of food security and lack of food among PKH program recipient households has increased, while food vulnerability and food insecurity have decreased after the pandemic (Table 11). This suggest an increase in households where non-food expenditure dominantes across all levels of energy consumption per capita.

The proportion of food security and food vulnerable in households that do not receive PKH Program has decreased, while the proportion of lack of food and food insecurity have increased after the pandemic. This indicates a decrease in the level of energy consumption after the COVID-19 pandemic in all expenditure percentages, both dominated by food

and non-food expenditure among households that do not receive PKH Program.

The proportion of food security in households with inadequate sanitation decreased by 5.09% (Table 12). Conversely, the proportion of food vulnerable, lack of food, and food insecurity increased respectively by 0,48%; 2,43%; 2,18%. The proportion of food security in households with adequate sanitation decreased 1,46% but not significant as in households with inadequate sanitation.

Table 13. Average Household Expenditure on Pre and Post the Pandemic in Bengkulu Province

Average Household Expenditure	Pre	Post	Shift
	..... % .....		
0-2 millions			
Food Security	26.96	27.95	0.99
Food Vulnerable	46.16	43.88	-2.28
Lack of Food	13.55	14.29	0.74
Food Insecurity	13.32	13.87	0.55
2-3 millions			
Food Security	32.02	31.29	-0.72
Food Vulnerable	47.46	43.64	-3.82
Lack of Food	11.67	14.15	2.48
Food Insecurity	8.85	10.92	2.07
3-4 millions			
Food Security	43.40	38.36	-5.04
Food Vulnerable	40.62	41.38	0.76
Lack of Food	10.15	13.67	3.52
Food Insecurity	5.82	6.59	0.77
4-8 millions			
Food Security	62.81	54.73	-8.08
Food Vulnerable	25.70	31.34	5.63
Lack of Food	9.77	11.35	1.57
Food Insecurity	1.71	2.59	0.88
>8 millions			
Food Security	86.62	79.02	-7.60
Food Vulnerable	6.35	8.97	2.62
Lack of Food	7.03	11.74	4.71
Food Insecurity	0.00	0.26	0.26
Total	100.00	100.00	100.00

The table data indicate that the higher the expenditure, may have experienced greater economic disruption due to the pandemic. This is in line with the increasingly high decline in the proportion of food security. On the other hand, lower-income households may have been less affected to other categories of household food security (Table 13).

The dynamics observed before and after the pandemic in the criteria (independent variable) for household food security reveal several significant tends. In households with private property status and households that did not receive the PKH Program experienced a decrease in energy consumption levels



after the COVID-19 pandemic. Significant changes occurred in households with non-PLN lighting types, where the proportion of food security increased significantly by 20.93% and the proportion of food vulnerable decreased significantly by 22.93%. This indicates that households with sufficient energy consumption per capita transitioning from food expenditure dominance to non-food expenditure dominance. Households with inadequate sanitation tended not to be food secure because after the pandemic the proportion of food secure decreased and other categories increased. The impact of the pandemic appears to be higher on household expenditure level, as indicated by the increasingly high decline in the proportion of food security. Conversely, other categories of household food security may have experienced different dynamics or lesser impacts.

### Research Implication

Since everything in today's globalized world is interconnected, globalization makes people more susceptible to pandemics like COVID-19. The steady rise in human population, which raises the demand for food supplies, the percentage of the population living in cities, and the consumption of meat are other factors that make people more vulnerable to pandemics in the future. Low food stocks in homes and minimal or nonexistent agricultural self-supply are associated with modern living. The aforementioned facts highlight how crucial it is for food systems to be resilient and resistant to disturbances brought on by pandemics (Roubík et al., 2022).

COVID-19 disrupted food system, and the effects of lockdowns on household earnings and physical access to food, food security have compromised both directly and indirectly. Concerns about both physical and financial access to food are given more weight by the four pillars method (availability, access, utilization, and stability); the latter may be especially significant in settings where there are physical barriers to movement and at outdoor markets. In contrast, the food systems approach highlights the basic interdependence of every component of the food value chain, shedding light on how disruptions to one area of the system impact other areas. The entitlement approach breaks down and fine-tunes the demand-side factors influencing household food availability and emphasizes the significance of specific mechanisms like social capital and informal transfers that the other two frameworks do not adequately address. However,

it ignores supply-side issues more often. Therefore, utilizing the advantages of each strategy rather than favoring one over the others will improve knowledge of the pandemic's effects on food security as well as the most effective ways to address them (Devereux et al., 2020).

