ASSESSMENT OF FOOD INSECURITY AMONG MARGINAL FARMING HOUSEHOLDS IN NORTH ACEH REGENCY

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Abstract

Background: North Aceh Regency's average daily per-capita energy consumption is 1,927 kcal below the national adequacy standard placing it as the sixth-lowest in Aceh despite being the province's largest rice producer. Limited resources reduce the purchasing power of marginal farming households, diminishing their food availability and consumption. These households represent a relevant sample for developing effective food-security solutions, as their high vulnerability makes them suitable for testing new agricultural methods amid climate-related challenges.
Purpose: This study aimed to determine the categories and composite mapping of food insecurity among marginal rice farming households in North Aceh Regency, Aceh Province, Indonesia.
Design/methodology/approach: The Household Food Insecurity Access Scale (HFIAS) and Household Food Insecurity Access Prevalence (HFIAP) instruments were employed to identify and analyze vulnerability instruments and priority composite mapping. Both quantitative and qualitative analytical techniques were used, in alignment with the research objectives. Marginal rice farmers from four villages across two sub-districts were selected via purposive sampling complemented by proportional random sampling, yielding a sample of 100 households from four villages in North Aceh Regency.
Findings/Results: The results revealed that 43% of marginal rice-farming households were classified as moderately food-insecure, 35% as severely food-insecure, and 22% as slightly food-insecure. Furthermore, FSVA-based mapping designated Lhok Kareung Village and Nga Lt Village in Lhoksukon District as Priority Composite 1, with a vulnerability index of 0.23%, denoting severe food insecurity.
Conclusion: The results of the study indicate that most marginal rice-farming households in North Aceh Regency were classified as moderately food-insecure (43%), while the remainder were categorized as severely and slightly food-insecure, with percentage values of 35% and 22%, respectively. Consequently, these findings elucidate the food security level of marginal farmers in North Aceh, which has direct implications for managers focusing on availability, access, including affordability of food distribution, and utilization, thereby fostering a sustainable food system. Effective managerial implications can foster food-secure marginal farmers, indicated by infrastructural modernization (provision of warehousing for stock and accessibility, precise irrigation, food diversification, affordable prices, and enhanced welfare reflected in higher incomes), as well as community cultural factors grounded in local wisdom.
Originality/value (State of the art): This study first analyzes the integration of food-insecurity analysis with food-security composite mapping, providing a nuanced understanding of vulnerability dynamics.

Keywords: food insecurity, marginal farming households, FSVA instrument, food security priority map

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INTRODUCTION

Food insecurity is a major issue in communities and countries worldwide. Food insecurity can negatively impact the economic system at both macro and micro levels. Food insecurity is a multidimensional issue requiring in-depth analysis and support systems with various indicators and measurement parameters. The complexity of food insecurity can be analyzed and assessed through the dimensions of food access, household access, and individual food utilization. These three dimensions of food insecurity are highly interconnected, despite their distinct aspects. One problem that arises is that if people experience a decline in purchasing power, especially for food needs, it will impact the quality of nutritional intake and overall community food security (Faradilla et al. 2022).

Social and economic aspects play crucial and strategic roles in addressing various economic challenges. For example, extensive agricultural and plantation lands can provide a source of food for the community. Aceh Province is one of the provinces in Indonesia with extensive agricultural and plantation land. This makes the agricultural sector the primary source of livelihood for the people of Aceh. The agricultural sector contributes significantly to the regional economy through food production (BPS, 2023). However, despite the availability of extensive land and plantations, food insecurity remains a threat to the people of Aceh Province. The threat, potential, and opportunity for food insecurity continue to increase in Aceh Province, particularly in areas with high poverty rates. Household food insecurity in farming communities is typically caused by high food prices, disruptions in food availability, extreme weather or conflict, and limited access to food. Household poverty is characterized by limited family income, which reduces purchasing power for quality food and makes access to food more difficult (Aceh Food Agency, 2023).

In response, Aceh Province strives to devise strategies to achieve the availability, distribution, and security of the four priority foods (rice, meat, eggs, and fish), involving both relevant agencies and other stakeholders in providing these four food types. Strategies to achieve optimal food security, especially in Aceh, are implemented through distribution spread figures that can be mapped locally and linked to food availability mapping. This approach aligns with governmental directives to establish food provision policies and development strategies, thereby realizing sustainable food security and sovereignty through integrated agricultural, livestock, and marine development that is environmentally conscious, culturally sensitive, and economically and ecologically balanced (Bappeda Aceh, 2022).

This study employs a mixed-methods design, differing from prior research, owing to the incorporation of numeric data and interactive statistics that necessitate in-depth exploration through descriptive analyses. Methodological integration encompasses experimental, case study, and descriptive approaches to maximize outcomes aligned with the research objectives of addressing food insecurity in North Aceh Regency, Indonesia.

Accordingly, the research hypotheses are formulated as follows: (a) Null Hypothesis (H_0): Fewer than 50 % of marginal farming households in North Aceh Regency are classified as experiencing moderate to severe food insecurity according to the Household Food Insecurity Access Scale (HFIAS); (b) More than 50 % of marginal farming households in North Aceh Regency is classified as experiencing moderate to severe food insecurity according to the Household Food Insecurity Access Scale (HFIAS).

One of the areas with a high level of vulnerability to food insecurity is North Aceh Regency, where, even though the region is one of the regions with the largest rice and rice production levels in Aceh Province, reaching 238,087.58 tons and rice production of 137,158.16 tons (Figure 1), which should make North Aceh Regency have a good level of food security, food security for the people of North Aceh Regency is still a major challenge for the Aceh government (BPS, 2023). This can be seen from one of the low Energy Adequacy Rate (Angka Kecukupan Energi abbreviated to AKE) indicators as one of the indicators used to measure food insecurity criteria.

The North Aceh Regency has experienced a decline in agricultural production due to malfunctioning irrigation systems that have led to droughts. The decline in rice production in recent years (BPS, 2025) has affected food availability, particularly rice. In addition, limited food access, influenced by socioeconomic factors, has contributed to food insecurity in the region. Land scarcity is another factor affecting low food security

levels, primarily because of the increasing conversion of agricultural land into residential areas. High agricultural input prices (such as fertilizers and seeds) and low selling prices for agricultural products have reduced farmers' productivity levels. Another factor contributing to food insecurity is cultural or traditional dependence, as the local community maintains a high reliance on rice as their primary staple food.

