Research Paper

Sociodemographic Factors and Policy Implications for Improved Food Security

Tri Wahyu Cahyono[1*] and Hiromi Tokuda[2]

[1,2]*Department of Plant Production Science, Graduate School of Bioagricultural Sciences, Nagoya University, Japan*

***) Correspondence author**: cahyono.tri.wahyu.r7@s.mail.nagoya-u.ac.jp*

Abstract

Ensuring food security is a pressing challenge facing East Kalimantan, and practical solutions are necessary. With the impending relocation of Indonesia's capital to this region, it's crucial to evaluate the area's food security in light of projected population growth and economic shifts. Prior to the new capital city project, it's essential to understand East Kalimantan's socio-economic factors to develop policies that strengthen food security for the future. This research uses logistic regression to analyze data from the Food Insecurity Experience Scale (FIES) module of the 2021 National Socio-Economic Survey (Susenas-BPS). The results show that 14.75% of households experience food insecurity, while 85.25% maintain food security. Factors such as education, family size, land ownership, marital status, employment, residence, and retirement security influence food security status significantly. However, age, gender, and home ownership have little impact. Notably, agricultural workers are more likely to experience food insecurity, while education and land ownership correlate with higher food security. Additionally, larger families are more vulnerable to food insecurity.

Keywords: food security; FIES; socio-demographic factors; East Kalimantan.

1.   Introduction

Food security stands as a fundamental pillar of societal welfare, ensuring access to adequate, affordable, nutritious, and culturally appropriate sustenance while honoring individual beliefs and values. Indonesian Law No. 18 of 2012 underscores pivotal principles prioritizing sufficient food supplies, stable pricing mechanisms, and convenient access to foster healthy and productive livelihoods. Typically, research on food security status and its sociodemographic determinants is conducted at the national level. However, with the forthcoming relocation of the National Capital to East Kalimantan, extending this inquiry to the regional level becomes imperative. East Kalimantan, designated as Indonesia's future capital, presents a distinctive case meriting specific attention due to its socio-economic challenges and abundant natural resources. Thus, scrutinizing East Kalimantan's food security status and the sociodemographic factors influencing it will offer critical insights for fortifying food security and promoting regional development. By conducting research at the regional level, policymakers can aptly tailor interventions and strategies to address East Kalimantan's unique needs and challenges, ensuring a resilient and sustainable food supply for its populace in the years ahead.

East Kalimantan, situated in the eastern part of Kalimantan Island, spans an area of 120,000 km², with a population of merely 3.77 million, resulting in a population density of 30 people/km². Predominantly reliant on mining and quarrying, the region has witnessed limited growth in these sectors in recent years, necessitating the introduction of new economic initiatives. The relocation of the capital city is anticipated to stimulate migration to East Kalimantan and catalyze the development of novel industries. As Indonesia is a diverse archipelago nation with distinct demographics and geography, the capital relocation endeavors to bridge development disparities and foster more equitable economic growth nationwide (Government of Indonesia, 2022).

The impending relocation of the national capital will precipitate a surge in population, necessitating proactive measures for food security in East Kalimantan. As per the Decree of the Head of the Authority: 01/SE/Kepala-Otorita IKN/X/2022, population growth in the National Capital Region is projected to escalate until 2045. Initially estimated at 488,409 individuals between 2022 and 2024, the population comprised approximately 335,073 dependents and workforce residents. Subsequently, 153,000 inhabitants settled within the capital's boundaries. Projections indicate a population of 1.28 million by 2025-2029, escalating to 1.45 million in 2030-2034, and reaching 1.67 million within the subsequent five years. At its zenith, the population is forecasted to peak at 1.91 million between 2040 and 2045 (Otorita IKN, 2022). Given the envisaged population upsurge and ensuing shifts in consumption patterns, it is imperative to ensure the sustainability of East Kalimantan's food system to meet the needs of all its inhabitants.

Although recent reports suggest a relatively high food security index for East Kalimantan, utilizing the Global Food Security Index (GFSI), delving into micro-level impacts and outcomes remains essential. This entails scrutinizing health and socio-economic ramifications at the individual and household levels, recognizing that food insecurity encompasses not only availability but also demand and access influenced by socio-economic conditions. Factors such as gender, ethnicity, and education can impede participation in food system decision-making, exacerbating food insecurity. Thus, addressing these socio-economic determinants is pivotal in attaining Sustainable Development Goal (SDG) number 2 and advancing sustainable agriculture towards the "Zero Hunger" objective. Consequently, comprehending the factors influencing food security or insecurity is paramount (Grimaccia & Naccarato, 2019).

In Figure 1, the National Food Agency recently disseminated a comprehensive report detailing the prevailing state of food security across various regions in Indonesia. The report underscores East Kalimantan's high food security index range, as indicated by the GFSI-based food security index. Nonetheless, this index has been adjusted to enhance data accessibility at the provincial and district/city levels, facilitating the identification of disparities in food security among different regions and the formulation of tailored policies to address each region's specific needs (Badan Pangan Nasional, 2022).
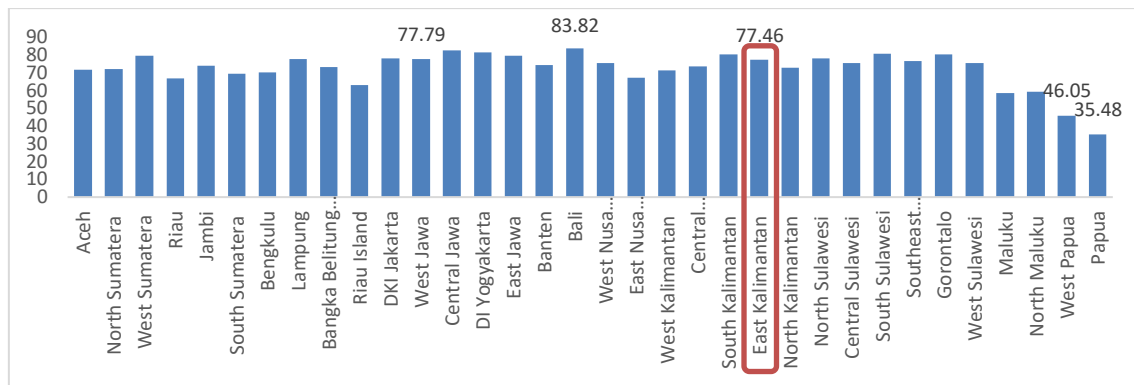
Figure 1. *Food Security Index in Indonesia, 2021* (Badan Pangan Nasional, 2022).

