



# Food Security in Aceh, North Sumatera, Riau, and South Sumatera

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**Abstract.** Food security is a condition that must be achieved by every region in any part of the world because this condition will help people to live better, healthier, and more productive. This study aims to determine the factors that increase the probability of achieving food security. The secondary data comes from the publications of the Food Security Agency and the Central Statistics Agency in 2020 and 2021. The observation areas are districts and cities in Aceh, North Sumatra, Riau, and South Sumatra. The analytical tool used is binary logit regression with a value of zero for food insecure and one for food secure. The results obtained, the variable amount of rice production and HDI could improve food security conditions, and the number of poor people could increase food insecurity.

**Keywords:** Food security · Sumatera · Logit

## 1 Introduction

Food security is one of the goals of Sustainable Development Goals (SDGs), namely realizing zero hunger. The achievement is related to the achievement of other goals, namely the reduction of poverty and inequality. Food security is one of the mandatory requirements that must be filled because it is related to human development [1]. Food adequacy conditions will help children grow and develop and reduce the risk of mental disorders. Increased knowledge of food sources and processing will help parents produce nutritious menu variations [2].

When the food security process was still running, Indonesia was hit by the Covid-19 pandemic at the end of 2019. The impacts that occurred included an economic slowdown, decreased purchasing power, and increased unemployment and poverty. It is not only in Indonesia but also in other countries [3]. The impact of the Covid-19 pandemic on food security is quite bad, including disruption of food distribution, increased transaction costs, decreased household purchasing power, increased food prices, and changes in household consumption patterns [4].

The Food Security Agency of the Indonesian Ministry of Agriculture determines the method of calculating food security for districts and cities. This method is different from the method of calculating food security [5–7] because the data used is secondary

**Table 1.** Percentage of Districts and Cities in Selected Provinces in 2020 and 2021 with Food Status

Provinces	Priority 1 to 4		Priority 5 and 6	
	District	City	District	City
Year 2020				
Aceh	12	20	88	80
North Sumatera	16	34	84	76
Riau	80	0	20	100
South Sumatera	15	50	85	50
Year 2021				
Aceh	17	20	83	80
North Sumatera	24	37	76	63
Riau	70	0	30	100
South Sumatera	15	75	85	25

<sup>a</sup> Source: The Food Security Agency [1, 2].

<sup>b</sup> Note: Priority 1 to 4 = food insecure; Priority 5 and 6 = food secure.

data that has been adjusted for availability at the district and city levels. Secondary data makes it easier for researchers to get information more quickly and efficiently but has drawbacks in more macro analysis.

Almost all provinces in Indonesia experience food insecurity problems. The study will take Sumatra Island because several provinces have varying conditions. Aceh, North Sumatera, Riau, and South Sumatera are the observation areas with these conditions (Table 1).

Districts in the four observation areas have variations in food security status or priority, from 1 for food insecure to 6 for food secure. Some districts and cities in Riau have opposite conditions, most of the districts are in priorities 1 to 4 (high risk for food insecurity) meanwhile all cities are priority 5 and 6 (food secure). This condition is different from Aceh, North Sumatera, and South Sumatera.

Food security measured by various indicators, one of which is the Core Food Security Module (CFSM) developed by the U.S. Department of Agriculture (USDA) [6]. This method uses 18 questions to measure diminished household food resources, force economizing in food spending, further diminished resources, managing insufficient resources, and severe hunger. The category of food security using the CFSM method divided into food secure with a score of less than 0–2, food insecure level 1 with a score of 3–7, food insecure level 2 with a score of 8–12, and food insecure level 3 with a score of 13–18 [7].

Jonsson and Toole (1991) stated that a household declared food secure if food consumption has met at least 80 percent of caloric adequacy and obtained through the proportion of expenditure on food below 50–60 percent. Furthermore, the availability of food at the household level is determined by many things, such as the livelihood of

**Table 2.** Food Security Indicator

<b>Indicator</b>		<b>Unit</b>
Food availability	Normative consumption per capita on net production of rice, corn, sweet potatoes, cassava, and local government rice stocks	Ratio
Food affordability	People living below the poverty line	Percent
	Household with food expenditure proportions more than 65 percent of total expenditure	Percent
	Household without access to electricity	Percent
Food use	Household without access to clean water	percent
	Life expectancy at birth	Years
	The average length of schooling for girls over 15 years	Years
	Number of population per health worker to population density	Ratio
	Stunting	Percent

<sup>a</sup> Source: The Food Security Agency [1, 2]

the majority in the neighborhood, health condition and job status of the breadwinner, price of food, and calorie adequacy rate which is differentiated by gender, occupation, and regional origin of the head of the family [5].

