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# Cost and Feasibility Analysis of Corn Farming on Replanted Oil Palm Land in Jorong Giri Maju

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A B S T R A C T

This study aims to analyze the influence of land area, labor, seeds, pesticides, and fertilizers on the cost of corn farming and to assess its feasibility on oil palm replanting land in Jorong Giri Maju, Nagari Koto Baru, Luhak Nan Duo District, West Pasaman Regency. The research was conducted from March to April 2022 using a descriptive method with purposive sampling. A total of 63 farmers were selected from a population of 173. The data used were both primary and secondary, analyzed using multiple linear regression, R/C ratio, and BEP analysis. The results show that labor and pesticide costs significantly affect corn farming costs, while land area, seed, and fertilizer costs do not. Simultaneously, all variables together influence total costs. The majority of farmers are aged 15–55, with most having 2 hectares of land and a high school education. Based on the R/C ratio, BEP price, and BEP production, corn farming is considered economically feasible.

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## INTRODUCTION

Corn, as a cereal crop, can grow in almost all parts of the world (Revilla et al., 2021). It is considered an important food source because it is the second-largest source of carbohydrates after rice (Fauziah et al., 2023; Fitriana et al., 2025). As one of the staple food commodities, corn has become a primary agricultural product after rice (Erenstein et al., 2022; Grote et al., 2021). In fact, in several regions of Indonesia, corn is used as the main staple food. In addition to its role as food, corn is also widely known as a source of animal feed and as a raw material for various industries (Corsato Alvarenga et al., 2022; Jiao et al., 2022). In Indonesia, corn has been cultivated for approximately 400 years, having been introduced by the Portuguese and Spanish (Luckyardi et al., 2022). Initially, the main corn production areas were concentrated in Central Java, East Java, and Madura (Akhmad et al., 2022). Over time, corn cultivation gradually expanded to areas outside of Java. West Pasaman Regency is one of the major corn-producing regions in West Sumatra Province.

The prospects for corn farming are quite promising, particularly if managed intensively and commercially using an agribusiness-oriented approach. Domestic market demand and export opportunities for corn have shown a consistent upward trend each year, driven by both food and non-food uses (Grote et al., 2021). Corn can be cultivated on oil palm plantations that are undergoing replanting. Such farming practices can serve as an alternative income source for farmers while they wait for the newly replanted oil palms to become productive (Petri et al., 2024). Replanting is a key effort aimed at improving the productivity of oil palm plantations. During the replanting phase, farmers are left with large areas of idle land, which can be utilized for income-generating activities such as corn farming. Although oil palm replanting brings positive impacts, it also introduces new challenges, particularly in regard to how farmers meet their household needs while waiting for their oil palm trees to mature (Murphy et al., 2021). In Nagari Koto Baru, located in Luhak Nan Duo Subdistrict, West Pasaman Regency, Jorong Giri Maju is the largest replanting area, covering approximately 346 hectares. The oil palm plantations in this area have reached the replanting age, typically between 20 to 25 years. Farmers have started using these lands to grow corn. One of the main challenges they face is securing adequate funding, especially for purchasing production inputs. Despite these challenges, farmers continue to find ways to sustain their operations, often by borrowing capital from corn traders (toke jagung). Given this situation, it is important to analyze the production costs and assess the feasibility of corn farming, so that farmers do not fall into debt due to unprofitable farming practices.

Although several studies have investigated factors affecting corn farming costs and feasibility, limited research has specifically focused on corn cultivation on replanted oil palm land, particularly in rural regions like Jorong Giri Maju, Nagari Koto Baru. Most existing studies emphasize conventional agricultural land, overlooking the unique agronomic and economic conditions of previously cultivated oil palm areas. As such, there is a lack of empirical evidence regarding the cost structure and viability of corn farming on converted oil palm land, which this study seeks to address. Based on this context, the objectives of this study are: (1) to analyze the influence of land area, labor, seeds, pesticides, and fertilizers on corn farming costs on replanted oil palm land in Jorong Giri Maju, Nagari Koto Baru, Luhak Nan Duo Subdistrict, West Pasaman Regency, and (2) to assess the feasibility of corn farming on replanted oil palm land in the same area.