Although the GFSI is commonly utilized to assess national food security, the inclusion of outcome indicators is imperative for achieving a comprehensive understanding. Additionally, recognizing the micro-level ramifications of food insecurity, encompassing health and socio-economic consequences for individuals and households is crucial (Izraelov & Silber, 2019). By thoroughly scrutinizing these factors, improvement endeavors can be customized to address the distinctive needs of each community. Furthermore, it is essential to acknowledge that hunger stems not only from food availability but also from socioeconomic conditions that influence the demand and control over food for consumption by society and the state (Burchi & De Muro, 2016). Societal structures such as gender, race, and education can impede individuals from participating in food system decision-making, thus perpetuating food insecurity. These factors often transcend an individual's control (Collins, 2022).

Securing access to food is paramount for economic stability and national resilience. Various impediments may hinder this access, including inadequate national food availability, subpar food distribution, and low-quality, and unaffordable food prices. Achieving food security at the household level necessitates ensuring that every member has access to sufficient food to maintain a healthy and active life. At the very least, food security entails providing nutritious, safe, and socially acceptable food. Unfortunately, food insecurity persists in certain rural areas where individuals require assistance in producing or procuring adequate food. As food and agricultural systems increasingly commercialize, food producers, such as small-scale farmers, may encounter food insecurity due to market and policy pressures (Abdoellah et al., 2020).

Ensuring food security is intrinsically linked to local development and human resources. To effectively gauge the level of food security, assessing the food security of individual households, instead of solely relying on national or provincial evaluations, is imperative. One effective method for measuring food security is the Food Insecurity Experience Scale (FIES), devised by the Food and Agriculture Organization (FAO). FIES establishes experience-based metrics to assess the severity of individual or household food insecurity derived from individuals' direct responses to questions regarding their access to adequate quality and quantity of food. FIES represents the first experience-based food insecurity measurement system producing formally comparable measures of desired measurement properties across numerous countries. These steps enable a micro-level analysis of the relationship between food insecurity status and other individual or household characteristics, thereby contributing to Sustainable Development Goal (SDG) number 2 by measuring food insecurity levels and facilitating inter-regional comparisons (FAO, 2016).

Food insecurity presents itself as disruptions in food intake resulting from inadequate financial means or resources, thereby impacting the severity of household food security and its associated health outcomes. Indicators of food insecurity encompass stress due to concerns about food access, micronutrient deficiencies, being underweight, and experiencing hunger (Saint Ville A et al., 2022). The measurement of households' ability to access food, a crucial facet of food security, poses significant challenges in objective quantification. The Food Insecurity Experience Scale (FIES) comprises eight items contributing to global food insecurity monitoring indicators, facilitating the assessment of food security status at a country or regional level (Cafiero et al., 2018).

While national-level studies on household food security and sociodemographic characteristics have been conducted (Amrullah et al., 2019; Lujabe et al., 2022; Obayelu et al., 2021; Smith et al., 2017), there is a need for increased detailed research at the regional level (Pakravan-Charvadeh et al., 2022). Indonesia, being a vast archipelago with diverse geography, culture, and economic disparities across its regions, requires tailored approaches. What may effectively ensure food security in one area may not be applicable or feasible in another due to variations in climate, infrastructure, agriculture, and socio-cultural factors. Regional research provides more precise and applicable data that accurately reflects ground realities, thereby empowering policymakers to make informed decisions. For instance, while national-level data indicates that the education level of the head of the family influences the family's food security status (Amrullah et. al., 2019), research conducted in Jakarta, Bandung, and Surabaya suggests that education level did not have a significant impact (Kharisma & Abe, 2020).

 Multiple studies have shown that various factors are crucial in determining household food security, including the geographic location of the household (Ali et al., 2016; Ganpule et al., 2023), type of occupation (Antara et al., 2023; Ogundari, 2017), age and gender of the head of the household (Ogundari, 2017; Omidvar et al., 2019), their education level (Amrullah et al., 2019; Smith et al., 2017), family size (Lujabe et al., 2022), marital status (Grimaccia & Naccarato, 2019), and ownership of assets such as houses (Pakravan-Charvadeh et al., 2022; Saint Ville A et al., 2022), land (Naipunu & Kadir, 2023), and social security (Sutikno & Budiasih, 2022). Utilizing these factors in the analysis of regional-level data is essential for a better understanding of food security statistics at the regional level in Indonesia. Thus, studying food security at the regional level is vital for formulating comprehensive strategies to address food insecurity in Indonesia. Understanding the socio-economic factors in East Kalimantan before the new capital city project is crucial for developing policies that strengthen food security for the future. It lays the groundwork for addressing pre-existing challenges, anticipating potential impacts, making informed decisions, and leveraging local capacities to ensure resilient and sustainable food systems in East Kalimantan and beyond.

Leveraging the FIES enables a nuanced understanding of household-level food security while analyzing socio-economic variables. Family size, age, gender, education level, occupation, income, and marital status influence households' resource allocation, including food. Ensuring equitable food availability across all social and demographic groups is paramount (Herlina et al., 2020). Economic factors shape household food demand in East Kalimantan through income, price fluctuations, and socio-demographic factors (Cahyono & Tokuda, 2023). Sociodemographic data assists in identifying food access and consumption disparities among various groups. Considering these factors in measuring household food security can yield more accurate and pertinent information for crafting effective policies to enhance food security. This study analyzes the socio-economic factors affecting East Kalimantan's food security, providing policymakers with valuable insights to inform decision-making. By using national data as a foundation, policymakers can make informed decisions and implement measures to improve the region's food security landscape.