Food insecurity in North Aceh Regency usually occurs because of low agricultural productivity due to conversion, lack of farmer access to adaptive agricultural technology, and ownership of fertile agricultural land. The most dominant factors causing high food insecurity in the region are the low purchasing power of farming households to buy sufficient and nutritious (quality) food and the existence of limitations in food distribution that do not reach remote areas (BPS, 2023).

The existence of agricultural land is decreasing due to the high rate of land conversion. Land conversion can reduce the rice production. This poses a threat to food security in the North Aceh Regency. Land conversion is a multidimensional issue; therefore, solutions to address various issues in the food sector and other interrelated variables can be implemented using several approaches. Controlling the existence value of land requires consideration of multiple aspects. This poses a threat to food security in the North Aceh Regency. Land conversion is a multidimensional issue; therefore, solutions to address various issues in the food sector and other interrelated variables can be implemented using several approaches. Controlling the existence value of land requires consideration of multiple aspects. Meanwhile, well-controlled control through a perfect and integrated management system can provide an efficient and effective contribution to solving problems that can be achieved with a policy of permanent rice fields, policies on the allocation and distribution of farmer household intensities, and high productivity.

The Energy Adequacy Rate of North Aceh Regency remains below the national energy adequacy standard. The average energy consumption of the people of North Aceh Regency is only 1,927 kcal per capita per day, compared to the national energy adequacy rate of 2,150 kcal per capita per day (Table 1). Based on the energy adequacy rate, North Aceh Regency ranks sixth lowest in Aceh Province, after the Great Aceh Regency and Aceh Tamiang Regency (National Food Agency, 2023). Figure 2 shows the energy adequacy rate (AKE) of Aceh Province in 2023.

The Energy Adequacy Index for North Aceh Regency decreased from 2021 to 2023 and was lower than that of other regions in Aceh Province (BPN, 2024) (Table 2).The data show that North Aceh Regency has the largest rice and paddy production in Aceh Province; however, food insecurity is a significant threat and challenge for Aceh Province in the future to meet the energy needs of its people. This is an indicator of the problems that occur in the regional economy of North Aceh Regency; therefore, it is necessary to identify and analyze food insecurity, especially in marginal rice farming households in North Aceh Regency, and policies to overcome this problem so that efficient and effective solutions can be formulated for the creation of independent food security in North Aceh Regency, which will be an example for other regions in Aceh Province.

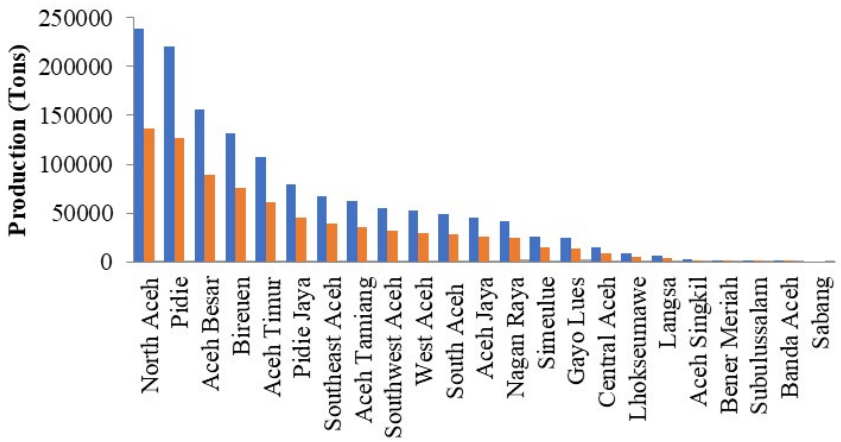

Figure 1. Paddy dan rice production in Aceh Province, 2023

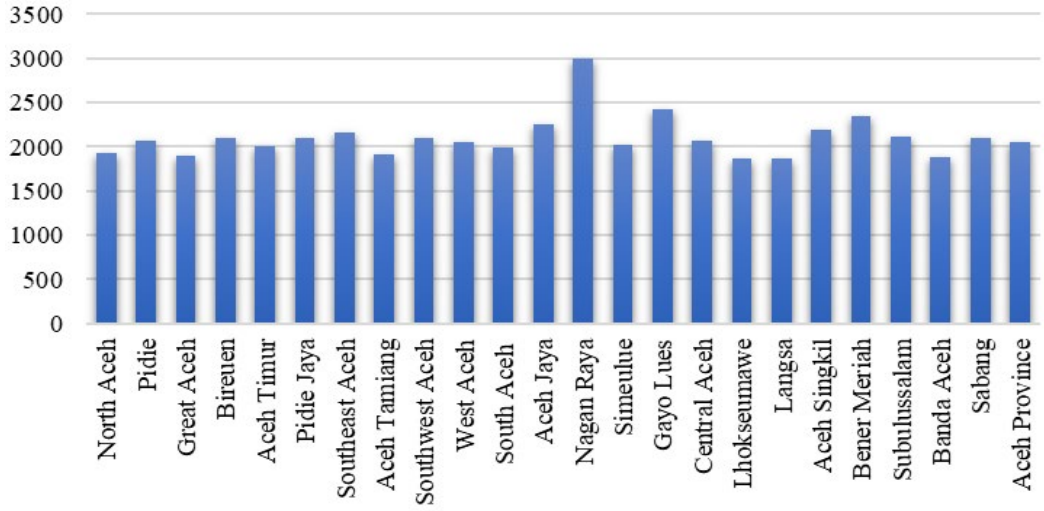

Figure 2. Energy Adequacy Rate (AKE) of Aceh Province 2023

Table 1. Comparison in Energy Adequacy Rate (AKE) of Aceh Province (Lowest to Highest), 2023

Regency	AKE (Kcal/ capita/ day)
Lhokseumawe	1873
Langsa	1874
Banda Aceh	1881
Great Aceh	1892
Aceh Tamiang	1914
North Aceh	1927
Aceh Province	2052,85
Indonesia (National)	2150

