

Analysis of Household Income and Food Security of Watermelon Farmers During The Covid-19 Pandemic in Lamongan Regency (A Case in Trosono Village, Sekaran District, Lamongan Regency)

Annisa, Berti Genia Dwi Saputri, Nuhfil Hanani, Fahriyah, Rosihan Asmara
Department of Agricultural Socio-Economics, Faculty of Agriculture, Brawijaya
University
correspondence author: nuhfil.fp@ub.ac.id

Submitted : 11 July 2022 ; Revised : 07 September 2022 ; Accepted : 25 November 2022

ABSTRACT

The Covid-19 pandemic has disrupted the Indonesian economy in almost all sectors, including the agricultural sector. The government's policy for large-scale social restrictions has an impact on farmers' household income because it disrupts access to sales of agricultural products. Meanwhile, low income reduced opportunities to meet the needs of good quality food consumption, making food security challenges in the household. The level of energy adequacy and the proportion of household food expenditure were calculated to depict food security. The research was conducted in Toronto Village, Sekaran District, Lamongan Regency. The income, food security, and determinant factor of food security were analyzed. The household food security was measured using the Jonnson and Toole model. Further, factors influencing food security were analyzed using multiple linear regression analysis. This research found that (1) the average income of watermelon farming reached IDR 23,496,465 per hectare. Additionally, the research revealed that (2) watermelon farming households fell into the vulnerable(46.5%), the secure (23.2%), the insecure (20.9%), and the less secure (9.3%) categories. Finally, it was found that (3) several variables, such as the number of family members, the head of the family's education, income, rice expenditure, and maternal education, significantly affected the energy adequacy rate. The study recommends that farmers hold technology counseling to increase their income. Also, there is a need for socialization about the importance of regulating balanced, nutritious, and diverse food consumption patterns to increase mother knowledge and improve their families' nutritional status.

Keywords: energy adequacy level, farmers income, food security, share of food expenditure

How to cite : Annisa., Saputri, B.G.D., Hanani, N., Fahriyah, and Asmara, R. 2022. Analysis of Household Income and Food Security of Watermelon Farmers During The Covid-19 Pandemic in Lamongan Regency (A Case in Trosono Village, Sekaran District, Lamongan Regency). *Agro Ekonomi* 33(2), 84-93

INTRODUCTION

The Statistic Indonesian (2020) report that 41.9% of Indonesian people experienced a decreased income during the Covid-19 pandemic. The decline

caused low purchasing and food consumption ratios, eventually decreasing farmers' income. Therefore, as food producers, farmers became the most critical parties related to food

security issues during the COVID-19 outbreak (Utami, 2020). Farmer households are unique because they act as producers of their farming products and consumers. Thus, they must allocate their economic resources for production and consumption activities amid uncertain income. As a result, farm households are the most affected by food insecurity and poverty (Kuwornu et al., 2013).

According to Puspita, (2017), food security is a multidimensional concept that includes the food and nutrition system chain starting from production, distribution, and consumption. The size of various indicators determines a household food security system. Food security is described as the availability of adequate food. Initially, the definition of food security was only used at the national level to measure food self-sufficiency. This concept was then extended to the household level. Households are considered to have food security if they can obtain the food needed by all family members (Mohamed, 2017).

During the Covid-19 pandemic, large-scale social restriction policies disrupted access to sales of watermelon farmers in Trosono Village. Horticultural products, like watermelons, can only be stored for a short time. If the watermelon is quickly distributed and consumed, its quality and selling price will increase. This decrease will then have an impact on the income of watermelon farmers. Low income reduces the household's opportunity to buy quality food, making food security difficult.

The low income of farmers, which affects food security, can be seen in the low energy consumption. Based on Lamongan Regency Food Security Service (2020), energy consumption in Lamongan Regency was 1,806.4 kcal/capita/day. It was lower than the ideal energy suggested by the WNPG (Widyakarya Nasional Pangan dan Gizi). The consumption should reach 2,150 kcal/capita/day. A household is categorized as sufficient if its energy consumption exceeds 90% of the RDA (Recommended Dietary Allowance) or equal to 1,935 kcal/capita/day. If the consumption is equal to or less than that amount, it is categorized as food insecure. Meanwhile, if it is less than 70% of the RDA or below 1,505 kcal/capita/day, it is categorized as very food insecure (Ruhyana et al., 2020).

Research on food security has been carried out, but there has yet to be much research on food security in watermelon farmer households, especially during the COVID-19 pandemic. The pandemic can affect the income and decisions of farmer households in allocating income so that it can impact their share of food expenditure and energy adequacy. Based on the description, it is necessary to investigate watermelon farmers' income, food security, and factors that affect the energy adequacy rate of watermelon farmers' households during the Covid-19 pandemic.

METHODS

This study used a quantitative approach with a survey method. It was conducted in Trosono village, Sekaran

Sub-district, Lamongan Regency, determined intentionally (purposive sampling) by researchers considering as the central production of watermelon in East-Java Province. While the villagers mainly worked as various types of farmers, the research focused on investigating watermelon farmers as the research sample. Forty-three households were selected for this study. They were chosen using the cluster random sampling method, specified based on the demographics of the research area.