2.   Methods

This research paper analyzes the 2021 SUSENAS dataset from East Kalimantan Province, which was collected by the Central Statistics Agency. The dataset incorporates the Food Insecurity Experience Scale (FIES) module, which evaluates food insecurity at the individual level, considering respondents' experiences along with various social, economic, and demographic factors. The study is conducted on a sample size of 5,944 household heads. Logistic regression analysis, utilizing the STATA program, is employed to ascertain the influence of several household socio-economic factors on food security status in households within East Kalimantan.

The Food Insecurity Experience Scale (FIES) serves as an indicator quantifying food access on an individual or household level by assessing the severity of food insecurity through community responses to inquiries concerning barriers to acquiring adequate sustenance (Ballard et al., 2014). Formulated to gauge food insecurity, the FIES evaluates individuals' direct encounters with food accessibility as documented in surveys (Cafiero et al., 2018; Frongillo, 2013). In 2012, Indonesia enacted Law Number 12 pertaining to Food, which delineates food security as the ability of a nation or region to furnish all its inhabitants with ample safe, and nutritious sustenance. This definition encompasses both routine circumstances and adversities such as natural calamities and economic downturns. This study employs

said definition as a framework to scrutinize Indonesia's efforts in ensuring universal food security, regardless of the prevailing level of food insecurity. The investigation is focalized on the nation's food security status and instances of food insecurity. Prospective efforts to ensure food security necessitate the provisioning of sufficient quality sustenance tailored to individual life stages and sustainable livelihoods, informed by experiences and repercussions of food insecurity (Hendriks, 2015).

Table 1 presents the proportions of respondents affirming each FIES item. Notably, Q4 (item label omitted) exhibited a lower affirmation rate compared to Q5 (item label omitted), implying a requisite for enhanced consistency in respondents' reporting of their experiences. Consistency, in this context, denotes consistent affirmation of less severe items subsequent to a positive response to an item. The survey's conduct in Indonesian raises the prospect of respondents necessitating clarification on the inquiries, thereby mandating a review of the Indonesian translation to ensure its fidelity. Additionally, it merits emphasis that FIES measurements in Indonesia hold validity when employing the Rasch Model (Herlina et al., 2020).

Drawing from FIES survey findings, households encountering food insecurity, as delineated in Table 1's FIES survey questions, are evident. In East Kalimantan in 2021, 1.5% reported experiencing hunger, and 1.14% disclosed foregoing meals throughout the day. The severity of food insecurity, as per FIES, is contingent upon individual or household experiences. Respondents' encounters regarding sustenance access, hindered by fiscal constraints or inadequate resources over a span of 12 months, serve as the basis for ascertaining food insecurity. Individuals enduring severe food insecurity confront food depletion, hunger, and in extreme cases, endure prolonged periods without sustenance.

Table 1. FIES Data in East Kalimantan, 2021

No.	Questions	Label	n	%
	During the last 12 months, was there a time when, because of lack of money or other resources:			
Q1	You were worried you would not have enough food to eat?	Worried	795	13.37
Q2	You were unable to eat healthy and nutritious food?	Healthy	427	7.18
Q3	You ate only a few kinds of food?	Few food	391	6.58
Q4	You had to skip a meal?	Skipped	139	2.34
Q5	You ate less than you thought you should?	Ate less	253	4.26
Q6	Your household ran out of food?	Runout	150	2.52
Q7	You were hungry but did not eat?	Hungry	98	1.65
Q8	You went without eating for a whole day?	Whole day	68	1.14

Note: Data processed from Susenas 2021.

2.1 Analysis

A logistic regression analysis was conducted to investigate the influence of socioeconomic factors on household food security. The study aimed to ascertain whether households were classified as food-secure or food-insecure. Such insights are instrumental in guiding policymakers in the formulation, implementation, and assessment of programs aimed at enhancing food security and community well-being, as mandated by Law No. 12 of 2012 pertaining to Food. Let y_i represent the binary variable, taking the value of 1 when household *i* is categorized as having food security status and 0 otherwise. The probability of observing y as 1 can be denoted as:

$$P(y = 1|x) = P(y = 1|x_1, x_2, \cdots, x_{m,} \cdots x_M) \tag{1}$$

where x_k represents the explanatory variables, encompassing individual characteristics such as residence, occupation, age, gender, education, family size, marital status, homeownership, land ownership, and possession of pension insurance. Based on this, the binary logistic regression model can be formulated as:

$$ln\left(\frac{p(y)}{1-p(y)}\right) = x_m\beta_m \qquad (2)$$

The left-hand side of Equation (2) denotes the log-odds, also known as the logit, representing the logarithm of the odds ratio—the relative ratio of the probability of an event occurring to that of it not occurring. This binary logistic regression model illustrates the linear relationship between predictor variables and log odds. The probability of being food-secure is expressed as a ratio, with the numerator representing the probability of being food-secure and the denominator indicating the probability of being food-insecure. Notably, the odds range from 0 to ∞ since the probability ranges from 0 to 1 (Chatterjee & Simonoff, 2013).

To determine the probability of a change in the dependent variable resulting from a one-unit change in the independent variable, odds ratio analysis is utilized, employing the formula:

$$OR = e^{\beta_m} \qquad (3)$$

In Equation (3), the odds ratio (OR) is represented by the exponential value (e). The socioeconomic variables employed in this study, as well as in prior research, are detailed in Table 2. In binary logistic regression, a single intercept estimate is produced, while the coefficients/slopes of independent variables are denoted by β_m —the logistic regression coefficients, also referred to as parameter estimates (Garson, 2014). The data utilized in this research were sourced from the National Socio-Economic Survey (Susenas) conducted by the Central Statistics Agency (BPS) to gather information regarding the social and economic conditions of individuals in East Kalimantan. Susenas focuses on collecting household information, including demographic characteristics, employment status, education level, and economic circumstances of household heads.

