

10-FOOD SECURITY OF AGRICULTURAL HOUSEHOLDS IN HULU SUNGAI UTARA REGENCY, INDONESIA

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FOOD SECURITY OF AGRICULTURAL HOUSEHOLDS IN HULU SUNGAI UTARA REGENCY, INDONESIA

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ABSTRACT

Food is considered a fundamental necessity in the development of high-quality human capital. Food security can be described as the state in which a community has consistent access to an adequate supply of safe and nutritious food, which is distributed in a manner that is affordable and accessible to all individuals within that community. Food security at the household level can be defined as the capacity of a household to adequately supply food for all its members. In order to maintain a healthy lifestyle and enhance productivity in daily activities, it is essential for agricultural households in Hulu Sungai Utara Regency to strike a balance between quality and variety in their daily routines. The objective of this study is to assess the degree of food security and identify the determinants impacting the food security of agricultural households in Hulu Sungai Utara Regency. The utilized data consists of secondary data sourced from the National Socio-Economic Survey (Susenas) conducted in March 2022. The study was conducted in Hulu Sungai Utara Regency, encompassing a sample size of 148 agricultural households. The initial objective entails conducting cross-classification analysis to assess two indicators of food security, specifically examining the relationship between food expenses and the sufficiency of energy intake. This analysis aims to determine the level of food security among agricultural households in Hulu Sungai Utara Regency. The second objective of this study employs an ordinal logistic regression model to ascertain the factors that exert influence on the food security of agricultural households in the Hulu Sungai Utara Regency. The findings of the study indicate that the food security status of agricultural households in Hulu Sungai Utara Regency can be determined through a cross-calculation of the proportion of expenditure allocated to food and energy consumption. The results reveal that 47% of households are classified as food secure, 38% as food vulnerable, 12% as food deficient, and 3% as food insecure. Several factors have been identified as significant determinants of food security among agricultural households in Hulu Sungai Utara Regency. These factors include household income, the total number of household members, and household food expenditure.

KEY WORDS

Food security, agricultural households, ordinal logistic regression.

The provision of sustenance is a fundamental requirement for human survival, as it fulfills a primary physiological necessity. Consequently, every individual possesses an inherent entitlement to acquire an ample quantity of nourishment. Hence, it is imperative that food is adequately accessible, ensuring its safety, superior quality, nutritional value, and variety, while also being affordable within the constraints of individuals' purchasing capacity and in alignment with their respective beliefs and cultural practices. According to Soekirman (Suhaimi, 2019), individuals possess the entitlement to acquire an ample and satisfactory amount of nourishment in accordance with their personal requirements.

Food security can be defined as the state in which a community has consistent access to an adequate supply of safe, nutritious, and affordable food, which is distributed equitably among its members. Food security encompasses not only the regional-level provision of food, but also extends to the household and individual levels. Food security is a multifaceted concept that encompasses three key components: availability, access, and food utilization. It is imperative that the quantity and variety of food available is both adequate and consistent.



Food access pertains to the equitable distribution of food resources among households, facilitated by the provision of infrastructure such as roads and transportation. These measures aim to enhance the accessibility and affordability of food for households. The components of food utilization are interconnected with the specific dietary choices made, as well as their ability to fulfill the body's requirements for energy, vitamins, and other essential nutrients. In order to mitigate the issue of food insecurity, it is imperative that three essential requirements are adequately met. Food needs can be fulfilled through self-production, receiving gifts, or making purchases.

An agricultural household refers to a household in which one or more members are engaged in the management or labor of the agricultural sector, encompassing various sub-sectors such as food crops, horticulture, plantations, fisheries, animal husbandry, and forestry. The Hulu Sungai Utara Regency is a geographical region distinguished by its marshy terrain, which presents promising opportunities for agricultural endeavors. According to the data provided by the Hulu Sungai Utara Regency Agriculture Service in 2022, the population of Hulu Sungai Utara Regency was recorded at 231.29 thousand individuals. Among this population, 179.166 thousand individuals were of productive age, with a notable proportion of 25.436 thousand individuals engaged in the agricultural sector.