Table 2. Energy adequacy rate data for North Aceh Regency 2021-2023

Regency	Year	Energy Adequacy Rate (AKE)
North Aceh	2021	1937 Kcal
	2022	1935 Kcal
	2023	1927 Kcal

North Aceh Regency has the highest level of food insecurity among the 10 areas with high food insecurity in Aceh Province (BPN, 2023) (Figure 3). The Food Security and Vulnerability Atlas (FSVA, 2023) describes and explains the conditions and position of food insecurity areas in North Aceh Regency, with 94 out of 858 villages in the North Aceh Regency categorized as food insecure. The National Food Agency states that food insecurity indicates a condition in which individuals or communities are unable to obtain sufficient, high-quality, and nutritious food for a healthy and active life, with contributing factors including an imbalance between food production and community needs. Map and graph of the number of food insecure areas in the North Aceh Regency based on FSVA data.

Several studies have examined factors influencing food security. Ndlovu, Thamaga-Chitja, and Ojoyang report that farmer participation in value chains significantly reduces food insecurity in Swayimane, primarily due to high involvement in vegetable marketing activities within the chain, which contributes to lowering food-insecurity levels. Furthermore, a 2021 study shows that the use of hermetic storage technology for agricultural commodities helps mitigate food insecurity in Tanzania. Overall, the literature highlights that strong integration among key variables particularly input–output relationships and input–input interactions provides viable pathways for addressing food-security challenges and improving farmer welfare.

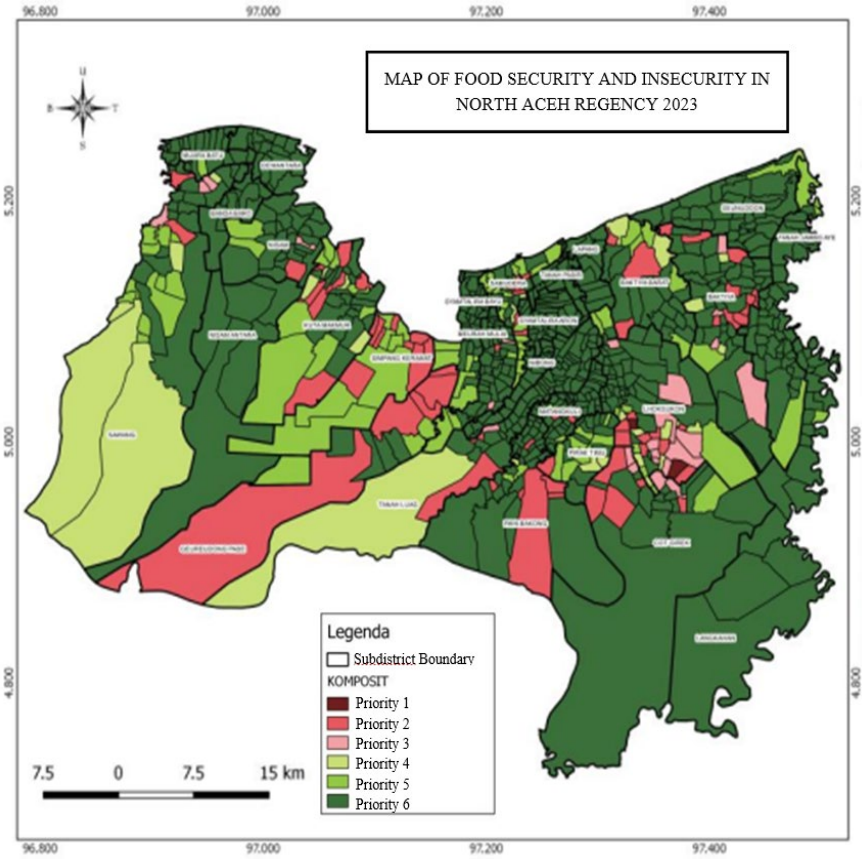

Figure 3. FSVA Map of North Aceh Regency (National Food Agency, 2023)

Further research employing a descriptive cross-sectional analysis, utilizing the USDA Household Food Security Survey Module and structured dietary intake assessments, revealed that a substantial proportion of farmers endure high levels of food insecurity in the country. Consequently, it is imperative to investigate the degree of food insecurity in North Aceh Regency, Aceh Province, to address and surmount agricultural development challenges, particularly in rural locales, where food constitutes a priority sector for governmental focus, encompassing technical distribution and socioeconomic dimensions.

Sustainable food policy frameworks are essential for guaranteeing food availability for impoverished and vulnerable populations, coupled with incentive systems to curb agricultural land conversion, thereby ensuring policy effectiveness. This study focuses on identifying food insecurity categories via nine highly relevant indicator statements, constituting a novel contribution insofar as prior research has not undertaken such an approach. Moreover, the methodological innovation lies in the dual analytical paradigms employed: the Household Food Insecurity Access Score (HFIAS) and Household Food Insecurity Access Prevalence (HFIAP) scores.

The food insecurity levels in North Aceh Regency are categorized as extremely, moderately, and slightly insecure, with varying color levels. Overall, the average food insecurity level fell within the moderate range. This issue needs to be a top priority for the Aceh Provincial Government, with various solutions designed to ensure that the North Aceh Regency becomes food secure.

The approach used to describe several research problems was carried out by identifying the food insecurity status of marginal rice farming households in North Aceh Regency, identifying and reviewing food insecurity instruments through three main aspects of FSVA in North Aceh Regency, and conducting a food security priority mapping analysis. The objectives of this study were to identify the food insecurity status of marginal rice farming households in North Aceh Regency, identify and examine food insecurity instruments in three main aspects of FSVA in North Aceh Regency, and conduct an analysis of food security priority mapping in North Aceh Regency, Aceh Province.

This study is anticipated to reveal findings wherein the dimensions of food insecurity can be identified according to food insecurity categories among marginal farmers in Aceh Utara Regency, Aceh

Province. Research on food insecurity is essential to support the achievement of food security at both regional and national levels. It is necessary to ensure the availability of sufficient, nutritious, and accessible food through sustainable natural resource management and technological innovations. Focused investigation of food insecurity will facilitate the development of high-resilience crops, thereby meeting the food needs of marginal farmers, particularly in Aceh Utara.