This study examines various factors influencing household food security. The independent variables analyzed comprise a dummy variable for place of residence (with urban as the variable of interest and rural as the reference category), a dummy variable for type of employment (with non-agricultural as the variable of interest and agricultural sector as the reference category), a dummy variable for the age of the household head (with less than 25 years as the reference category, and 25-40 years, 41-65 years, and more than 65 years), a dummy variable for gender (female as the reference category), a dummy variable for the education level of the household head (with no schooling as the reference category, and elementary school, middle school, high school, and college as the variables of interest), a dummy variable for family size (with 5-8 people and more than 9 people as the variables of interest and 1-4 people as the reference category), a dummy variable for the marital status of the household head (with married as the variable of interest and single/divorced as the reference category), a dummy variable for homeownership (with not owning a house as the variable of interest and owning a house as the reference category), a dummy variable for landownership (with not owning land as the variable of interest and owning land as the reference category), and a dummy variable for possession of pension security (with not having pension security as the reference category).

Some of these variables have been frequently utilized in prior research, thereby serving as reference points when discussing the current study. It is well-established that rural households typically exhibit higher levels of food insecurity compared to their urban counterparts (Amrullah et al., 2019; Grimaccia & Naccarato, 2019). Agricultural workers engaged in small-scale enterprises often contend with low incomes, predisposing them to food insecurity (Antara et al., 2023). Concerning the factor of age, older individuals in regions characterized by higher income levels tend to face comparatively lower food security, whereas in areas with lower income levels, age differentials do not significantly influence food security status (Omidvar et al., 2019). Women, particularly those heading households, are disproportionately susceptible to food insecurity. Despite their pivotal role in global food production, women encounter numerous inequalities, including limited access to sufficient food and fewer options for nutritious choices (Ganpule et al., 2023). Individuals with higher levels of education, enhanced social networks, increased income, and stable employment are less prone to experiencing food insecurity. For

instance, individuals with only a basic education exhibit a 14.6 percentage point higher likelihood of encountering food insecurity than those holding a bachelor's degree (Smith et al., 2017).

Household food security intricately intertwines with socioeconomic status and demographic attributes. Both the number of household members and the gender of the household head emerge as pivotal factors influencing food security. Households with larger membership and those headed by females are more predisposed to experiencing food insecurity. Demographic and socioeconomic variables play pivotal roles in determining household food security, offering invaluable insights to decision-makers in formulating pragmatic solutions to tackle this issue (Lujabe et al., 2022). Furthermore, distinct geographic regions harbor unique determinants of food insecurity (Pakravan-Charvadeh et al., 2022). Therefore, it is imperative to conduct regional assessments of household food security, such as in East Kalimantan, to identify the key socio-demographic factors influencing food security.

3.   Results and Discussion

A survey conducted by BPS (Susenas) in the area utilizing the FIES category revealed that out of 5,944 households, 85.25% were deemed food secure, while 14.75% were classified as food insecure. These findings underscore the persistence of barriers hindering certain communities from accessing adequate food. It is imperative to undertake further measures to address food insecurity, given its potential to engender discomfort and hinder food accessibility for households in East Kalimantan. Moreover, the food security categorization is predicated on the Ideal Food Pattern (Pola Pangan Harapan/PPH). In 2021, East Kalimantan Province attained a PPH score of 83.40%, indicating a diverse and nutritionally balanced food consumption level. This statistic underscores the imperative of focusing on dietary diversity and nutritional balance in the daily consumption patterns of East Kalimantan's populace to attain optimal food security (BPS Kaltim, 2022a).

Analyzing the statistics from Table 2, it is evident that the majority of households, comprising 60.16%, reside in urban areas, with the remaining 39.84% situated in rural locales. Regrettably, the data also reveals that 12.30% of urban households and 18.45% of rural households are classified as food insecure—a worrisome trend consistent with the broader Indonesian context, wherein rural families face heightened vulnerability to food insecurity and economic instability compared to their urban counterparts (Amrullah et al., 2019). Table 2 provides a comprehensive summary of sociodemographic characteristics alongside household food security status. Households engaged in the agricultural sector exhibit a higher susceptibility to food insecurity compared to those in other sectors. While 87.43% of households across various sectors maintain food security, only 80.16% of agricultural households can affirm the same. Furthermore, larger families are predisposed to food insecurity, with 85.82% of families comprising one to four members reporting food security, compared to 84.3% of families with five to eight individuals. However, only 76.32% of families with more than nine members can assert food security.

Notably, families with pension security exhibit the highest percentage of food security at 94.41%. Conversely, households where the head lacks formal education exhibit the lowest rate of food security at 72.90%. It is crucial to acknowledge that every socio-economic factor influencing family food security harbors instances of food insecurity. The provided data indicates that several individuals experience food insecurity across all education levels. Even among those with higher education, the prevalence of food insecurity tends to decrease, albeit a minor proportion persists. For instance, within the "University" category of the "Education" variable, 6.36% of individuals still grapple with food insecurity—a comparatively lower figure vis-à-vis groups with lower education levels. Nonetheless, this underscores the multifaceted nature of factors contributing to household food security.

Table 2. Status of Household Food Security in East Kalimantan, 2021

Variable	Category	Total (%)	Percentage	
			Food Secure	Food Insecure (FIES)
Residence	Urban	60.16	87.70	12.30
	Rural	39.84	81.55	18.45
Occupation	Agriculture	30.01	80.16	19.84

Variable	Category	Total (%)	Percentage	
			Food Secure	Food Insecure (FIES)
	Non-Agriculture	69.99	87.43	12.57
Age	<25 year	2.07	87.80	12.20
	25-40 year	46.47	85.99	14.01
	41-65 year	43.51	85.58	14.42
	>65 year	7.96	78.44	21.56
Gender	Male	87.63	85.74	14.26
	Female	12.37	81.77	18.23
Education	No School	10.62	72.90	27.10
	Elementary School	23.79	80.69	19.31
	Secondary School	15.70	84.35	15.65
	High School	37.99	89.28	10.72
	University	11.91	93.64	6.36
Family Size	1-4 people	68.83	85.82	14.18
	5-8 people	29.90	84.30	15.70
	≥ 9 people	1.28	76.32	23.68
Marital Status	Married	82.44	86.02	13.98
	Unmarried	17.56	81.61	18.39
House ownership	Has own house	73.08	85.38	14.62
	No own house	26.92	84.88	15.12
Land ownership	Has own land	72.70	86.39	13.61
	No own land	27.30	82.19	17.81
Pension security	Has pension security	13.54	94.41	5.59
	No pension security	86.46	83.81	16.19
All (Total)			85.25	14.75

Note: Processed from 2021 Susenas data.