Agriculture assumes a crucial role in sustaining human livelihoods. The agricultural sector is exclusively reliant on natural conditions, including land, water, climate, and other ecosystem resources. Various factors such as unpredictable weather conditions, increased production costs, infestation by pests, and other challenges have the potential to impact agricultural commodity production. The production of agricultural commodities, particularly staple foods like rice, can be significantly influenced by natural factors, such as unpredictable climate conditions. According to data sourced from the Central Statistics Agency (2023), there has been a decrease in rice production within the Hulu Sungai Utara Regency over the past three years. In the year 2020, the total quantity of rice produced amounted to 103.749,20 metric tons. In the year 2021, there was a decline observed in total production, amounting to a mere 73.786,78 tons. Subsequently, a substantial decline is anticipated to occur in the year 2022. The projected quantity of rice production is estimated to be 37.127 tons. The occurrence can be attributed to a catastrophic flood event, resulting in the failure of agricultural crops.

According to the Central Statistics Agency (2023), there has been a consistent upward trend in the population of Hulu Sungai Utara Regency over the past three years. The population of Hulu Sungai Utara Regency in 2020 was recorded as 226.727 individuals. Subsequently, in the year 2021, there was a notable rise in population to reach a figure of 228.83 thousand individuals. This upward trend continued into 2022, where the population further increased to 231.29 thousand. The presence of a negative correlation between population growth and rice production suggests that the current supply of food, particularly rice cultivated in the Hulu Sungai Utara Regency, is insufficient to meet the demands of the local community, necessitating the importation of supplies from external sources.

Food security at the household level can be defined as the capacity of a household to consistently and adequately supply its members with a sufficient quantity of food that is nutritionally balanced and diverse, enabling them to maintain good health and engage in productive daily activities. The issue of food adequacy encompasses both the quality and quantity of food. In order for a household to achieve food sufficiency, it is imperative that they possess the capacity to acquire food through either market purchases or self-production (Suhaimi, 2019).

The financial capacity of a household plays a significant role in determining both their access to food and the quality of food they are able to consume. There exists a correlation between income and household expenses. Household income can be derived from either agricultural or non-agricultural pursuits. The quantity of household income is influenced by the outcomes of agricultural activities. An increase in production quantity is expected to result in a corresponding rise in income. Conversely, a decrease in production will result in a corresponding decrease in household income. To fulfill domestic requirements, it may be



necessary to sell all agricultural output, thereby necessitating the acquisition of food consumption through purchases.

Household expenditures typically encompass both essential and non-essential items, including provisions for sustenance as well as other miscellaneous necessities. When examining the relationship between household food security and the concept of food consumption, it becomes evident that household income plays a significant role in determining the household's ability to access high-quality and suitable food options. Hence, the level of income can serve as an indicator of the agricultural household's ability to fulfill its dietary requirements. The primary objective of ensuring food security is to enhance the well-being of communities, as evidenced by the fulfillment of individuals' right to access and consume food. The problem formulation in this research is derived from the background information provided:

- What is the level of food security of agricultural households in Hulu Sungai Utara Regency?
- What are the factors that influence the food security of agricultural households in Hulu Sungai Utara Regency?

METHODS OF RESEARCH

The study was carried out in the Hulu Sungai Utara Regency between the months of January and June in the year 2023. The research utilizes secondary data obtained from the National Socio-Economic Survey (Susenas) for Hulu Sungai Utara Regency in March 2022, which was sourced from the Central Statistics Agency (BPS) of South Kalimantan Province. The research sample consists of agricultural households that were included in the National Socio-Economic Survey (SUSENAS) conducted in the Hulu Sungai Utara Regency area. A sample of 148 agricultural households was obtained from the Susenas data.