**LITERATURE REVIEW**

Corn (*Zea mays*) is one of the most widely cultivated cereal crops globally due to its adaptability to a broad range of agroecological conditions (Altieri et al., 2015). It is recognized as a major food source, ranking second after rice in terms of carbohydrate contribution (Kennedy & Burlingame, 2003). In Indonesia, corn is not only a key staple food in some regions but also serves as an essential commodity in livestock feed production and various industrial applications (Grote et al., 2021). Historically, corn has been cultivated in Indonesia for over four centuries, having been introduced by the Portuguese and Spanish (Singh, 2023). Initially concentrated in Central Java, East Java, and Madura, its cultivation gradually expanded to other parts of the country, including West Sumatra, where West Pasaman Regency has become one of the major corn-producing areas.

The economic prospects for corn farming in Indonesia are generally favorable, particularly when implemented using a commercial and agribusiness-oriented approach. Growing domestic and export demand—driven by both food and non-food uses—has made corn a highly valuable commodity (Banerjee, 2011). One innovative approach to corn cultivation involves the use of idle land from oil palm plantations undergoing replanting. Replanting, which typically occurs when oil palm trees reach 20 to 25 years of age, is a critical step in maintaining and enhancing the productivity of palm oil plantations. However, during the replanting period, farmers are often left with non-productive land for several years. Utilizing this land for corn farming presents a viable strategy to maintain household income during the oil palm's non-productive phase (Tschakert et al., 2007).

Despite the potential benefits, corn cultivation on replanted oil palm land presents distinct challenges, particularly in terms of capital access. Farmers often face difficulties in securing funding for necessary production inputs such as seeds, fertilizers, pesticides, and labor. In areas like Jorong Giri Maju, Nagari Koto Baru, this financial gap is frequently bridged by borrowing capital from corn traders (locally known as *toke jagung*), which may increase financial vulnerability if farming outcomes are not profitable. Therefore, assessing the cost structure and economic feasibility of corn farming on such land is essential to ensure sustainability and prevent farmers from falling into debt.

While numerous studies have analyzed corn farming from agronomic and economic perspectives, most have focused on conventional agricultural land, with limited attention to former oil palm plantation areas. Replanted oil palm land poses unique agronomic conditions, such as soil fertility differences, residue management issues, and altered microclimates, all of which can affect productivity and cost structures. These distinctions underscore the need for specific research on the cost-effectiveness and profitability of corn farming in these settings. Consequently, this study aims to fill the existing research gap by (1) analyzing the effect of land area, labor, seed, pesticide, and fertilizer use on the cost of corn farming in replanted oil palm areas in Jorong Giri Maju, Nagari Koto Baru, Luhak Nan Duo Subdistrict, West Pasaman Regency, and (2) assessing the overall feasibility of such farming practices in these conditions.

## METHODOLOGY

This research was conducted in Jorong Giri Maju, Nagari Koto Baru, Luhak Nan Duo Subdistrict, West Pasaman Regency. The selection of this location was done purposively, based on the consideration that Jorong Giri Maju has the largest area of oil palm replanting land in Nagari Koto Baru. The total area used for replanting is 346 hectares, involving 173 farmers (Information from KUD Makmur, 2021). The research was carried out over a period of one month, from April to May 2022. The basic method used in this study is a quantitative descriptive method, employing multiple linear regression analysis. The purpose of descriptive research is to explain the current or ongoing situation by describing events as they actually occur at the time of the study. The population in this study consists of oil palm farmers who cultivate corn on replanting land in Jorong Giri Maju, Nagari Koto Baru, totaling 173 individuals.

Since the total population is known, the sample size was determined using Slovin's formula (Husein, 2003). Based on the calculation, the number of respondents selected was 63. The sampling technique used was simple random sampling. The data sources in this study include both primary and secondary data. The types of data collected are quantitative and qualitative. Data collection techniques included observation, interviews, and documentation. The variables observed in this study were: land area, labor cost, seed cost, pesticide cost, fertilizer cost, input prices, and product prices. To analyze the factors influencing corn farming costs on oil palm replanting land, a multiple linear regression model was used with the following equation:

$$\mathbf{Y = a + b_1x_1 + b_2x_2 + b_3x_3 + b_4x_4 + b_5x_5 + e}$$

Information :

| | |
|---|---|
| $Y$ | = Corn farming cost |
| $X_1$ | = Land area |
| $X_2$ | = Labor cost |
| $X_3$ | = Seed cost |
| $X_4$ | = Pesticide cost |
| $X_5$ | = Fertilizer cost |
| $a$ | = Intercept |
| $b_1,b_2,b_3,b_4,b_5$ | = Regression coefficients |
| $e$ | = Error term |

Furthermore, to assess the feasibility of corn farming, the R/C ratio (Revenue/Cost ratio) was used, which is the comparison between total revenue and total cost

$$R/C = \frac{TR}{TC}$$

Information:
TR = Total Revenue
TC = Total Cost

There are three criteria in the calculation of the R/C (Revenue/Cost) ratio:
a) If R/C > 1, it means that corn farming is profitable.
b) If R/C = 1, it indicates that the corn farming activity is breaking even.
c) If R/C < 1, it implies that the corn farming activity is unprofitable or incurring a loss.