This research will contribute to stakeholders by providing insights that will enhance the welfare of marginal farmers whose livelihoods remain precarious. Mapping vulnerable areas by category will assist the government in formulating strategies to address the challenges in food security. Given the complex socioeconomic issues faced by farmers, resolving these challenges will significantly alleviate difficulties through effective rural development strategies, especially in the food security domain. An optimal strategy is reflected in villages with surplus food availability, thus ensuring that food is readily accessible to farmers.

METHODS

The North Aceh Regency was chosen as the research location for food insecurity, with marginal farmers as respondents. Two sub-districts and two research villages were selected, namely the Lhoksukon Sub-district, consisting of the Bhaktiya Sub-district, Tanjong Glumpang, and Arongan Lise Villages, based on purposive sampling. These sub-districts and villages have socioeconomic characteristics and a high level of dependence on the agricultural sector, as well as considering the food insecurity level of each selected sub-district and village. The scope of this research covers socioeconomic aspects, including household income factors of marginal farmers, age, education level of the head of the household, and number of dependents.

Marginal farmers in this study are defined as those who own agricultural land of ≤ 0.5 hectares (BPS Aceh Utara, 2023) and reside in Lhoksukon Sub-district specifically in Nga-Lt and Lhok Kareung Villages and Bhaktiya Sub-district, which includes Tanjong Glumpang and Arongan Lise Villages. The food insecurity indicator used in this study illustrates the condition of households that face difficulties in accessing sufficient and nutritious food. To measure food insecurity, this study employs the Household Food Insecurity Access Scale (HFIAS), which uses an ordinal scale consisting of four classifications: food secure (HFIAS Score 0–1), mildly food insecure (HFIAS Score 2–7), moderately food insecure (HFIAS Score 8–14), and severely food insecure (HFIAS Score 15–27). The independent variable (X1) represents the main and secondary incomes of marginal farmers in the most recent month, measured in Rp/kg. Land area (X2) refers to the agricultural land owned by marginal farmers (≤0.5 ha), whereas total rice production (X3) indicates the total amount of unhusked rice harvested during the latest planting season. The number of household dependents (X4) refers to family members supported by the marginal farmer and the age of the household head (X5) represents the age of the marginal farmer. The research data comprised primary and secondary data obtained from the sample and agencies related to the research object. Cross-sectional data were used based on the data collection period according to research needs. The research data collection techniques used were surveys, interviews, and structured questionnaires.

Three-stage purposive sampling was used to determine the number of research samples. The initial stages were sub-district selection, village selection, and respondent selection. The sample size was determined using proportional random sampling techniques (Arikunto, 2006). The research population was all marginal rice farmers in North Aceh Regency, in total 334 farmers from 4 villages (Tanjong Glumpang Village with 87 farmers, Nga-Lt Village with 93 farmers, Lhok Kareung Village with 87 farmers, and Arongan Lise Village with 73 farmers. A proportional random sampling technique was used to randomly determine the sample by considering the proportion and number of respondent farmers.

(1) The Household Food Insecurity Access Scale (HFIAS) method is a research instrument designed to gauge food insecurity categories based on nine statements pertaining to three core dimensions of food security, namely availability, access, and consumption, as stipulated by the National Food Agency (Badan Pangan Nasional, 2022). Developed by the Food and Nutrition Technical Assistance (FANTA) project with USAID support, the HFIAS classifies respondents' experiences into nine questions concentrated on three principal aspects: anxiety about food availability, reduction in the quantity of food consumed, and diminished dietary quality. A recall methodology was

employed for data collection, wherein participants recounted their food access experiences over the preceding four weeks. Conditional branching is utilized; if a respondent endorses a particular condition, they are directed to subsequent items within the nine indicator sequence. The frequency of such experiences is recorded on the following scale (Coates et al. 2007): 0 = never (no occurrence of the condition); 1 = rarely (1–2 times per month); 2 = Occasionally (3–10 times per month); 3 = Often (more than ten times per month). Quantitative analysis integrates indicators of food security, namely availability, access (affordability), and consumption (nutritional quality and quantity), to assess food insecurity in the North Aceh Regency. Additionally, spatial analysis utilizing geospatial food insecurity data was conducted to delineate vulnerability patterns across specific locales, such as Lhoksukon Village, Nga-Lt, Tanjong Glumpang, and Arongan Lise.

The measurement of food insecurity in the study area adopts Amartya Sen's theory (Dereux, 2001), which posits that food insecurity arises not only from food scarcity but also from failures in entitlements—individuals or households' (marginal farmers) capacity to access available food. Such access depends on initial endowments (land, labor, and skills) and exchange entitlements (production, trade, and assistance). The research variables encompass indicators of food security, namely anxiety over food availability; limited dietary diversity; and deficiencies in quantity, quality, and frequency of food intake due to economic constraints and low purchasing power.

(2) Household Food Insecurity Access Prevalence (HFIAP) is a method for classifying households into four categories of food insecurity severity based on HFIAS scores. These categories illustrate the prevalence or proportion of households that experience varying degrees of difficulty in accessing food. The quantitative formulation employed to assess the Household Food Insecurity Access Prevalence (HFIAP) is as follows (Coates et al. 2007):

$HFIAP_{category}$ = ∑ Households in category / ∑ Total of households

The category includes food security, mild food insecurity, moderate food insecurity, and severe food insecurity, classified based on the HFIAS scores: (1) Food Security Households with HFIAS scores of 0–1 indicated little or no difficulty in accessing food, both in quantity and quality; (2) Mild Food Insecurity. In households with HFIAS scores of 2–7, where anxiety over food availability or reduced quality begins, consumption is not significantly diminished; (3) Moderate Food Insecurity. Households with HFIAS scores of 8–14 experience reductions in both the quality and quantity of food, such as reduced meal frequency or portion sizes; (4) Severe Food Insecurity. Households with HFIAS scores of 15–27 face the highest level of insecurity, including days without food or going to bed hungry due to extreme scarcity.

