AGRITROPICA Journal of Agricultural Sciences

Content is available at:
https://ejournal.unib.ac.id/jagritropica
ISSN: (Print) 2621-217X, (Online) 2621-699X
Agritropica. J. Agr. Sci. 8 (2): 112-118 November 2025

Household Food Security of Rice Farmers Based on Food Expenditure and Energy Consumption in Singaran Pati Sub-District, Bengkulu City

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Article info: Submitted: 2025-10-27, Accepted: 2025-11-27, Publish: 2025-11-30

ABSTRACT: This study was conducted in the Singaran Pati Sub-district of Bengkulu City to analyze food expenditure shares, energy consumption, and household food security levels among rice-farming households. A descriptive-analytical method was employed, with research sites selected purposively and samples determined proportionally, resulting in 63 respondents from Dusun Besar and 34 from Panorama. Both primary and secondary data were utilized. Food expenditure share was calculated based on the ratio of food to total household expenditure, while energy consumption was assessed using a one-sample t-test. Food security status was measured by cross-classifying food expenditure share and energy consumption. The results show that the food expenditure share reached 80.98%, indicating a high category, while energy consumption was 97.38%, categorized as sufficient. Overall, most rice-farming households were classified as food-insecure.

Keywords: Energy Consumption, Food Expenditure Share, Food Security.

Reference to this paper should be made as follows:
Ifebri, R., H. E. Wibowo, A. Fauzi, and M. P. Nolasary. 2025. Household Food Security of Rice Farmers Based on Food Expenditure and Energy Consumption in Singaran Pati Sub-District, Bengkulu City. Agritropica. J. Agr. Sci. 8 (2): 112-118. Doi: https://doi.org/10.31186/J.agritropica.8.1.112-118.

INTRODUCTION

Food security is a primary indicator of household welfare and the sustainability of agricultural systems. Rice-farming households play a dual role as both producers and consumers of food; therefore, their food security is strongly influenced by production dynamics, income, and daily consumption patterns (Darojat et al., 2025). Although they are rice producers, not all farming households are free from the risk of food vulnerability. According to Royamanti et al. (2024), factors such as food price fluctuations, limited market access, and the allocation of expenditure between food and non-food items affect households' ability to meet energy and nutritional needs.

The demand for food continues to increase alongside the growth in the variety and utility of food products, as adapted from the theory of supply and demand (Zahara & Anwar, 2021). On the supply side, not all food needs can be met due to constraints on production and distribution capacity. Food availability can be improved if production keeps pace with consumption growth, which often exceeds food production growth (Susanti & Gusriati, 2023). A region is considered successful in achieving food security when there is an increase in food production, efficient food distribution, and safe, nutritionally adequate food consumption for the entire population. Food security consists of three dimensions: 1) Food Availability, 2) Food Access, and 3) Food Utilization (Nudia & Aprilia, 2020).

Household food security can be assessed using various indicators, including household food expenditure. A High proportion of food expenditure relative to total spending often indicates a strong dependence on staple foods, making households more vulnerable to changes

in prices and food availability (Sulistyaningsih & Khoiriyah, 2022). Food security issues are not only about the quantity of food consumed but also about its nutritional and protein content. Therefore, diversifying food consumption becomes a crucial strategy to enhance household food security, particularly for low-income households (Razi & Wahyuni, 2022).

The choice of food diversification also considers energy requirements and actual consumption, which in turn affects energy needs and farmer productivity. It is aligned with indicators of nutritional adequacy. The nutrients considered as indicators of food security are macronutrients, specifically energy and protein (Rokhmah et al., 2022). Improving household food security is a challenging task. Nutritional issues are inextricably linked to food issues, as dietary problems arise from either excess or deficiency of nutrients.

An approach based on food expenditure and energy consumption can provide a deeper understanding of resource allocation patterns, consumption priorities, and household-level food security (Pambudi et al., 2021). This approach is applied because, fundamentally, humans require energy intake and spend money to access food as their primary source of energy—conditions that can be observed within a household. In Singaran Pati Sub-district, Bengkulu City, rice-farming households are the main contributors to the local food supply; however, their food security conditions still require further analysis, even though rice farmers in the area are generally considered relatively well-off (Putri et al., 2025). This study aims to assess the food security of rice farming households by considering both economic and nutritional dimensions, thereby providing a foundation for formulating sustainable agricultural development policies and more targeted socio-economic interventions.

METHODS

Research Location and Time Selection

This study was conducted from January to February 2025 in Singaran Pati Sub-district, Bengkulu City. The research site was purposively selected because Singaran Pati is one of the main rice-producing areas in Bengkulu City. The sub-district has a total paddy field area of 115 hectares across six villages, with the largest paddy fields located in two villages, Dusun Besar and Panorama, covering 26 hectares and 61 hectares, respectively (BPS, 2023).