Furthermore, the Break-Even Point (BEP) analysis is used to determine the minimum level of output or revenue required to cover total costs (Kasmir, 2009).

1. Break-Even Point in terms of Price (Rupiah) is calculated using the formula:

   **BEP = TC / Product**

   Information:
   BEP = Break-Even Point
   TC = Total Cost
   Product = Total Production Output
2. Break-Even Point in terms of Output (Production units) is calculated using the formula:

   **BEP = FC / Price**

   Information:
   BEP = Break-Even Point
   FC = Fixed Cost
   Price = Selling Price per unit

## RESULTS

### *Corn Farming Costs*

1. Production Costs

   Based on the results of the research, production costs in this study refer to cash expenditures per hectare. The detailed breakdown of these costs can be seen in Table 1.

Tabel 1. Average production costs incurred by farmers (per metric ton per hectare)

| No | Cost Description | Amount (Rp) | Percentage (%) |
|---|---|---|---|
| **1.** | **Labor** | **3.260.285,7** | **40,2** |
| | Pruning | 515.079,3 | 6,3 |
| | Planting | 456.269,8 | 5,6 |
| | Spraying | 250.000 | 3,1 |
| | Fertillizing | 334.888,8 | 4,1 |
| | Felling | 411.785,7 | 5,1 |
| | Husk Peeling | 992.619,05 | 12,2 |
| | Transport | 299.642,8 | 3.8 |

| | | | |
|---|---|---|---|
| **2.** | **Seeds** | **1.285.714,3** | **15,8** |
| **3.** | **Pesticides** | **880.952,4** | **10,9** |
| | • Gramoxon | 286.507,9 | **3,5** |
| | • Konvoi | 594.444,4 | **7,4** |
| **4.** | **Fertilizers** | **2.327.222,2** | **28,7** |
| | • Urea | 1.033.809,5 | 12,7 |
| | • KCL | 535.476,2 | 6,6 |
| | • Ponska | 757.936,5 | 9,4 |
| **5.** | **Depreciation of Farming Tools** | **11.629,4** | **4,4** |
| | **Total** | **7.765.804** | **100,00** |

From Table 1, it can be seen that there are five categories of production costs: labor, seeds, pesticides, fertilizers, and depreciation of farming tools. Among these, the highest cost incurred by farmers is for labor, amounting to Rp 3,260,285.7 per hectare (40.2%). Within the labor category, the largest expenditure is for husk peeling, which costs Rp 992,619.05 per hectare. On the other hand, the lowest cost incurred is for the depreciation of farming tools, amounting to Rp 732,652 per hectare (4.4%). The average cost for seeds is Rp 1,285,714.3 per hectare (15.8%). Meanwhile, the average cost for pesticides is Rp 880,952.4 per hectare (10.9%), which includes Gramoxone pesticide at Rp 286,507.9 per hectare (3.5%) and Konvoi pesticide at Rp 594,444.4 per hectare (7.4%). Fertilizer costs amount to Rp 2,327,222.2 per hectare (28.7%). This includes Urea fertilizer at Rp 1,033,809.5 per hectare (12.7%), KCL fertilizer at Rp 535,476.2 per hectare (6.6%), and Ponska fertilizer at Rp 757,936.5 per hectare (9.4%).

***Analysis of Factors Affecting Corn Farming Costs***

The results of data processing using SPSS version 2020, specifically regarding the coefficients, can be seen in Table 2.