Household Food Insecurity Access Score (HFIAS score)

The HFIAS method produces a total score based on nine questions from the HFIAS instrument, which states the level of food insecurity with the criteria that the higher the score, the higher the category of food insecurity, and vice versa, with the lower score results, the lower the level of food insecurity with the formula:

HFIAS Score = sQ1 +sQ2+ sQ3 +sQ4+ sQ5+ sQ6+ sQ7+ sQ8+ sQ9……..……(1)

Note: Q = HFIAS question i; sQ = score of question i
Household Food Insecurity Access Prevalence (HFIAP) covers the categories of food insecurity in marginal farming households, namely, food security, mild food insecurity, moderate food insecurity, and severe food insecurity, with the following food insecurity prevalence formula:

Formula for calculating the prevalence of food insecurity (Coates et al. 2007):

$HFIAP_{category}$ = ((∑ Households in category) / (∑ Total of households)) × 100% ……..……(2)

Description: Marginal farmer household category = food security, mild food insecurity, moderate food insecurity, severe food insecurity.

Food security priority mapping analysis is based on a weighting system that categorizes all villages in the two sub-districts of Lhoksukon and Bhaktiya into three priority categories. Priority 1 represents the highest level of food insecurity, Priority 2 represents moderate insecurity, and Priority 3 represents food security.

RESULTS

The North Aceh Regency has highly varied topography. Its area varies from the vast lowlands in the north. The lowlands in the North Aceh Regency are economically developed compared with the southern region, where the lowlands are dominated by agricultural land, including rice paddies and residential areas, and the coastline consists of saltwater fishponds. The highlands are dominated by plantations. Despite its vast agricultural potential, the agricultural sector has not yet been sufficiently developed to improve the welfare of the region's people.

North Aceh Regency is one of the regions in Aceh Province and is the largest producer of rice and paddy in 2023. This is an important part that has relevance and connection with the number of rice farmers in North Aceh Regency, reaching 128,344 people and farming households with as many as 92,628 heads of families. (BPS North Aceh, 2023). Demographically, most of the North Aceh Regency area has potential in the agricultural sector which is planted with most of its area with rice crops in several sub-districts. The agricultural sector is dominated by rice crops, with a rice field area of 68,643.43 hectares and a total rice production of 182,035.54 tons per year.

Analysis of Food Insecurity Indicators in North Aceh Regency

The determination of indicators and status of food insecurity in Lhoksukon and Bhaktiya Districts, North Aceh Regency, Aceh Province, uses several descriptive and cumulative statistical approaches, which are very complex and integrated between economic and social aspects, especially factors from each aspect, namely income, number of dependents, age of marginal farmers, and number of heads of households of marginal farmers in North Aceh Regency. The results of the study using the Household Food Insecurity Access Prevalence (HFIAP) method, which is a statistical approach, were used to determine the vulnerability category of marginal farmer households.

Data processing using the HFIAS and HFIAP methods shows that in Lhoksukon District, the majority of marginal farmer households are at a very food insecure level, with 27 people. This indicates that 51.93% of marginal farmer households experience an inability to access the availability of food needed according to sufficient quantity and quality, nutrition, safety, and adequate maintenance. This condition could be due to the influence of economic and social aspects in general, specifically economic limitations, namely the low income of marginal farmer households in Lhoksukon District, North Aceh Regency. This is in accordance with the BPS information about the income of rice farmers in the Lhoksukon District, which is around IDR5.23 million per year/capita, and in the North Aceh Regency IDR473,719, - / capita / month (BPS, 2025), limited resources and imbalances in obtaining food, and food supply instability.

These findings align with the measurements of food security indicators derived from the three dimensions of availability, access, and consumption. Adequate food availability, both in terms of quantity and quality, exerts a substantial influence on the food security conditions of a region. Moreover, availability is a pivotal factor that enhances the quality of human resources and is supported by sufficient nutritional and quantitative food supplies (Masniadi et al., 2020). This condition is corroborated by the majority of marginal farmers, who consistently reported experiencing anxiety regarding food sufficiency over the past 30 days. Such an apprehension reflects farmers' responses to limited access to food, which subsequently affects their consumption patterns, resulting in restricted dietary diversity, reduced meal frequency, and diminished food intake. These outcomes are further exacerbated by constrained economic circumstances, compelling farmers to curtail food consumption.

Meanwhile, marginal farming households in Baktiya District experienced moderate food insecurity of 54.17%, where the National Land Agency (BPN) stated that moderate food insecurity indicated several factors, such as insufficient food (energy), both in terms of the quantity of availability and for individuals or groups, such as marginal farming households in North Aceh Regency (National Food Agency, 2022) referring to the Food Insecurity Experience Scale (FIES). Moderate food insecurity in Baktiya Village (comprising Tanjong Glumpang and Arongan Lisa) signifies a low level of food security, as evidenced by data derived from HFIAS analysis. The predominant factor underlying this deficiency stems from the hunger condition indicator (Table 3; question no. 8), and 84 respondents reported sleeping in a state of hunger. This phenomenon indicates insufficient food availability precipitated by multiple determinants, including economic constraints, limited access to food, and inadequate supply.

Table 3. Response to marginal farming households

Questions about the HFIAS method (Last month data)?	Never	Rarely	Occasionally	Often	Total (%)
Have you ever experienced concerns about food sufficiency?	0	12	36	52	100
Have you ever eaten food that you didn't like?	11	29	43	17	100
Do you experience limited availability of food variety?	0	14	30	56	100
Have you ever shown an attitude of refusal when you were unable to consume a certain type of food?	19	44	37	0	100
Have you ever been in a situation where you ate a quantity that did not meet your needs?	23	17	45	15	100
Have you and your family ever reduced the frequency of eating out due to low purchasing power?	32	30	32	6	100
Have there been times when you and your family were unable to buy food due to financial circumstances?	62	21	16	1	100
Do you and your family go to bed hungry?	84	9	6	1	100
Are there any family members who are not eating because there is no food available?	76	13	11	0	100

All marginal farmer households in the Lhoksukan and Bhaktiya Districts experience high variations in food insecurity. Marginal farmer households experience mild food insecurity as much as 22% or 22 farmer households, 43% or 43 farmer households experience moderate food insecurity, and 35% or 35 farmer households experience severe food insecurity, which is indicated as marginal farmer households with the inability to access the availability of food needed both in terms of quantity and quality, 43% based on nine standard questions for determining the category of food insecurity Coates et al. (2007) show important indicators as a measure of the reflection of moderate food insecurity, namely households rarely and sometimes experience concerns about food sufficiency in farmer households, rarely and sometimes consume types of food that are less preferred, rarely and sometimes have a limited type of food menu, and the inability to refuse to consume less preferred food; sometimes, there are members of marginal farmer households who do not eat all day due to limited access to food.