The study employed logistic regression analysis to elucidate the food security status of households vis-à-vis various socio-demographic factors. The model forecasts the likelihood of household food security utilizing predictor variables. The Hosmer-Lemeshow test was employed to assess the model's fit to the observational data. As delineated in Table 3, the chi-square value of the Hosmer-Lemeshow test stands at 4.52 with a corresponding p-value of 0.8077, suggesting the appropriateness of the logistic regression model for analysis. It can thus be inferred that the regression model aptly aligns with the data, with no significant disparity between the model and observational data.

Table 3. Hosmer and Lemeshow Test

Number of observations	Number of groups	Chi-square	df	Prob>chi square
5,944	10	4.52	8	0.8077

Source: calculations using STATA.

Table 4 presents a summary of logistic regression analysis, examining the influence of various independent variables on food security. The investigation reveals several statistically significant independent variables impacting food security, including type of residence, occupation, educational attainment of the household head, family size, marital status, land ownership, and pension security. Employing the odds ratio to scrutinize logistic regression outcomes, this study gauges the likelihood of food security or insecurity. The findings indicate that gender, age, and house ownership lack a significant impact on food security. Notably, the study's findings regarding the nexus between population age, gender, and food security diverge from those of a Canadian study. Empirical evidence from Canada

suggests that older individuals are more susceptible to food insecurity, and women exhibit a higher likelihood of food insecurity compared to men (Huet et al., 2017). Disparities in social, economic, and cultural contexts across diverse research regions and countries may underpin such variations.

Table 4. Logistic Regression Estimation Results

Food Secure	Coef.		Odds Ratio	Std. Err.
Residence	0.229	***	1.257	0.083
Occupation	-0.251	***	0.778	0.087
Age	-0.002		0.998	0.003
Gender	-0.002		0.998	0.158
Education	0.296	***	1.344	0.035
Family size	-0.229	***	0.795	0.075
Marital status	0.228	*	1.256	0.138
House ownership	0.090		1.094	0.106
Land ownership	0.398	***	1.489	0.099
Pension security	0.768	***	2.156	0.163
Constant	0.619	***	1.856	0.216

Note: *** significant at 1% level and * significant at 10% level.

Among the enumerated independent variables, pension security demonstrates the highest odds ratio of 2.156, implying that households with pension security are 2.156 times more inclined to experience enhanced food security compared to those lacking such security. It merits attention that Indonesia's pension security system primarily caters to formal sector employees, such as corporate, governmental, and private sector workers enrolled in pension schemes. Participation in these schemes is typically automatic for individuals with fixed monthly salaries, with contributions deducted from their earnings. Consequently, many food-insecure households often lack social security, possess lower educational qualifications, and face precarious employment situations (Sutikno & Budiasih, 2022). However, workers in other sectors are not obligated to partake in pension schemes, contrasting with developed nations where pension enrollment is compulsory, with contributions deducted from employees' salaries. Nonetheless, participation in pension schemes remains non-mandatory for workers in other sectors.

Households residing in urban areas, characterized by higher educational attainment, marital status, and land ownership, exhibit increased odds of food security compared to their rural counterparts with lower educational attainment, single marital status, and absence of land ownership. Precisely, urban households are 1.257 times more likely to attain food security than rural households. The relatively higher incomes of urban residents, determined by employment status, influence the food security status of urban households (Kharisma & Abe, 2020). The odds ratio coefficient value for education stands at 1.344, suggesting that higher household education levels correspond to a 1.307 times higher likelihood of food security. A correlation between education levels and food insecurity emerges, with higher educational attainment correlating with superior nutritional knowledge and practices within households. This relationship may be attributed to the enhanced economic opportunities associated with higher education, ultimately facilitating greater access to nutritious food. Conversely, individuals with lower literacy levels may encounter difficulties in accessing adequate nutrition, as literacy deficiencies can impede various aspects of nutrition (Jubayer et al., 2023).

Regarding the marital status variable, the odds ratio coefficient value of 1.256, significant at the 10% level, indicates that married household heads are 1.278 times more likely to experience food security than their unmarried counterparts (see Table 4). Married household heads may benefit from additional income sources, with both spouses contributing to household earnings. However, this scenario is not universal, as many couples have low incomes. Indonesia has also implemented a maternity leave system to enable working women to retain their jobs during pregnancy and childbirth.

The land ownership variable exhibits an odds ratio coefficient value of 1.489, suggesting that land-owning households are 1.489 times more likely to achieve food security compared to those without land ownership. Land ownership facilitates household food production and augments income streams.

Additionally, it enables households to cultivate and sell crops or lease out land, thereby enhancing overall earnings. Consequently, land ownership plays a pivotal role in ameliorating household food security and financial stability. However, this does not universally hold for agriculture-dependent occupations.
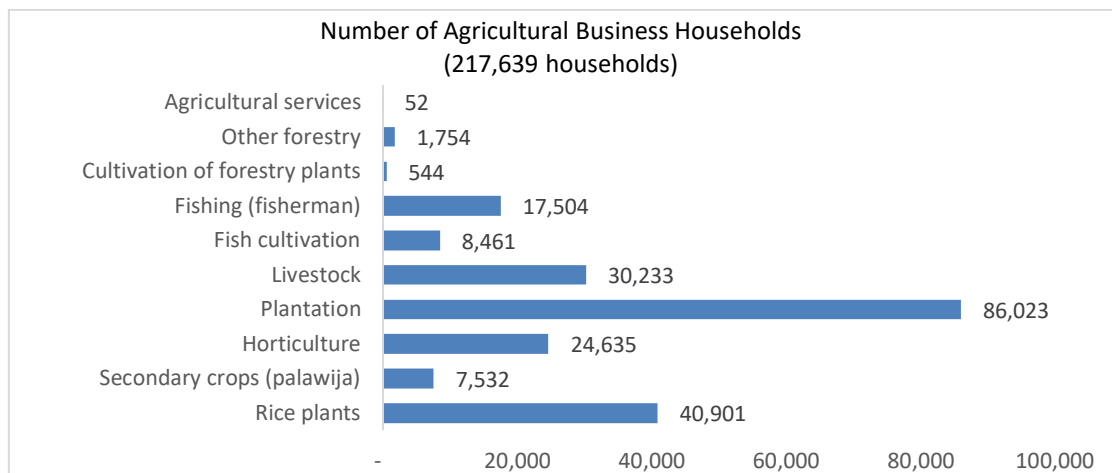
Number of Agricultural Business Households
(217,639 households)