Table 2. Results of Multiple Linear Regression Analysis

| Model | | Unstandardized Coefficients | | Standardized Coefficients | T | Sig. |
|---|---|---|---|---|---|---|
| | | B | Std. Error | Beta | | |
| 1 | (Constant) | -14341962.765 | 5.294E6 | | -2.709 | .009 |
| | Land Area | -1490657.572 | 2.417E6 | -.055 | -.617 | .540 |
| | Labor Costs | 4.170 | 1.383 | .564 | 3.015 | .004 |
| | Seed Costs | -1.851 | 2.983 | -.077 | -.620 | .537 |
| | Pesticide Costs | 16.493 | 4.148 | .494 | 3.976 | .000 |
| | Fertilizer Costs | -.038 | 1.211 | -.006 | -.031 | .975 |

The constant value of the corn farming costs is -Rp 14,341,962.765, indicating that without the influence of independent variables (land area, labor costs, seed costs, pesticide costs, and fertilizer costs), the cost of farming would decrease by this amount. The coefficient for land area is -Rp 1,490,657.572, suggesting that for every 1-hectare increase in land area, farming costs decrease by this amount. The coefficient for labor costs is 4.170, showing that an increase of Rp 1 in labor costs results in a Rp 4.170 increase in farming costs. The coefficient for seed costs is -1.851, meaning an increase of Rp 1 in seed costs leads to a decrease in farming costs by Rp 1.851. This finding contrasts with studies by Siti Walida Mustamin and Ribut Santoso, which show a positive relationship. The pesticide cost coefficient is 16.493, indicating a positive relationship with farming costs; every Rp 1 increase in pesticide costs results in a Rp 16.493 increase in farming costs. This aligns with Siti Walida Mustamin's findings but contradicts Ribut Santoso’s study, which found a negative relationship. Finally, the coefficient for fertilizer costs is -0.038, meaning that an increase in fertilizer costs by Rp 1 leads to a decrease of Rp 0.038 in farming costs, which aligns with Ribut Santoso's research but not with Siti Walida Mustamin’s, who found a positive relationship.

***F-Test (Simultaneous Test)***

The F-test is used to determine whether all independent variables collectively have an effect on the dependent variable, as explained by the changes in all the variables. The decision rule is based on the results of the ANOVA or F-test. If the t coefficient ($\beta 1$) is less than the established significance level ($\alpha = 5\%$), then the regression model can be used to predict the dependent variable. This means that all independent variables collectively influence the dependent variable, and H0 is rejected (Singh, 2002). For more details, you can see table 3 below.

Table 3. Results of the F-Test (Simultaneous Test)

| Model | | Sum of Squares | Df | Mean Square | F | Sig. |
|---|---|---|---|---|---|---|
| 1 | Regression | 4.839E9 | 5 | 9.678E8 | 43.647 | .000[a] |
| | Residual | 1.264E9 | 57 | 2.217E7 | | |
| | Total | 6.103E9 | 62 | | | |

The results of the study, as shown in Table 3, indicate that the significance value is 0.000 < α 0.05. This means that H0 is rejected and H1 is accepted. Therefore, it can be concluded that, collectively, land area, labor costs, seed costs, pesticide costs, and fertilizer costs have a significant effect on the costs of corn farming.

***T-Test (Partial Test)***

Priyanto (2012) states that the t-test is used to test the regression coefficients partially, from the independent variables to the dependent variable. The decision rule is based on comparing the probability value (p) of the t-statistic with the significance level α = 5%. The results of the t-test can be seen in Table 4 below.

Table 4. Results T-Test

| Model | | Unstandardized Coefficients | | Standardized Coefficients | t | Sig. |
|---|---|---|---|---|---|---|
| | | B | Std. Error | Beta | | |
| 1 | (Constant) | -14341962.765 | 5.294E6 | | -2.709 | 0.009 |
| | Land Area | -1490657.572 | 2.417E6 | -.055 | -.617 | 0.540 |
| | Labor Costs | 4.170 | 1.383 | 0.564 | 3.015 | 0.004 |
| | Seed Costs | -1.851 | 2.983 | -0.077 | -.620 | 0.537 |
| | Pesticide Costs | 16.493 | 4.148 | 0.494 | 3.976 | 0.000 |
| | Fertilizer Costs | -0.038 | 1.211 | -0.006 | -.031 | 0.975 |