A comparison of food insecurity with the severe food insecurity category of marginal farming households in the two sub-districts, namely, Lhoksukon Sub-district and Bhaktiya Sub-district, shows significant differences in various categories of food insecurity, especially the high food insecurity category, namely 51.93% and 16.67%. This indicates that access to three key aspects of the nine indicators food availability, food accessibility or affordability, and food utilization is very low. These indicators encompass socioeconomic factors, such as income and expenditure, nutritional status, and food consumption, as well as indicators of agriculture and the very low level of household mechanisms for farmers, particularly marginal farmers, in both sub-districts of North Aceh Regency, in addressing food insecurity.

Based on the HFIAS analysis, of the majority of marginal farmers in Lhoksukon and Bhaktiya Districts, 43% consumed foods they disliked due to their low income, indicating low household purchasing power. This reflects their habit of consistently and routinely consuming foods that they disliked. Furthermore, marginal farmers also experienced concerns about insufficient food intake, as research has shown that 52% of marginal farmers experienced food insecurity. This implies that farmers are accustomed to and anxious about experiencing food insecurity in their households. Using this method, the FSVA instrument also explains the results of the determination of the low variety of food types consumed. As many as 87% of marginal farming households stated that they had experienced limited consumption of various types of food, with a frequency of sometimes and often 56%. The condition of reduced food intake by farming households was also experienced with a frequency of sometimes (45%) and often (15%). This condition of reduced food intake by marginal farmers will impact food insecurity and reduce the nutritional security of farming households if it continues over a long period or in the long term. This statement is in accordance with the results of research by Fortunate et al. (2025) which shows that this study used the HFIAS method, the prevalence of household food insecurity access (HFIAP), food consumption scores and main components which were analyzed separately to analyze survey data from 305 households. The results showed that only 29.8% of households were

food secure, while the rest experienced mild (36.4%), moderate (27.9%), or severe (5.9%) food insecurity. Furthermore, 4.6% of the households consumed poor diets, and 23% of the sample households were on the border of food insecurity. Further results indicate that several variables significantly influence household food and nutritional insecurity, including non-agricultural income variables, irrigation access, livestock ownership, and household members.

Based on surveys conducted among marginal farmers, the scarcity of food is attributed to climate change. Climate variability disrupts agricultural productivity, thereby jeopardizing food security for marginal farmers in the North Aceh Regency, particularly in the four villages located in the Lhoksukon and Baktiya districts. Nevertheless, data spanning the past five years indicate an overall improvement in food security in the North Aceh Regency. This paradoxical trend can be explained by the occurrence of drought during the dry season and floods during the rainy season. Drought conditions, precipitated by the dysfunction of the Krueng Pase irrigation system at the end of 2020, have resulted in annual yield reductions (Distanpan Aceh Utara, 2024). Consequently, the findings of this study can serve as a reference for the Aceh provincial government to address the food security challenges. By identifying the determinants of food insecurity in Lhok Kareung, Nga-Lt, Arongan Lise, and Tanjong Glumpang villages, policymakers can devise targeted interventions, such as promoting drought-resistant crop varieties, innovating post-harvest storage technologies to extend shelf life, developing sustainable agricultural systems, and ensuring optimal food-service access to fulfill the nutritional needs of marginal farmers in the North Aceh Regency.

The global food insecurity situation, with 280 million people affected by acute hunger every day (World Bank, 2025), demonstrates a close link between food security and broader humanitarian crises. This situation can trigger internal and external conflicts between communities in various regions. The call for a unified global response demonstrates the need for efforts to mitigate the effects of food insecurity. The drivers of the food crisis include a variety of factors, such as uncontrolled climate change, displacement, violence, and economic instability, which severely impact food production and limit access to vital markets. Conflict and climate-related factors have become increasingly alarming in the recent decades. This creates environmental conditions with high levels of food insecurity as an early symptom and factor of increasingly widespread humanitarian challenges in the future, and will have a negative impact if not anticipated as well as possible globally for future generations.

Mitigation of food insecurity impacts in North Aceh Regency is imperative to avert further, widespread, and persistent food insecurity across other localities. Although the four studied villages (Lhok Kareung, Nga-Lt, Tanjong Glumpang, and Arongan Lise) presently exhibit moderate to low levels of food insecurity, failure to implement early mitigation measures risks exacerbating economic and social vulnerabilities, particularly within the food sector. Environmental degradation not only precipitates ecological problems, but also intensifies economic and social hardships. Southeast Asia, which is highly susceptible to climate change, requires sustainable mitigation strategies. Moreover, the socioeconomic dependence of communities on agriculture increases their exposure to climate-related risks (Ministry of State Secretariat of the Republic of Indonesia, 2025).

The analytical mapping of food security and vulnerability, based on the ratio of agricultural land area to population (479 points) and the ratio of the lowest-income population (81 points), underscores the correlation between these indicators and the observed food insecurity in the aforementioned villages. The nine-statement HFIAS framework, encompassing availability, access, and consumption, revealed causal interlinkages among these dimensions. Consequently, the local government of the North Aceh Regency has instituted sustained food security initiatives, focusing on its availability, access, and utilization. Strategies to enhance availability include expanding arable land, augmenting production capacity, and developing non-wetland agricultural potential. Access-focused mitigation entails improving food distribution channels and strengthening social safety nets for impoverished households. Infrastructure-related mitigation, particularly addressing water scarcity, is pursued through the provision of basic infrastructure such as clean water systems (FSVA North Aceh, 2023).