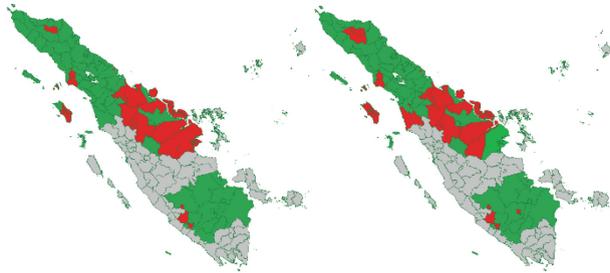
Determination of food security can also use another method, namely the time approach. Chronic food insecurity will be experienced by households when the minimum amount of food needed for a healthy life cannot be achieved for more than three months. Transitory food insecurity occurs when the minimum food requirements for a healthy life cannot be reached for less than three months. Households are food secure if they are free from chronic and transitory [10].

This study uses an approach made by the Food Security Agency of the Indonesian Ministry of Agriculture for food security in districts and cities with the following details (Table 2).

The topic of food security becomes interesting to study because the factors that cause it can be very many and can be different for each observation area. It happens because each region has diverse natural characteristics and resources. Based on the background that has been described, this study aims to determine the factors that can increase the probability of food security with choices in 2020 and 2021. The things to consider when choosing are the availability of data from the Food Security Agency and the presence of Covid-19.

## 2 Method

The research areas are districts and cities in the provinces of Aceh, North Sumatra, Riau, and South Sumatra by considering several things. Those provinces are located on the island of Sumatra, which is the western part of Indonesia and the second largest GRDP contributor after Java [11]. In addition, the research area has districts and cities classified



**Fig. 1.** 2020 (Left) and 2021 (right)

as food secure and food insecure [9]. The research years used are 2021 and 2020 because of the availability of data and the remaining COVID-19.

The food security data used the calculation method from the Food Security Agency of the Indonesian Ministry of Agriculture. The indicators are food availability, food affordability, and food use. The composite indicator value will produce six priority groups related to the condition of food security status. The six priority levels will be grouped into 'food secure' and 'food insecure.' The first group consists of priority levels 5 and 6, while the second group consists of priorities 1 to 4. Food secure will be worth one then food insecure will be worth zero. The binary logistic regression equation used is as follows.

$$FS_i = \beta_0 + \beta_1 Padi_i + \beta_2 Poverty_i + \beta_3 HDI_i + \beta_4 Density_i + \varepsilon_i$$

Food security or FS is worth 1 if the condition of the observation area is food secure, and 0 if the observation area is food insecure. Padi is the volume of rice production in an area in tons. Poverty is the number of poor people in a certain area with units of thousands of people. HDI is a human development index that is formed from the dimensions of long life and healthy life, knowledge, and a decent standard of living. This index describes how the population can access development outcomes [12]. Density is the population density for each square kilometer outside the area.

### 3 Result

The number of districts and cities studied for 2020 and 2021 is the same, namely as many as 85 regions, but there have been some changes related to food security (Fig. 1).

The red color indicates food insecurity, and the green color indicates food security conditions. The level of food security in the research area is not too different for 2020 and 2021. Most districts and cities have food security conditions, only a few have food insecure status, but the majority of food insecure areas are in Riau Province. These can be seen from the red distribution.