Category	Value
Agricultural services	52
Other forestry	1,754
Cultivation of forestry plants	544
Fishing (fisherman)	17,504
Fish cultivation	8,461
Livestock	30,233
Plantation	86,023
Horticulture	24,635
Secondary crops (palawija)	7,532
Rice plants	40,901

Figure 2. *Agricultural Business Households in East Kalimantan, 2021*

Figure 2 illustrates that in East Kalimantan, agriculture constitutes the primary income source for 217,639 households involved in various agricultural sectors. Rice cultivation predominates among 40,901 households, underscoring its significance in local food production. Secondary crops also feature prominently, engaging 7,532 households and diversifying agricultural activities. Horticulture, encompassing various vegetables and fruits, involves 24,635 households, while plantations, particularly of oil palm and rubber, engage 86,023 households, highlighting the region's emphasis on plantation crops. Livestock rearing constitutes another crucial aspect, involving 30,233 households, alongside substantial participation in fish farming and fishing activities, engaging 8,461 and 17,504 households, respectively (BPS Kaltim, 2022c).

Furthermore, forestry plant cultivation, other forestry activities, and agricultural services complement the agricultural landscape, involving 544, 1,754, and 52 households, respectively. This multifaceted involvement reflects the diverse agricultural economy of East Kalimantan, spanning from food crop production to plantation and livestock commodities. However, despite the vitality of the agricultural sector, challenges persist, particularly regarding food security among agricultural workers. In Table 4, the odds ratio coefficient for occupation in the agricultural sector is 0.778, indicating lower odds of achieving food security than in other sectors. This discrepancy is attributed to several factors, including relatively lower wages, widespread poverty in rural areas, and the prevalence of small-scale farming with limited income potential. In East Kalimantan, a significant portion of farmers, approximately 26.47% or 47,260 individuals, are categorized as small-scale farmers (BPS-Statistics Kalimantan Timur Province, 2023). Addressing income disparities and enhancing financial resilience among agricultural workers are imperative steps toward ensuring equitable food security outcomes and sustainable agricultural development in the region. The results of this research are also consistent with findings regarding the condition of the farming community in Madagascar, where small business farmers with limited land are more likely to experience food insecurity (Herrera et al., 2021).

Additionally, as the number of family members increases, household food security decreases. This is evidenced by the odds ratio coefficient for family size, which is 0.795, signifying that with each increase in household members, the odds of household food security decrease by a factor of 0.795. This finding aligns with previous research conducted in Indonesia (Amrullah et al., 2019), Brazil (de Sousa et al., 2019), Trinidad and Tobago (Saint Ville A et al., 2022), and the Middle East and North Africa (Omidvar et al., 2019).

Recognizing the right to food is crucial in food law as it emphasizes the need to prioritize efforts toward ensuring food security for all individuals and families. Policies stemming from logistic regression analysis must align with this principle by promoting equal distribution of resources, empowering vulnerable populations, and establishing accountability mechanisms and legal protections to safeguard individuals' entitlements to food. Our comprehensive logistic regression analysis has identified several

factors significantly impacting a household's food security status, including education, family size, land ownership, marital status, occupation, place of residence, and pension security. Interestingly, age, gender, and house ownership do not appear to affect household food security. Conversely, households with pension security experience the most significant positive impact on food security. Additionally, agricultural workers tend to experience more food insecurity due to the lower income associated with this industry. Based on these findings, food security policies should prioritize vulnerable groups, such as households with low education levels, large family sizes, no land ownership, unmarried or single-parent households, agricultural workers, rural residents, and those without pension security. Specific interventions and programs should aim to improve access to education, increase household income, enhance agricultural productivity, and strengthen social safety nets to address the specific needs of these groups and reduce the risk of food insecurity in East Kalimantan.

Conclusion

Drawing from Susenas data in 2021, a study conducted in East Kalimantan revealed that out of 5,944 households surveyed, 85.25 percent were deemed food secure, while 14.75 percent experienced food insecurity. Employing logistic regression analysis, the study identified education, family size, land ownership, marital status, occupation, place of residence, and pension security as significant determinants of household food security within the region. Conversely, gender, age, and house ownership were found to lack any discernible impact. Notably, households with pension security exhibited the most substantial positive influence on food security among all the factors examined.

This study underscores the critical imperative to prioritize policies aimed at promoting food security, particularly among those most vulnerable to experiencing food insecurity, especially in East Kalimantan, soon to be Indonesia's capital. The government and other stakeholders must implement programs and policies designed to enhance household food security and mitigate the risk of food insecurity. This research demonstrates that households engaged in the agricultural sector are more susceptible to food insecurity than those in other industries. Therefore, improving the welfare and income of farming families is of paramount importance. Despite the significant contribution of oil palm plantations to the agricultural sector's gross domestic product in East Kalimantan, many farmers still earn low incomes. To effectively address the needs of vulnerable groups, such as households with low levels of education, large family sizes, no land ownership, unmarried or single-parent households, agricultural workers, rural residents, and those lacking pension security, policies should concentrate on targeted interventions and programs aimed at improving access to education, increasing household income, enhancing agricultural productivity, and strengthening social safety nets.