Food shortages can lead to negative and detrimental economic and social outcomes for marginalized farmers. This can occur because of crop failure, low productivity, declining product quality, unstable supply chain issues, threats to the sustainability of businesses,

and the well-being of marginalized farming families, particularly in the North Aceh Regency. This finding aligns with those of Evan et al. (2025). In his research, he explained the serious impact of food insecurity on land use changes that occurred in 2013 and 2020 in 25 low-income and middle-income countries. The author uses the theory of land use change, especially the use of land for agricultural intensification, land rent theory, and changes in government structure. The study found that food insecurity led to a 4% decrease in food production, 3% decrease in planted area, and 4% increase in forest clearing. Furthermore, this study found that drought leads to food insecurity, which in turn leads to increased land use. Meanwhile, food insecurity caused by conflict factors or variables has a greater impact on population and nighttime lighting. Another impact of food insecurity is the increase in population migration to urban areas due to the push for local migration from rural to urban areas.

To answer the second objective of the study based on food insecurity instruments through three main aspects of FSVA (9 food insecurity instruments, Coates 2007) produced responses from marginal farmer households that had large percentage variations for all instruments. Instrument 3 of the main aspects of FSVA explained that marginal farmer households in the two sub-districts, namely Lhoksukon and Bhaktiya, 56 people (56%) stated that they often experienced conditions of unavailability of varied foods. 45 people (45%) stated that they sometimes experienced situations in which the quantity of food consumed did not match the wishes and expectations of the farming household. In other words, farmers sometimes experience food shortage. Furthermore, 84 participants (86%) had never experienced going to bed hungry.

Several studies have shown that food insecurity occurs in many regions of Brazil. Based on data analysis using Food and Animal Husbandry (FIES) and multinomial regression, 63% of female farmers experienced food insecurity, 24% reported mild food insecurity, and the remaining 13% experienced moderate food insecurity. The impact of climate change, which increases the risk of food insecurity, influences female farmers' responses to frequent droughts on their farms. Adaptability due to repeated exposure to drought in the region, the advanced age of farmers, high land rents, and low levels of participation in farmer associations means that farmers as a whole tend to experience moderate vulnerability. In line with previous research (E.J. P'erez et al. 2025) through the results of his research aimed at examining the relationship between the use of community-based social assistance programs and the reduction in household food insecurity among new food assistance recipients in Quebec, Canada, found that the trend of decreasing household food insecurity with multiple food procurement practices (multiple AFS) was higher than that of households that only used existing food availability. Fikiru et al. (2024), in their study, stated that based on household food calorie intake, 45.5% of households were in a condition of food insecurity, with milk contract participants and non-participants accounting for 31.21% and 68.79% of these households, respectively. The results of the study indicated that most of the marginal rice farming households in North Aceh Regency were classified as moderately food insecure, while the rest were categorized as very food insecure and slightly food insecure, with percentage values of 43%, 35%, and 22%, respectively. This indicates that compared to the study conducted by Fikiru et al. there are differences in terms of variables, methods, and analytical models used to examine the categories of food insecurity across different research locations. The comparison of research findings shows that the percentage of marginal farming households categorized as moderately to severely food insecure amounted to 78 in the North Aceh Regency, with 22 households classified as mildly food insecure, 43 households as moderately food insecure, and 35 households as severely food insecure. This suggests a gap between the implementation of food security programs and the actual conditions observed in the research area, highlighting the need to improve food access among marginal farming households.

Dipak and Bishwajit (2024), in their study, stated that overall, 26.1% of respondents reported having reduced meal portion sizes, 5.7% reported that someone in their household went hungry, and 5.9% reported running out of food. Participants from the Scheduled Caste had a higher risk of reduced portion size (RR = 1.54; 95% CI = 1.26–1.89) and food shortage (RR = 1.57; 95% CI = 1.01–2.45). Male sex was associated with a lower risk of a reduced portion size (RR = 0.82; 95% CI = 0.72–0.93). Compared with participants from Rajasthan, those from other states, such as Uttar Pradesh, Bihar, and Madhya Pradesh, were found to have a significantly higher risk of experiencing all three indicators of food insecurity. For instance, participants from Bihar had the highest risk of reduced portion size (RR = 3.14; 95% CI = 1.95–5.06), feeling hungry and not eating

(RR = 3.14; 95% CI = 1.95–5.06), and running out of food (RR = 2.79; 95% CI = 1.66–4.68).

The results of the study indicate that when designing food security programs in rural India, it is important to consider factors such as gender, household size, religion, occupation, and region. In addition, non-farming households were found to face a relatively high risk of food insecurity, emphasizing the need for targeted interventions and support to address household vulnerability. This study focuses on the design of food security programs based on gender and meal portion size. This differs from the research conducted in the North Aceh Regency, which focuses on identifying categories of food insecurity levels based on factors such as age, income, and land area owned by marginal farmers.

Food insecurity not only stems from economic or social factors but can also be influenced by climatic conditions. This is consistent with the findings of Palupi (2025), who explained that adverse weather conditions frequently occurring in agricultural regions contribute to a higher prevalence of food insecurity among female farmers, making the agricultural sector more vulnerable to climate change. The difference in her study lies in the quantitative survey method involving 150 female farming households, specifically focusing on female farmers as the research sample. Conversely, the study conducted in North Aceh Regency used marginal farmers with relatively little land ownership as the research sample. Another difference lies in the research focus, where Palupi's study emphasized climatic factors, particularly food insecurity caused by repeated drought exposure in the agricultural areas of Sleman Regency. As a result of recurring droughts and the financial burden of land rent, female farmers tended to experience food insecurity across three categories: 63% faced severe food insecurity, 24% moderate, and 13% mild.