Table 3 provides information that there is a change in food status, the number of regions in food insecure status has increased. On the other hand, regions with food secures status have decreased. This condition might happen because there is a change in the function of agricultural land, a reduction in human resources willing to work in

**Table 3.** Changes in the Number of Districts and Cities

Condition	Frequency	
	2020	2021
Food insecure	21	25
Food secure	64	60

<sup>a</sup> Source: Author calculation, 2022

**Table 4.** Changes in Independet Variable

Variable	2020	2021
Padi	82.738,488	76.660,418
Poverty	43,097	44,620
HDI	70,551	70,816
Density	620,081	626,533

<sup>a</sup> Source: Author calculation, 2022

**Table 5.** Hosmer and Lemeshow Test

Step	Chi-square	Sig.
<b>2020</b>		
1	7,112	0,525
<b>2021</b>		
1	6,007	0,539

the sector, and the problem of poverty among farmers. The occurrence of the Covid 19 pandemic only exacerbated the situation but was not the cause [13].

Changes occurred not only in the value of the dependent variable but also in the value of the independent variable (Table 4).

The volume of rice production decreased in 2021 followed by a decrease in rice harvested area in each research area. Rice production should continue to increase along with the increase in population because it is the staple food for Indonesian. The decline in production will create scarcity in certain areas and cause dependence on other regions [9]. Another thing that has changed is the increasing number of poor people, one of the causes is the increase in the poverty line value [14, 15] (Table 5).

Hosmer and Lemeshow tests for food security in 2020 and 2021 provide information that the model formed in the study is feasible to be used in further analysis. It is known based on the value of Sig. Namely 0.525 and 0.539 which are greater than the value of 0.05 (Table 6).

**Table 6.** Determination

Step	2 Log likelihood	Cox&Snell R Square	Nagelkerke R Square
<b>2020</b>			
1	54,074	0,380	0,560
<b>2021</b>			
1	61,842	0,384	0,546

**Table 7.** Partial Test of Determinan factors

Variable	B	S.E	Wald	df	Sig.	Exp(B)
<b>2020</b>						
Padi	0,000***	0,000	12,298	1	0,000	1,000
Poverty	-0,034*	0,019	3,327	1	0,068	0,967
HDI	0,228**	0,101	5,164	1	0,023	1,257
Density	0,001	0,001	2,251	1	0,134	1,001
Constant	-16,356	7,045	5,391	1	0,020	0,000
<b>2021</b>						
Padi	0,000***	0,000	13,557	1	0,000	1,000
Poverty	-0,020	0,013	2,176	1	0,140	0,980
HDI	0,259***	0,099	6,801	1	0,009	1,296
Density	0,001	0,000	1,631	1	0,202	1,001
Constant	-19,182	7,232	7,231	1	0,007	0,000

<sup>a</sup> Note: \* significant on  $\alpha = 10$  percent; \*\* significant on  $\alpha = 5$  percent; \*\*\* significant on  $\alpha = 1$  percent

Determination analysis is seen from Nagelkerke's R Square, the value in that section provides information about the amount of variation of the independent variable that explains the dependent variable. The independent variable can explain the dependent variable in 2020 by 56 and 44 percent is explained by other variables outside the model. In 2021 the independent variable can explain the dependent variable by 54.6 percent and 45.4 percent is explained by other variables outside the model (Table 7).

This study has four independent variables to explain food security. In 2020, the population density variable is not statistically proven to increase the probability of creating food security. Statistically, the amount of rice production and the human development index will increase the probability of food security. Unfortunately, the role of rice production in the regression is the smallest. The number of poor people is the opposite the more the number, the greater the probability of food insecurity.

The role of independent variables in food security in 2021 is slightly different. The number of poor people is statistically not proven to play a role in food security even though the sign in the coefficient remains negative. HDI remains the most valuable variable in food security.

There are many dimensions in measuring HDI, including indicators for measuring income, community welfare, and the stock of human capital owned by an area. The higher the income the higher the welfare, the more food security is expected to be achieved. Then, the large amount of human capital in an area becomes an important factor for better economic growth. The HDI variable is also used to evaluate Indonesia's macroeconomic progress, so its progress needs the government's attention [16].

## 4 Conclusion

Food security can be obtained by paying attention to the staple product in this case, rice. To increase rice production, appropriate production inputs are also needed, such as the adequacy of agricultural land. Furthermore, a better human development index can also help improve food security. Another finding is that poverty will exacerbate food vulnerability. It is recommended for further research to use more variables because there are many factors that may be related to the creation of food security.

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