The educational attainment of the head of a household is a crucial determinant of the family's level of food security. Households with better-educated heads are more likely to achieve greater food security. Unfortunately, many heads of households lack adequate education. According to Susenas data, 8.21% of heads have no formal education, 19.95% are primary school graduates, and 21.29% have only completed secondary education (BPS Kaltim, 2022b). Addressing these educational disparities can indirectly tackle food security issues. When heads of households are better educated, they gain better access to higher-paying jobs and other economic opportunities. This increased income can be invested in nutritious food, ensuring a more stable and diversified diet for their families.

The research indicates that households owning land have better food security than those who do not. In East Kalimantan, where over a quarter of households do not own land, this could significantly impact their ability to secure sufficient food. Introducing policies for land distribution can be pivotal in enhancing wealth and income for households, particularly those currently without land. This approach empowers families to cultivate their food, engage in agricultural activities, and potentially generate additional income through land use. With ample land available due to the government's plan to relocate the capital to East Kalimantan, there is an opportunity to make land ownership more accessible and affordable for households. Land distribution programs could prioritize marginalized groups, ensuring equitable access to this vital resource. By owning land, households can establish a sustainable means of food production, leading to enhanced food security in the long term. Alongside land distribution, providing income subsidies can offer immediate relief for households facing food insecurity, irrespective of land ownership status. Income subsidies can support families in purchasing nutritious food items and

meeting other basic needs. This assistance can benefit vulnerable households, including those without land ownership or limited employment opportunities.

This research demonstrates that households with pension security plans are more likely to have adequate access to food. Unfortunately, in East Kalimantan, only 13.54% of households have access to these plans. Encouraging participation in pension security programs is crucial for the long term but may not be the most practical or expedient solution to addressing food insecurity in the region. This is especially true given that a significant portion of the population in East Kalimantan works in informal labor, which makes it challenging to establish traditional pension plans. To provide a safety net for households without pension security, it is recommended that social security programs be expanded to cover all sectors, including informal workers.

Acknowledgments

References

Abdoellah, O. S., Schneider, M., Nugraha, L. M., Suparman, Y., Voletta, C. T., Withaningsih, S., Parikesit, Heptiyanggit, A., & Hakim, L. (2020). Homegarden commercialization: extent, household characteristics, and effect on food security and food sovereignty in Rural Indonesia. *Sustainability Science*, *15*(3). https://doi.org/10.1007/s11625-020-00788-9

Ali, A. D., Mutundu, K., & Ngare, G. W. (2016). Examination of Socio-Economic Determinants of Household Food Insecurity in Juba Valley Region, Somalia. *International Journal of Education and Research*, 4(10).

Amrullah, E. R., Ishida, A., Pullaila, A., & Rusyiana, A. (2019). Who suffers from food insecurity in Indonesia? *International Journal of Social Economics*, *46*(10), 1186–1197. https://doi.org/10.1108/IJSE-03-2019-0196

Antara, M., Lamusa, A., Effendy, Laksmayani, M. K., Tangkesalu, D., Jems, & Imran, E. (2023). Income Diversity and Other Socioeconomic Factors That Influence the Household Food Security of Small-Scale Lowland Rice Farmers in Indonesia. *International Journal of Sustainable Development and Planning*, *18*(3). https://doi.org/10.18280/ijsdp.180333

Badan Pangan Nasional. (2022). *Indeks Ketahanan Pangan Tahun 2022*. Bapanas.

Ballard, T. J., Kepple, A. W., Cafiero, C., & Schmidhuber, J. (2014). Better measurement of food insecurity in the context of enhancing nutrition. *Ernaehrungs Umschau*, *61*(2), 38–41. https://doi.org/10.4455/eu.2014.007

BPS Kaltim. (2022a). Booklet Potret Indikator SDGs Provinsi Kalimantan Timur 2021-2022. BPS Prov. Kaltim.

BPS Kaltim. (2022b). Indikator Kesejahteraan Rakyat Provinsi Kalimantan Timur 2022. BPS Provinsi Kalimantan Timur.

BPS Kaltim. (2022c). Indikator Pertanian Provinsi Kalimantan Timur 2021. BPS Prov. Kaltim.

BPS-Statistics Kalimantan Timur Province. (2023). Hasil Pencacahan Lengkap Sensus Pertanian 2023 - Tahap I Provinsi Kalimantan Timur (Complete Enumeration Results of the 2023 Census of Agriculture Kalimantan Timur Province). BPS Provinsi Kalimantan Timur.

Burchi, F., & De Muro, P. (2016). From food availability to nutritional capabilities: Advancing food security analysis. *Food Policy*, *60.* https://doi.org/10.1016/j.foodpol.2015.03.008

Cafiero, C., Viviani, S., & Nord, M. (2018). Food security measurement in a global context: The food insecurity experience scale. *Measurement: Journal of the International Measurement Confederation*,

116, 146–152. https://doi.org/10.1016/j.measurement.2017.10.065

Cahyono, T. W., & Tokuda, H. (2023). New Capital Relocation of Indonesia: Estimating Food Demand in East Kalimantan and Jakarta. *Journal of Agricultural Science*, *15*(9), 26. https://doi.org/10.5539/jas.v15n9p26

Chatterjee, S., & Simonoff, J. S. (2013). Handbook of Regression Analysis. *Handbook of Regression Analysis*. John Wiley & Sons, Inc. https://doi.org/10.1002/9781118532843

Collins, A. M. (2022). Empowerment, rights, and global food governance: gender in the UN Committee for World Food Security. *Globalizations*, *19*(2). https://doi.org/10.1080/14747731.2021.1877006

de Sousa, L. R. M., Segall-Corrêa, A. M., Ville, A. Saint, & Melgar-Quiñonez, H. (2019). Food security status in times of financial and political crisis in Brazil. *Cadernos de Saude Publica*, *35*(7). https://doi.org/10.1590/0102-311x00084118

FAO. (2016). Methods for estimating comparable prevalence rates of food insecurity experienced by adults throughout the world.

Frongillo, E. A. (2013). Confronting myths about household food insecurity and excess weight. In *Cadernos de Saude Publica* (Vol. 29, Issue 2). https://doi.org/10.1590/S0102-311X2013000200005

Ganpule, A., Brown, K. A., Dubey, M., Srinivasapura Venkateshmurthy, N., Jarhyan, P., Maddury, A. P., Khatkar, R., Pandey, H., Prabhakaran, D., & Mohan, S. (2023). Food insecurity and its determinants among adults in North and South India. *Nutrition Journal*, *22*(1). https://doi.org/10.1186/s12937-022-00831-8

Garson, G. D. (2014). Logistic Regression: Binary & Multinomial. *Statistical Associates Publishing*.