Respondent Determination and Selection

The population of this study consisted of rice-farming households in Dusun Besar and Panorama villages, with 105 and 46 households, respectively, for a total of 151 households. The research sample was selected using simple random sampling. The sample size was determined using the formula by Stephen Isaac and William B. Michael (1981), as cited in Anzaini (2022). Based on this calculation, with a 10% margin of error, the sample size was 97 respondents. According to Sugiyono (2013), a proportional allocation method was applied to ensure that the number of samples from each village accurately represented the population in Singaran Pati Sub-district, resulting in 63 households from Dusun Besar and 34 families from Panorama.

Analysis of Food Expenditure Share

The analysis of food expenditure share can be calculated using the formula that divides household food expenditure by total household expenditure:

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

Formula:
PF = Household Food Expenditure Share (%)
PPt = Food Expenditure (Rp/month)
TPt = Total Expenditure (Food and Non-Food) (Rp/month)

If the food expenditure share is less than 60%, the household is considered food secure; if it is 60% or greater, the household is considered food insecure (Maxwell et al., 2000, as cited in Wahyuni, 2025).

Analysis of Energy Consumption Level

Consumption can be determined by measuring the amount of food each household consumes, which is then converted to energy consumption (kcal/person/day). The conversion is carried out using the Food Composition Table (Daftar Komposisi Bahan Makanan, DKBM) (Damora et al., 2008).

Household food consumption can be assessed from two perspectives: the quality and

quantity of food consumed (Sari & Zuber, 2020). In this study, food consumption is quantified to assess household food security. The amount of food consumption can be measured by the nutrients contained in the food items. Food consumption data can be obtained using the 24-hour recall method (Supriasa, 2002, as cited in Wahyuni, 2025). In this method, respondents are asked to report all foods and beverages they have consumed in the past 24 hours (Lubis et al., 2020). The amount of food consumed is expressed in household measures (URT), such as spoons, glasses, pieces, etc. These measures are then converted to grams using the standard measurements applicable in the study area.

In general, the assessment of the amount of nutrients consumed is calculated as follows:

$$Gij = \frac{BPj}{100} \times \frac{Bddj}{100} \times KGij$$

Equation:

G_{ij} : The amount of energy or protein consumed from food item j (energy in kilocalories and protein in grams)

BP_j : The weight of food item j consumed (grams).

Bdd_j: The edible portion of 100 grams of food item j (%).

KG_{ij} : The energy or protein content per 100 grams of food item consumed (energy in kilocalories and protein in grams).

Food consumption is examined in terms of the volume of food consumed and the nutrients it provides. These two aspects are used to determine whether food consumption adequately meets the requirements for a healthy life (Angka Kecukupan Gizi, AKG). To quantify food consumption, the Energy Consumption Level (Level of Energy Adequacy) parameter is used.

$$\text{TKE} = \frac{\sum(\text{Energy Consumption})}{Recommended\ Dietary\ Energy\ Intake} X\ 100\%$$

Equation:

TKE: Energy Consumption Level (%)

∑ Energy Consumption: Total Energy Consumption (kkal/person/day)

Analysis of Food Security Level

The indicator used to measure household food security is a cross-classification of two food security indicators: food expenditure share and energy consumption level (National Food Agency, 2024). Household categories based on these food security indicators are presented in Table 1.

Table 1. Food Security Categories Based on Energy Consumption and Food Expenditure Share.

Energy Consumption	Food Expenditure Share	
	Low <60% total Expenditure	**High** > 60 % total Expenditure
Sufficient (> 80% energy adequacy)	Food Secure	Vulnerable to Food Insecurity
insufficient (≤ 80% energy adequacy)	Insufficient to food security	Food Insecure

Source: Maxwell (2000), as cited in Wahyuni (2025)

A household is classified as food-secure if it has a low food expenditure share (i.e., less than 60% of total household expenditure) and consumes sufficient energy (i.e., greater than 80% of the energy adequacy requirement). A household is considered vulnerable to food insecurity if it has a high food expenditure share (greater than 60% of total household expenditure) but sufficient energy consumption. A household is considered food insecure if it has a low food expenditure share but insufficient energy consumption (< 80% of the energy adequacy requirement). Meanwhile, a household is classified as at risk of food insecurity if it has both a high food expenditure share and insufficient energy consumption (Hasrawati & Putri, 2020).

RESULTS AND DISCUSSION

Food Expenditure Share

The food expenditure share is the proportion of a rice farming household's total expenditure allocated to food. Total spending is the sum of food and non-food expenditures. The following table presents the expenditures of rice-farming households in Singaran Pati Sub-district, Bengkulu City. Table 2 shows that the average monthly food expenditure of rice-farming households in Singaran Pati Sub-district,

Bengkulu City, is IDR 1,806,704, accounting for 80.98% of total spending.

In comparison, non-food expenditure amounts to IDR 424,325 per month, or 19.02% of the total. This indicates that food expenditure in Singaran Pati Sub-district is very high, with most household income allocated to food, leaving only a small portion for non-food expenses. This finding aligns with the study by Novita & Dewi (2025), which found that in households of farmers involved in plantations, secondary crops, and horticulture, the head of the household or primary contributors prioritize food expenditure first, even though, at the macro level, this proportion may not be large relative to total household income.