The measurement of household food security can be accessed through the utilization of cross-classification, which involves the comparison of two indicators of food security: the cost of food and the sufficiency of energy intake (Jonsson and Toole in Putri et al. 2022). The subsequent table presents the degree of food security.

Table 1 – Calculating the Level of Household Food Security

	Food Expenditure Share	
Energy Consumption Rate	Low (less than 60% of total expenditure)	High (exceeds 60% of total expenditure)
Adequate (energy adequacy more than 80%)	Food Resistant	Vulnerable to Food
Less (no more than 80% energy adequacy)	Lack of Food	Food Insecurity

Source: Jonsson and Toole in Putri et al, 2022.

The factors affecting agricultural households' food security in Hulu Sungai Utara Regency were identified using ordinal logistic regression analysis. General logistics tasks include the following:

$$P(Y \leq j|X) = \frac{\exp(\theta_j + \sum_{k=1}^p \beta_k X_k)}{1 + \exp(\theta_j + \sum_{k=1}^p \beta_k X_k)}$$

Where: $j=1, 2, \dots, j$ is the sum of the different possible answers. An ordinal logistic regression equation is formed when the dependent variable has $j=1, 2, \dots, j$ categories, where j is the number of categories in the equation. In this study, we employ a four-factor framework to assess the level of food security among agricultural households in Hulu Sungai Utara Regency: 1 = Household experiences food insecurity; 2 = Household experiences food shortages; 3 = Household experiences food vulnerability; 4 = Household experiences food security.

By taking four different types of food security, the elements that influence category (p), an ordinal logistic regression model equation is formed as follows.



$$Y_i = \ln = + \left[\frac{P_i}{1-P_i} \right] \beta_0 \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 D_1 + \beta_5 D_2$$

Where:

- Y_i: Opportunities for households;
- P_i: Household opportunities determine food security when X_i is known;
- β₀: *Intercept*;
- β_i: Logistic coefficient of each factor;
- X₁: Household Income (Rp/Month);
- X₂: Amount All Household Members (People);
- X₃: Household Food Expenditures (Rp/Month);
- D₁: *Dummies* Area of Residence (Rural=0, Urban=1);
- D₂: *Dummies* Food Aid Recipients (No=0, Yes=1).

To evaluate the suitability of the Goodness of Fit, logistic regression model, with the following hypothesis, test statistics were used: H₀= Model fit; H₁= Model does not fit.

The statistics of the test are:

$$X^2 = \sum_{j=1}^J \frac{(y_j - m_j \theta_j)^2}{m_j \theta_j (1 - \theta_j)}$$

If y_j is the jth response variable and J=1,2,3,...,j, then m_j is ln most cases, the value of j is the cumulative probability. A rejection of H₀ is made if the calculated number 2 is larger than the calculated number 2 (J2). To determine whether or not the response variable is correlated with the predictor variables, a test of independence can be carried out. The Chi-Square statistical test is used for this purpose. The principle used is:

- H₀: The predictor variable and response variable are not correlated;
- H₁: The predictor variable and the response variable are correlated with each other.

The statistics used for the test are:

$$X^2 = \sum_{ij=1}^{rk} \frac{(o_{ij} - e_{ij})^2}{e_{ij}}$$

Where: $e_{ij} = \frac{(\text{rows total } k - i) \times (\text{columns total } k - j)}{\text{observation total}}$

Degrees of freedom (db) = (r-1) (k-1) for a matrix with r rows and k columns, where o_{ij} is the observed frequency at the ith row and jth column and e_{ij} is the expected frequency from row i to column j. Assumption (H₀) is discarded if (db) count 2 > count 2.