The results show that land area (X1) and seed costs (X3) do not significantly affect corn farming costs in Jorong Giri Maju, Nagari Koto Baru, as their significance values (0.540 and 0.537, respectively) are greater than the 5% significance level. However, labor costs (X2) and pesticide costs (X4) significantly impact farming costs, with significance values of 0.004 and 0.000, respectively. On the other hand, fertilizer costs (X5) do not significantly affect farming costs, with a significance value of 0.975. These findings indicate that labor and pesticide costs are the key factors influencing corn farming costs, while land area, seed costs, and fertilizer costs have no significant effect. The coefficient of determination ($R^2$) is used to measure how well the model explains the variation of independent variables. The value of $R^2$ ranges from 0 to 1, where a small $R^2$ value indicates limited ability of the independent variables to explain the variation of the dependent variable, while a value close to 1 suggests that the independent variables explain most of the variation in the dependent variable (Singih, 2002). In this study, the $R^2$ value of 0.793 indicates that land area (X1), labor costs (X2), seed costs (X3), pesticide costs (X4), and fertilizer costs (X5) explain 79.3% of the variation in corn farming analysis, while the remaining 10.1% is explained by other variables outside the model. This differs from Siti Walida Mustamin's research, where an $R^2$ of 0.998 indicates that fertilizer costs, labor wages, pesticide costs, and seed costs contribute 99.8%.

***Feasibility Analysis of Corn Farming***

Feasibility analysis is conducted to determine whether corn farming is feasible to continue based on calculations of production costs, revenue, R/C ratio, and break-even point (BEP). For more details, see table 5.

Table 5. Feasibility Analysis of Corn Farming per Hectar

| No | Description | Unit | Value / Remarks |
|---|---|---|---|
| 1 | Production | Kg | 3.923 |
| 2 | Price | Rp/Kg | 4.365,4 |
| 3 | Revenue | Rp/MT/ha | 17.113.920,6 |
| 4 | Total Costs | Rp/MT/ha | 7.765.804 |
| 5 | Fixed Costs | Rp/MT/ha | 11.629,4 |
| 6 | Variable Costs | Rp/MT/ha | 7.754.174,6 |
| 7 | Income | Rp/MT/ha | 9.348.116,6 |
| 8 | R/C | | 2,20 |
| | BEP | | |
| 9 | *BEP Price | Rp | 1.979,5 |
| | *BEP Quantity | Kg | 1.776,3 |

Based on Table 5, the average income received by corn farmers is Rp 9,348,116.6 per hectare, with an average selling price of Rp 4,365.4 per kilogram and a production yield of 3,923 kg per hectare. The data analysis shows that the average R/C ratio is 2.20 (2.20 > 1), which indicates that the farming activity is economically feasible. This value means that for every Rp 1.00 spent on production costs, farmers receive Rp 2.20 in return.

**Break-Even Point (BEP) Analysis: Production Volume and Product Price**

Break-even point analysis is conducted to determine the threshold at which the production volume or product price reaches the point of no profit and no loss—where total costs equal total revenues. The BEP in production volume is calculated by dividing total costs by the selling price at the producer level. This analysis helps identify the minimum level of production or price required to cover all costs. The BEP curve can be illustrated as follows (Sunarjono, 2000).