Government of Indonesia. (2022). Peraturan Presiden Nomor 64 Tahun 2022 Tentang Rencana Tata Ruang Kawasan Strategis Nasional Ibu Kota Tahun 2022-2024. *Kemensetneg*. Kementerian Sekretarian Negara Republik Indonesia.

Grimaccia, E., & Naccarato, A. (2019). Food Insecurity Individual Experience: A Comparison of Economic and Social Characteristics of the Most Vulnerable Groups in the World. *Social Indicators Research*, *143*(1), 391–410. https://doi.org/10.1007/s11205-018-1975-3

Hendriks, S. L. (2015). The food security continuum: a novel tool for understanding food insecurity as a range of experiences. *Food Security*, *7*(3). https://doi.org/10.1007/s12571-015-0457-6

Herlina, Sartono, B., & Susetyo, B. (2020). Kajian validitas instrumen pengukuran skala pengalaman kerawanan pangan di Indonesia. *Indonesian Journal of Statistics and Its Applications*, 4(1). DOI:10.29244/ijsa.v4i1.543

Herrera, J. P., Rabezara, J. Y., Ravelomanantsoa, N. A. F., Metz, M., France, C., Owens, A., Pender, M., Nunn, C. L., & Kramer, R. A. (2021). Food insecurity related to agricultural practices and household characteristics in rural communities of northeast Madagascar. *Food Security*, *13*(6). https://doi.org/10.1007/s12571-021-01179-3

Huet, C., Ford, J. D., Edge, V. L., Shirley, J., King, N., & Harper, S. L. (2017). Food insecurity and food consumption by season in households with children in an Arctic city: A cross-sectional study. *BMC Public Health*, *17*(1). https://doi.org/10.1186/s12889-017-4393-6

Izraelov, M., & Silber, J. (2019). An assessment of the global food security index. *Food Security*, *11*(5). https://doi.org/10.1007/s12571-019-00941-y

Jubayer, A., Islam, S., Nowar, A., Nayan, M. M., & Islam, M. H. (2023). Validity of Food insecurity experience scale (FIES) for use in rural Bangladesh and prevalence and determinants of household food insecurity: An analysis of data from Bangladesh integrated household survey (BIHS) 2018-2019. *Heliyon*, *9*(6). https://doi.org/10.1016/j.heliyon.2023.e17378

Kharisma, V., & Abe, N. (2020). Food Insecurity and Associated Socioeconomic Factors: Application of Rasch and Binary Logistic Models with Household Survey Data in Three Megacities in Indonesia. *Social Indicators Research*, *148*(2), 655–679. https://doi.org/10.1007/s11205-019-02210-z

Lujabe, B., Pretorius, B., Goliath, V., & Sibanda, W. (2022). Exploring the Food (In)Security Status of

Suburban Households and Its Determinants during COVID-19. *Sustainability (Switzerland)*, *14*(7). https://doi.org/10.3390/su14073918

Naipunu, A. E., & Kadir. (2023). Determinan Status Kerawanan Pangan Rumah Tangga di Provinsi Nusa Tenggara Timur: Analisis Regresi Logistik. *Jurnal Statistik Terapan*, *3*(1). https://doi.org/10.5300/jstar.v3i01.38

Obayelu, A. E., Obayelu, O. A., Bolarinwa, K. K., & Oyeyinka, R. A. (2021). Assessment of the Immediate and Potential Long-Term Effects of COVID-19 Outbreak on Socioeconomics, Agriculture, Security of Food and Dietary Intake in Nigeria. *Food Ethics*, *6*(1). https://doi.org/10.1007/s41055-021-00085-w

Ogundari, K. (2017). Categorizing households into different food security states in Nigeria: the socio-economic and demographic determinants. *Agricultural and Food Economics*, *5*(1). https://doi.org/10.1186/s40100-017-0076-y

Omidvar, N., Ahmadi, D., Sinclair, K., & Melgar-Quiñonez, H. (2019). Food security in selected Middle East and North Africa (MENA) countries: an inter-country comparison. *Food Security*, *11*(3). https://doi.org/10.1007/s12571-019-00935-w

Otorita IKN. (2022). Penetapan Buku Panduan One Map, One Planning , One Policy (1 MPP) sebagai Pedoman Informasi Rencana Persiapan dan Pelaksanaan Pembangunan Ibu Kota Nusantara yang Terintegrasi Lintas Kementerian/Lembaga. *Otorita Ibukota Nusantara*. https://www.ikn.go.id/storage/news/221006.01-se.penetapan-1mpp-pedoman-informasi-pelaksanaan-pembangunan-ikn-terintergrasi-kl.pdf

Pakravan-Charvadeh, M. R., Flora, C., & Khan, H. A. (2022). Simulating Potential Associated Socio-Economic Determinants with Sustainable Food Security (A Macro-Micro Spatial Quantitative Model). *Frontiers in Public Health*, *10*. https://doi.org/10.3389/fpubh.2022.923705

Saint Ville A, Francis-Granderson I, Bhagwandeen B, & Mohammed M. (2022). Food insecurity in Venezuelan migrants in Trinidad and Tobago using the food insecurity experience scale. *Front. Public Health*.

Smith, M. D., Rabbitt, M. P., & Coleman- Jensen, A. (2017). Who are the World's Food Insecure? New Evidence from the Food and Agriculture Organization's Food Insecurity Experience Scale. *World Development*, *93*, 402–412. https://doi.org/10.1016/j.worlddev.2017.01.006

Sutikno, L. H., & Budiasih, B. (2022). Household Food Insecurity in DKI Jakarta Province at The Beginning of The Covid-19 Pandemic. *Proceedings of The International Conference on Data Science and Official Statistics*, *2021*(1). https://doi.org/10.34123/icdsos.v2021i1.226