All tests were performed simultaneously to ensure the significance of the general coefficients. Concepts applied:

$$H_0 = \beta_1 = \beta_2 = \dots = \beta_j = 0$$

$$H_1: \text{Minimum } 1j \text{ is not equal to } 0, j = 1, 2, \dots, \text{ and } p$$

Testing Statistics:

$$G = -2 \log \left[\frac{M_{intercept}}{M_{full}} \right]$$

M_{intercept} is a special regression model that only uses an intercept (without any predictor variables), whereas M_{full} is a regression model that combines all predictor variables to evaluate their significance. At a level comparable to α, H₀ is rejected if p - value < α or G > x₂ α, b.

The Wald Test is a tool that can be used to assess model parameters for partial testing. Whether predictor variables are considered relevant or important to include in the model is evaluated using the results of the Wald Test. Concepts applied:

$$H_0 = \beta_k = 0; H_1 = \beta_k \neq 0, k = 1, 2, \dots, p; p \text{ is the total predictors available for the model}$$



$$\text{Statistics for the } W = \text{Test} \frac{\beta_k}{SE(\beta_k)}$$

6 H0 is rejected if $W > Z\alpha/2$ or $P - \text{value} < \alpha$. The large number of samples causes the W test statistic to follow a normal distribution.

The process of drawing inferences and choosing a course of action from estimated coefficients in an ordinal logistic regression model is called analysis of the coefficients. Changes in the response variable due to changes in the predictor variables are represented by these coefficients. Parameter coefficients are best grasped through the lens of the odds ratio (ψ). Odds ratios are useful when there is more than one independent factor. Ordinal logistic regression model coefficients can be analyzed using odds ratio values. Modifications to the logistic function are represented by the parameter k , and the likelihood ratio can be estimated with the formula $\psi = \exp(k)$.

RESULTS AND DISCUSSION

This study focuses on the demographics of agricultural households, specifically their geographical distribution, average age of the household head, average education level of the household head, and average family size.

Table 2 – Data on Respondent Household Characteristics

No	Characteristics	Category	Amount	%
1.	Location of residence	Rural	125	84.56
		Urban	23	15.44
2.	Age of head of household	15-64	126	85.22
		>64	22	14.78
3.	Education of the head of household	Not completed in elementary school	3	2.68
		Elementary school	106	71.14
		Junior high school	16	10.73
		Senior high school	22	14.78
		Bachelor	1	0.67
4.	Number of household members	1-2	35	24.16
		3-4	82	55.03
		5-6	28	18.8
		7-8	3	2.01
5.	Food aid recipients	Recipient	6	4.06
		Not a recipient	142	95.94

Source: Data Processing, 2023.

Table 2 displays the distribution of residential locations, showing that the vast majority of households (84.56%) that responded live in rural areas. Eighty-five point two percent of all heads of households are between the ages of 15 and 64, the prime working years. There were a total of 106 elementary school graduate household heads among the respondents or 71.14 % and 82 or 53.3% of those households had three or four people living there. 95.94% of agricultural households in Hulu Sungai Utara Regency were not eligible for government food assistance, according to this study's sample.²²

Food security in the agricultural household refers to a situation in which all members of the household have access to sufficient quantities of safe, nutritious food that is both affordable and easily accessible. This study uses the energy consumption rate and the food expenditure share method to assess food security. Jonnson and Toole (2002) use indicators of food expenditure share and energy consumption levels.

Based on the data in the table above, it is known that the number of agricultural households that are considered food secure is 70 households or 47%, 57 households are food insecure or 38%, 17 households are food insecure or 12%, and four households are food insecure or 3%. It shows that the status of agricultural households in the food secure category occupies the highest position, so most households in the Hulu Sungai Utara Regency are included in the food secure status.



Table 3 – Distribution of agricultural household food security in Hulu Sungai Utara Regency

No	Food Security Category	Food Expenditure Share (%)	Energy Consumption Rate (%)	Number of Households	%
1.	Food Hold If the Proportion of Food Consumption is not more than 60% and ECR is sufficient (more than 80%).	53.67	120.82	70	47
2.	Food Vulnerability: If the Proportion of Food Consumption is High (at least 60%), ECR is Sufficient (at least 80%)	64.78	126.31	57	38
3.	Food shortages occur when the ratio of food expenditure is low (less than 60%) and ECR is low (less than 80%).	53.21	64.70	17	12
4.	In food insecurity, the proportion of food expenditure must be high (at least 60%) and ECR must be low (at least 80%).	62.88	75.15	4	3
Amount				148	100

Source: Data Processing, 2023.