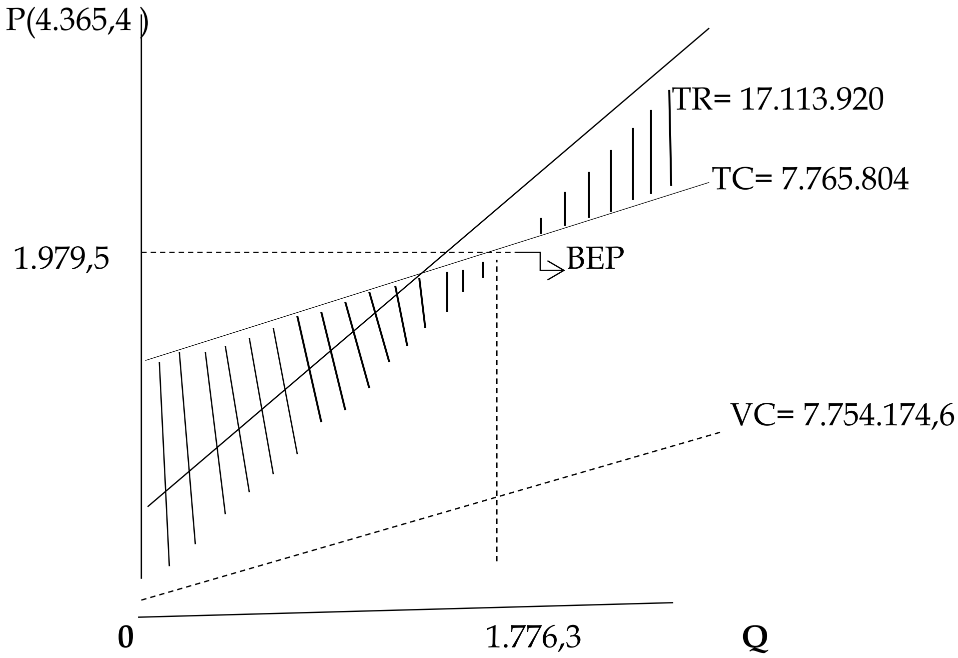


**Figure 1. Kurva BEP**

Based on the figure above, the break-even point (BEP) is the intersection between the total cost line and the total revenue (sales) line. The loss area is where the total cost line lies above the revenue line, meaning the costs exceed the income. Conversely, the profit area is where the revenue line lies above the cost line. From the data analysis of corn farming in Jorong Giri Maju, the BEP for price is Rp 1,979.5, which is lower than the observed selling price of Rp 4,365.4. Similarly, the BEP for production volume is 1,776.3 kg, which is lower than the observed production of 3,923 kg. These results indicate that corn farming on replanting land is economically feasible. This finding is consistent with the study conducted by Khairunnisyah Nasution, which also concluded that the farming activity was viable.

**DISCUSSION**

This research is important as it addresses a fundamental aspect of poor households' livelihoods—household food security. Food security goes beyond just caloric intake; it reflects a household's ability to access and afford nutritious food sustainably. In the context of Nagari Nyiur Melambai, the findings show that while most poor households are categorized as food secure, the actual average energy consumption is only 27.62% of the national dietary adequacy standard (2,100 kcal/day). This indicates a disparity between food access and consumption quality. The results align with the findings of Liu et al (2016), which revealed that household income has a positive impact on consumption, but the relationship is not necessarily linear. This is supported by the Sobel Test results in the present study, which show that poverty does not mediate the relationship between income and food security. The findings also support Steve Hatfield-Dodds (2007) which concluded that household size does not significantly influence food consumption in poor households. Conversely, this study found that husband's education level affects food security through poverty, in line with Janjua (2014) which emphasized that education reduces poverty and positively impacts household welfare. Educated heads of households are more likely to have better income and food access.

The implications of this study are significant for policy development aimed at poverty alleviation and improving food security. Local governments and social institutions can use these findings as a basis to design programs that focus on increasing educational access and vocational training for poor households. Moreover, food aid programs should not only address caloric needs but also focus on long-term economic empowerment and nutrition education.

However, the study has limitations. It does not consider other potential factors affecting food security, such as access to health services, cultural food practices, and local environmental sustainability. Additionally, the focus on energy intake (calories) overlooks important dimensions of nutrition, such as protein, vitamins, and micronutrients. Recommendations for future research include expanding the scope of variables to cover nutritional quality, environmental factors, and gender roles in food security. Longitudinal studies are also recommended to capture dynamic changes in food security over time. Furthermore, incorporating qualitative methods such as in-depth interviews could provide deeper insights into how poor households manage food insecurity and adapt during crises .

## CONCLUSIONS AND RECOMMENDATIONS

This study explores the relationship between household income, food expenditure, family size, education level, and poverty in determining food security in Nagari Nyiur Melambai, Ranah Pesisir Subdistrict, Pesisir Selatan Regency. The research finds that the majority of poor households in this area experience food security, but still face challenges in achieving adequate energy consumption. The average energy consumption is lower than the national requirement, indicating nutritional inadequacies. The study employs multiple linear regression analysis to examine how these factors affect food security, revealing that household income, education level, family size, and poverty significantly influence food security levels. Additionally, the Sobel test, which tests the mediating effect of poverty, shows no mediation effect between household income and food security, but does reveal a significant mediation effect for the husband's education level.

The results suggest that improving household income, reducing family size, and increasing the husband's education level can contribute to enhancing food security. Addressing poverty remains crucial, but its role as a mediator is more complex. The study highlights the interconnectedness of socioeconomic factors in shaping food security in rural communities.

**FURTHER STUDY**

Future research should investigate how cultural, behavioral, and gender-related factors interact with socioeconomic variables to influence household food security. Additionally, exploring the role of women's education and empowerment, as well as access to social safety nets, could provide a more holistic understanding. Longitudinal or mixed-method studies are also recommended to capture the evolving nature of poverty and its mediating effects over time in rural settings.

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