Some evidences such as in Canada and US. COVID-19 pandemic has greater impacts on the food security and Global Food Supply Chain (GFSC) due to disruption of the food supply chain leading to increase food insecurity. The pandemic has affected the GFSC in several ways, including a weak economy, a lack of farm workers, restrictions on food accessibility, limitations on the transportation of agricultural commodities, shifts in consumer demand, the closure of food production facilities, uncertainty about the quality and safety of food, restrictions on food trade policies, delays in the transportation of food products, etc. (Alabi & Ngwenyama, 2021).

In Indonesia, both rural and urban areas can be taken into account when discussing food security. According to study by Kharisma and Abe (2020), 27,4% of Indonesians living in urban areas felt insecure prior to the pandemic's arrival; this number has surely increased as a result of the epidemic. According to Anderson et al. (2013), Indonesia's self-sufficiency was 0,95 in 2004. By 2030, it is expected to have decreased to 0,83. Indonesia is struggle to meet expectations for self-sufficiency under normal circumstances, and this incapacity is increased under COVID-19 settings. In order to meet domestic demand and meet its food security needs, Indonesia continued to import food, particularly rice, from outside. According to Greenville et al. (2020), food exports should be discontinued in order to concentrate on meeting domestic food demand in a nation like Indonesia that is not self-sufficient.

Indonesia has been severely damaged by the COVID-19 pandemic. Farmers are facing significant challenges due to the increase in input prices during the pandemic. The Indonesian Ministry of Agriculture has released several strategies in response to COVID-19, with a primary focus on ensuring access to food for all citizens. Both long-term and emergency techniques are applicable to Indonesia. Food prices can be managed, food distribution during lockdown (PSBB) can be regulated, food waste awareness can be raised, farmers can be paid or given subsidies, unsold agricultural products can be purchased, food imports can be minimized, the BULOG can be

maximized in its ability to release food stock, and dietary awareness can boost immunity (Rozaki, 2020).

However, Indonesia continues to grapple with traditional agricultural challenges related to inputs, labor, land-use change, etc. Indonesia ought to put more effort into encouraging young people to pursue careers in agriculture, integrate agriculture to boost farmers' incomes, and boosting agricultural intensification for its limited farmland. Dependence on imports poses risks for future issues. Another problem arises from focusing too much on rice as the primary commodity for achieving food security. More regulation and initiatives are required to advance the food diversification program (Rozaki, 2021).

More specifically, this research indicates that COVID-19 also affected on household food security in Bengkulu Province. Besides the pandemic's impact, five variables were found that have a significant influence on household food security. These significant variables can serve as a policy basis for the Bengkulu Provincial Government. Strategies that can be implemented to enhance food security include increasing home ownership, increasing the use of PLN meters, optimizing the PKH Program, improving proper sanitation facilities, and improving the economy of the people of Bengkulu Province.

## CONCLUSION AND SUGGESTION

The research findings on household food security in Bengkulu Province reveal a negative trend from 2018 to 2022 where the percentage of the food secure and food vulnerable categories decrease and the lack of food and food insecure categories have increased. Moreover, the results of multinomial logistic regression analysis highlight several variables significantly impacting on household food security. These include the pre-post pandemic, home ownership status, type of lighting, recipients of the PKH Program, adequate sanitation, and household average expenditure. Interpretation of the odds ratio from the multinomial logistic regression analysis: For the "food vulnerable" category: The odds of being classified as "food vulnerable" post-pandemic are approximately 1.12 times greater than pre-pandemic. For the "lack of food" category: The odds of experiencing "lack of food" post-pandemic are approximately 1.29 times greater than pre-pandemic. For the "food insecurity" category: The odds of facing "food insecurity" post-pandemic are approximately 1.31 times greater than pre-pandemic.

The proportion of food security in households with inadequate sanitation decreased by 5.09%. Conversely, the proportion of food vulnerable, lack of food, and food insecurity increased respectively by 0,48%; 2,43%; 2,18%. The proportion of food security in households with adequate sanitation decreased 1,46% but not significant as in households with inadequate sanitation.

The pandemic has exerted a greater impact on households with contract or rent housing status, where the proportion of food security category has decreased by 13%, while the categories of food vulnerable, lack of food, and food insecurity have increased. Moreover, there has been a decrease in energy consumption levels in self-owned households and households that did not receive PKH Program after the COVID-19 pandemic. Significant changes occurred in households with non-PLN lighting types. Households with inadequate sanitation are more likely to experience food insecurity. The impact of the pandemic tends to be higher on household expenditure levels. It is recommended that further research be conducted to thoroughly assess the extent to which the pandemic has affected household food security and to identify effective strategies for addressing any shortcomings. Nevertheless, the Bengkulu Provincial Government can utilize these important findings as a foundation for policy development. Optimizing the PKH Program, promoting homeownership, increasing the user of PLN meters, improving sanitation facilities, and fostering economic growth among the residents of Bengkulu Province are among the strategies that can be implemented based on these key elements.

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