The data analysis used is ordinal logistic regression which includes model suitability tests, simultaneous tests and partial tests.

Model Suitability Test (Goodness of fit). The goodness of fit test is a test to determine a model that has no significant differences with the observed values (fit). The previous model suitability test results show that the Chi-Square value of the Deviance test is 258.625, and the significance value is 1.000. This conclusion is rejected H_0 because the significance value of 1.000 is greater than 0.05. It means that with a confidence level of 95%, it can be said that the research data is following the regression model.

Coefficient of Determination. The value of how much the predictor variable influences the response variable can be seen from the value of the coefficient of determination or R Square. Test results show that the Nagelkerke R Square with a value of 0.305. It proves that the predictor variables added to the regression model can explain the response variable of 30.5%. In comparison, the remaining 69.5% is caused by variables not included in the model. The level of household food security examined in this study can be explained by the 30.5% predictor variables included in the model.

Simultaneous Test. Test Simultaneous or simultaneous testing uses the Maximum Likelihood test by looking at the Fitting Information Model value. This table provides information on whether the predictor variables included in the model have better results than a model that only includes the intercept. Based on the analysis results the possibility of -2 Log Likelihood decreasing from Intercept Only to Final is 310.513 to 264.171 with a significance value of 0.000. In other words, a model with predictor variables has better quality than a model with only an intercept. It indicates that at least one predictor variable can explain its effect on the food security of agricultural families in Hulu Sungai Utara Regency. The results of the analysis carried out simultaneously show that predictor factors such as household income (X_1), total number of household members (X_2), household food expenditure (X_3), area of residence (D_1), and food aid recipients (D_2) together greatly influence the response variable, namely agricultural household food security in Hulu Sungai Utara regency.

Partial Test. The partial test is carried out with the Wald test which explains the influence of each independent variable on the dependent variable.

Table 4 – Parameter Estimate Values

Variable	Estimate	Wald	Sig.	Odds Ratio	Decision
Y = 1.00	-2,862	5,705	0.017		Reject H_0
Y = 2.00	-1,057	0.903	0.342		Reject H_0
Y = 3.00	1,273	1,320	0.251		Reject H_0
Household income (X_1)	0.361	24,908	0,000*	1,435	Reject H_0
Total number of household members (X_2)	-0.450	7,245	0.007*	0.638	Reject H_0
Household food expenditure (X_3)	-0.489	22,654	0,000*	0.613	Reject H_0
Region of residence (D_1)	0.621	1,667	0.197	1,861	H_0 cannot be rejected
Food aid recipients (D_2)	0.150	0.029	0.864	1,162	H_0 cannot be rejected

Note: * Significance at $\alpha = 0.01$.



Based on the results of the partial test, predictor variables needed to be more significant, namely the region of residence (D_1) and food aid recipients (D_2). However, the decision was that all predictor variables were included in the model. From the results of the tests that have been carried out, a regression model can be formed as follows:

$$\text{Ln } [P(Y \leq 1|x)] = -2,862 + 0,361 X_1 - 0,450 X_2 - 0,489 X_3 - 0,621 D_1 - 0,150 D_2$$

$$\text{Ln } [P(Y \leq 2|x)] = -1,057 + 0,361 X_1 - 0,450 X_2 - 0,489 X_3 - 0,621 D_1 - 0,150 D_2$$

$$\text{Ln } [P(Y \leq 3|x)] = 1,273 + 0,361 X_1 - 0,450 X_2 - 0,489 X_3 - 0,621 D_1 - 0,150 D_2$$

From the model that has been formed, it can be interpreted that the positive direction (+) in the household income variable (X_1) means that an increase in agricultural household income tends to increase the level of household food security compared to households whose income decreases. Then, the negative direction (-) in the variable for the total number of household members (X_2) means that the total number of agricultural household members becomes smaller than before, which tends to mean that the level of household food security will increase compared to households with many people. The negative direction (-) on the variable household food expenditure (X_3) means that the declining household food expenditure tends to increase the level of food security of households will increase compared to the life of households that spend higher food costs.