The World Bank provides three main priorities for the agriculture and food sector in 2025: coordinated action mobilization activities for food and nutrition security by expanding partnerships, expanding global environmental recovery in the agricultural sector in the form of agricultural intensification efforts, expanding agroforestry, and focusing on efforts to return to integrated agriculture with nutrition and sustainable healthy diets (World Bank, 2025). The purpose of this program is to improve the status of food insecurity to food security for the global community through sustainable agriculture so that nutrition and healthy eating patterns can create human resources that have high competence and can survive in a protected environment. Furthermore, the survey results show a downward trend obtained using the CB-SAPs method and food donation variables (RR: 1.30; 95%C1:1.03, 1.62), and Multiple AFS shows a decrease in food insecurity of recipient households in Quebec, Canada.
A composite analysis or analysis of food vulnerability categories based on priority shows that Lhok Kareung Village and Nga Lt Village, Lhoksukon District are included in priority composite 1 with a very vulnerable food category based on the results of the Food Security and Vulnerability Map (FSVA) analysis showing a value of 0.23%, indicating a village with severe food insecurity. Meanwhile, 68 villages, including Rambong Dalam, Krueng Lingka Barat, Alue Buya, and Tanjong Glumpang villages, were included in priority composite 2 in the food insecurity category. There are nine villages in Lhoksukon District (Alue Abee, Alue Itam Reudeup, Buket Krueng, Alue Itam Baroh, Teupin Kebeu, Seneubok Dalam, Lhok Seuntang and Buket Sentang, Abeuk Leupen) and four villages in Bhaktiya District (Ujong Dama, Ceumpedak, Alue I Tarek, and Alue Geudang) based on FSVA results, with a value of 2.82% indicating villages with moderate food insecurity status. The composite map of research results in Lhoksukon and Bhaktiya Districts, North Aceh Regency, Aceh Province, explains the vulnerability to food insecurity in the region. These results were obtained based on weighting, in which villages in the two sub-districts were grouped into three priorities. Priority 1 represents the highest level of food insecurity, while Priorities 2 and 3 represent relatively food-secure priorities. The results are shown in the following figure, which shows the percentage of villages based on priority.

There are various ways to overcome the problem of food insecurity in each composite area in Lhoksukon and Bhaktiya Districts, including by providing incentives to marginal farming households so that it will increase the motivation of farming households to try to revive their farming businesses so that it will improve the welfare of farming households and will be able to increase farmers' purchasing power and farmers will be able to meet the food needs of their families. Another way to achieve food security for marginalized farming households is to increase the area of land under

food crops, including rice and corn. This shifts the food insecurity status of marginal farmers to a better category than their previous status. This is in line with the discussion by Ratna et al. (2017) on the impact of the policy of expanding rice and corn land areas on food security in Indonesia, where the analysis was conducted using a CGE model based on SAM data and the 2008 Indonesian input–output table. The results show that increasing rice and corn land area by 4-10% will increase rice production by 36.21-87.93%, with corn remaining relatively stable. However, corn yield tended to decline by 0.55%.

Habtamu (2024) stated that a large proportion of the household population experienced moderate to critical food insecurity, amounting to 52.07%. In general, households living in other zones experienced similar levels of food insecurity and slight improvements. The transitions occurring in other regions indicate that high levels of food insecurity in other areas are shifting, particularly in northern and southwestern Ethiopia.

Managerial Implications

The findings indicate that most marginal farming households in the two districts continue to experience inadequate dietary variety and insufficient food quantities. This underscores the need for policies that guarantee diverse food supplies in amounts aligned with community needs and expectations. Furthermore, the study provides insights into the interrelations among food security indicators availability, access, and consumption and the internal factors affecting marginal farmers in Lhoksukon, Nga-Lt, Arongan Lise, and Tanjong Glumpang villages.

The study also identifies weaknesses and threat factors faced by marginal farmers, which reflect socioeconomic conditions characterized by low welfare levels, reduced purchasing power, and consequently inadequate consumption of nutritious food. These threat factors include deteriorating health conditions and malnutrition, which are likely to impair the future quality of human resources. These insights highlight the importance for policymakers and program implementers to consider the interconnected dimensions of food security in designing comprehensive interventions.

CONCLUSIONS AND RECOMMENDATIONS

Conclusions

The results of the study indicate that the majority of marginal rice-farming households in the North Aceh Regency are classified as moderately food insecure (43 %), while substantial proportions fall into the categories of severe food insecurity (35 %) and mild food insecurity (22 %). Complementary data derived from the Food Security Vulnerability Analysis (FSVA) revealed that 56 respondents (56 %) of marginal farming households in Lhoksukon and Bhaktiya sub-districts frequently encountered conditions of insufficient dietary diversity, and 45 respondents (45 %) reported occasional discrepancies between the quantity of food consumed and household expectations, signifying intermittent shortages in portion size. Encouragingly, 84 respondents (86 %) affirmed that they had never experienced hunger during the reference period.

Villages such as Lhok Kareung (Lhoksukon District) and Tanjong Glumpang in Bhaktiya District are designated Priority 1 (very food-insecure) and Priority 2 (food-insecure), respectively. The research underscores that the causes of food insecurity vary across villages; consequently, remedial measures must be context specific. Hence, it is imperative for each village, particularly within the Lhoksukon and Bhaktiya Districts, to adopt effective and efficient food policy interventions so that marginalized farming households can attain improved living conditions and sustainable fulfillment of their food needs.

Recommendations

A recommended intervention to enhance food security is the implementation of policies that ensure diverse food supplies in quantities commensurate with community needs, particularly for marginal farming households in Lhoksukon and Bhaktiya, where most people derive their livelihoods from agriculture. Comprehensive food security programs should be directed toward these marginal communities.

Based on the prioritization of food security determinants, mitigation strategies should address the primary causes of insecurity in these districts, including: (i) Food availability constraints, where production capacity fails to meet consumption demand, which can be reduced through increased productivity

and diversification of food consumption; and (ii) Limited food access, where low purchasing power resulting from poverty can be improved by central and regional governments through the provision of employment opportunities and facilitating easy access to food markets. Systematic implementation of these measures is expected to improve the food security conditions of marginal farming households in Lhoksukon and Bhaktiya Districts, North Aceh Regency, Aceh Province.

Despite the contributions of this study, the analysis did not examine specific food security indicators in greater detail. Therefore, further research is recommended to integrate food policy frameworks into regional governance regulations. While several studies have focused on mitigation efforts based on internal farmer-level variables, they often overlook external dimensions essential for a systematic approach, such as the development of superior crop varieties, sustainable food security strategies through partnerships, and the dissemination of climate change adaptation information. These components constitute an interdependent support system in which each variable interacts with and reinforces the others.

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