Table 2. Average Household Expenditure of Rice Farmers in Singaran Pati Sub-district

Description	Amount (IDR/Month)	Percentage (%)
Food expenditure	1,806,704	80.98
Food non-expenditure	424,325	19.02
Amount	2,231,029	100

Source: Primary Data Analysis, 2025

Energy Consumption

Household nutrient consumption is determined by calculating the food consumed by the household in the past 24 hours, using the recall method, in accordance with the guidelines of the Food Composition Table (Daftar Komposisi Bahan Makanan, DKBM). This nutrient intake is then compared with the Recommended Nutrient Intake (RNI) to determine the Nutrient Consumption Level (NCL) (Ministry of Health of the Republic of Indonesia, 2018). The RNI varies across individuals, as it is determined by age and gender. Energy consumption refers to the amount of dietary energy consumed per person per day, expressed in kcal/person/day (Rokhmah et al., 2022).

Table 3. Average Energy Consumption among Rice-Farming Households in the Singaran Pati Sub-district.

Description	Amount (kkal)
Total Required Energy (kkal)	9.259
Actual Energy Intake (kkal)	9.017,22
Energy Adequacy (%)	97.38%

Source: Primary Data Analysis, 2025

Based on Table 3, the average total energy requirement of rice farming households in Singaran Pati Sub-district is 9,259 kcal, while the average actual energy consumption is 9,017.22 kcal. This means that the average energy consumption of rice-farming households in Singaran Pati is relatively high, slightly above the required energy level. The household's energy adequacy is 97.38%, indicating that their energy consumption falls within the sufficient range. Several factors influence household energy adequacy, the most common being the age and number of household members, as well as the ability to meet nutritional needs from available protein sources (Kinanti & Dina, 2023)

Food Security

Aspects of food security can be assessed using three indicators: availability, consumption, and distribution (Nudia & Aprilia, 2020). In this study, food security is evaluated solely through food consumption, particularly energy consumption. This approach assumes that, at the household level, food distribution and prices are relatively stable (Sutrisno et al., 2022). Further details on the household food security categories among rice farmers in the Singaran Pati Sub-district, Bengkulu City, are provided below.

Table 4. Number of Rice Farming Households in Singaran Pati Sub-district by Food Security Category

Food Security Category	Food Expenditure Share (%)	Energy Consumption Level (%)	Number of Households	Percentage (%)
Food Secure				
If the food expenditure share is < 60% and energy consumption is sufficient (> 80% of energy adequacy).	0	0	0	
Vulnerable to Food Insecurity				
If the food expenditure share is ≥ 60% and energy consumption is sufficient (> 80% of energy adequacy).	87.25	113.032	64	42.38
Food Insecure				
If the food expenditure share is < 60% and energy consumption is insufficient (< 80% of energy adequacy).	0	0	0	
At Risk of Food Insecurity				
If the food expenditure share is ≥ 60% and energy consumption is insufficient (< 80% of energy adequacy).	76.50	67.11	87	57.62
Amount			151	100

Source: Primary Data Analysis, 2025

The table shows that, in this study, most rice-farming households in Singaran Pati Sub-district, Bengkulu City, fall into the vulnerable and at-risk categories of food insecurity. Specifically, 64 households (42.38%) are classified as vulnerable, while 87 households (57.62%) are classified as at risk of food insecurity. Vulnerable households are those at risk of food shortages, whereas at-risk households are unable to meet their daily staple food needs. According to the table, most rice-farming households allocate a relatively high proportion of their expenditure to food, with food accounting for more than 60% of total household expenditure. This is because basic food needs must be fulfilled within the household (Suryanto et al., 2023).

The household head's income also influences food security, as income is allocated to both food and non-food expenditures. Higher income generally allows households to meet food needs first, followed by non-food needs such as clothing and housing. However, in rice-farming households, the average income is insufficient to afford high-quality food that meets nutritional requirements, including protein and vitamins, let alone non-food needs. This aligns with Supriyanto's (2020) findings, which indicate that although household income is primarily allocated to food, the nutritional quality of the diet remains inadequate. In practice, farmers tend to prioritize satiety over a balanced nutrient intake.

CONCLUSION

The food expenditure share is 80.98%, indicating that the majority of household consumption expenditure among rice-farming households is allocated to food, placing it in the high category. The average energy consumption of rice-farming households is 97.38%, indicating that their energy needs are met. The most prevalent household food security category among rice-farming households in the Singaran Pati Sub-district is at risk of food insecurity.

SUGGESTION

Future research is essential to evaluate food security policies and develop models to meet the primary needs of the agricultural sector. From the farmers' perspective, increasing household income through alternative livelihood strategies is essential to fulfill household needs, along with enhancing knowledge of proper nutrition and

dietary practices. The government also plays a key role in monitoring community food security to prevent vulnerability and the risk of food insecurity.

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