The household income variable (X_1) will influence household food availability. In this study, the variable related to household income (X_1) has a significant value of $0.000 < 0.01$ (α is used), so H_0 is rejected, and H_1 cannot be rejected. The odds ratio value is 1.435, which means there is an increase in the tendency of 1.435 times to be more food secure in agricultural households with a higher income than households with a lower income. It proves that agricultural households in Hulu Sungai Utara Regency, which have higher incomes, tend to approach the level of household food security. By the opinion of Herdiana et al. (2014), a positive influence on the income variable means that the level of household resilience is positively correlated with income. This research results align with Susanti (2021), who states that household food security in Danau Panggang District, Hulu Sungai Utara Regency, is positively influenced by income factors. Higher income will affect household purchasing power to obtain food availability to meet their needs.

The variable in the total number of household members (X_2) has a significance value of $0.007 < 0.01$, so H_0 is rejected, and H_1 cannot be rejected. An odds ratio value of 0.638 can mean an increased tendency of 0.638 times to be more food secure in agricultural households with fewer family members than in agricultural households with more family members. It shows that agricultural households in Hulu Sungai Utara Regency with fewer household members tend to approach the level of household food security. It happens because how much money will be spent on the number of family members for food needs is increasing and will affect the composition of the distribution of food consumption for each household member. Previous findings are consistent with Rasmianti et al. (2016), who stated that the number of family members influences household food security. The opportunity to maintain household food security is lower as family members increase. Food needs and costs will increase with the number of household members.

The household food expenditure variable (X_3) shows a significance value of $0.000 < 0.01$, so H_0 is rejected, and H_1 cannot be rejected. With an odds ratio value of 0.613, there is an increased tendency of 0.613 times to be more food secure in agricultural households that spend less money on food than households that spend more on food. It proves that agricultural households in Hulu Sungai Utara Regency, which have lower food expenditure, tend to approach the level of household food security. By the BPS criteria, if food expenditure is more than 60% of the total household income, then the household is included in the group of people who are unhealthy or cannot get food. This study's results are from previous research from Susanti (2021) that household food expenditure significantly affects household food security in the Panggang Lake District of Hulu Sungai Utara Regency.



CONCLUSION

The level of food security of agricultural households in Hulu Sungai Utara Regency based on a cross-calculation of the share of expenditure on food and energy consumption shows that 47% of households are food secure, 38% are food vulnerable, 12% are food deficient, and 3% are food insecure.

Factors that have a simultaneous influence based on the test results show that household income, total number of household members, household food expenditure, location of residence, and food aid recipients significantly influence the food security of agricultural households in Hulu Sungai Utara Regency. Meanwhile, it partially shows that the factors that significantly influence the food security of agricultural households in Hulu Sungai Utara Regency are household income, the number of household members, and household food expenditure.

SUGGESTIONS

There is a need for a strategic plan to deal with food problems in Hulu Sungai Regency, especially for agricultural households, especially for agricultural households with food insecure, food insecure, and food insecure status.

The importance of support from related parties regarding managing agricultural activities for food crops, horticulture, fisheries, and livestock, which have great potential in the Hulu Sungai Utara Regency area to minimize production risks such as flooding and pest attacks.

The importance of counseling, education, training, and support from the government and other related parties to the community, especially agricultural households, both heads of households and their members, to create entrepreneurship in the agricultural sector so that they can increase income to achieve and maintain household food security.

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