This research employed several types of data analysis. The first analysis addressed the first objective by calculating the farmers' income. This value was obtained from the difference between revenue and total costs, as expressed by the following formula:

$$I = TR - TC \dots \dots \dots (1)$$

where, I is farmers' income in that season, TR is total revenue, and TC is total cost.

The second objective analyzed household food security. The Jonnson and Toole model assessed household food security by looking at energy consumption and the share of food expenditure. In this model, cross-classification was carried out between the energy adequacy level and the share of food expenditure. The analysis resulted in four categories of household food security: food secure, food vulnerable, food less secure, and food insecure. Farmer households are classified as food secure if the energy adequacy level value is >80% and the share of food expenditure value is <60%. Meanwhile, households fall into the food-

vulnerable category if the energy adequacy level value is >80% and the share of food expenditure value is ≥60%. Suppose the energy adequacy level value is ≤80% and the share of food expenditure value is <60%, the farmer households are categorized as food less secure. Finally, households are claimed to be food insecure if the energy adequacy level is ≤80% and the share of food expenditure value is ≥60% (Umbu et al., 2021). Mathematically, the proportion of farmer household food expenditure is written as:

$$SFE = \frac{FE}{TE} \times 100\% \dots \dots \dots (2)$$

where SFE is the share of food expenditure in a unit (%), FE is the expenditure of food in a unit (IDR/year), and TE is the total household expenditure in units (IDR/year).

In addition, energy adequacy is written as:

$$EAL = \frac{\Sigma HEC}{EAR \text{ recommended}} \times 100\% \dots \dots (3)$$

where, EAL is energy adequacy level percentage (%), and ΣHEC is total individual energy consumption (kcal/capita/day). Meanwhile, EAR recommended is based on the age group and gender of the respondents using the energy nutrient adequacy rate (RDA) table.

The third objective aimed to determine factors of energy consumption. To address this objective, multiple linear regression was used. The equation is as follows:

$$EAR = \beta_0 + \beta_1FHA + \beta_2NFM + \beta_3FHE + \beta_4Inc + \beta_5RE + \beta_6ME + \varepsilon \dots \dots \dots (4)$$

where, EAR is energy adequacy rate, FHA is family head age, NFM is the number of family members, FHE is the length of family head education, Inc is farmers' income in that season, RE is rice expenditure, ME is the length of mother education, and ε is an error term.

RESULTS AND DISCUSSION

Income Analysis

In Trosono Village, a large-scale social restriction policy has disrupted watermelon sales because middlemen cannot reach the location. This issue affected the village's farmers as they had low bargaining power. As a result, the sales and the selling price declined, and so did the watermelon farmer's income. Before Covid-19, the watermelon price in the village was around IDR3,000-IDR8,000/Kg. However, when the pandemic hit, the price declined to IDR2,500- IDR7,000/Kg.

The average selling price of watermelon during the pandemic was around IDR 3,703/Kg. With the production of around 9.47 tons, the revenue of watermelon farmers was around IDR 35,087,304/Ha/planting season. After deducted by the farming cost, the average income was IDR 23,496,465/Ha/planting season. It is important to note that farmers' income will affect their household consumption.

If the income increases, the opportunity for consumption will increase. In addition, a high-income level

will increase

Table 1. Average of Revenue, Total Cost, and Income of Watermelon Farmers

Revenue, Cost, and Income	Value (IDR/Ha)
Revenue	35,087,304
Fix Cost	394,799
Variable Cost	11,196,040
Total Cost	11,590,839
Income	23,496,465

Source: Primary Data, 2021 (Processed)

food security and vice versa (Limi et al., 2021).

Food Expenditure Share Analysis

The average allocation of food and non-food consumption of watermelon farmer households is presented in Table 2.

Household expenditure which consists of food and non-food expenditure, can describe how the population allocates their household needs. Based on the expenditure ratio, this research found that, on average, the watermelon farmers spent 57.3% on food, and the remaining (47.7%) was used for non-food needs. The data

Table 2. Average Household Food Expenditure of Watermelon Farmers in Trosono Village

Consumption Allocation	Expenditure / Year (IDR)	Percentage (%)
Food Consumption	19,944,823	52.3
Non-Food Consumption	16,759,415	47.7
Total	36,704,238	100

Source: Primary Data, 2021 (Processed)

shows that the ratio of food is larger than non-food expenditure, an indicator of limited household income. Engel's law indicates that a lower percentage of food expenditure to total expenditure indicates a better economic level. On the other hand, the greater the percentage of food expenditure to total expenditure, the less prosperous the household is.

Table 3 describes how farmer households spend their income on food products. It was found that rice, tubers, and their processed products (18.7%), tobacco (17.6), and fish (10,6%) were the highest food expenditures for farmer households. Meanwhile, a minor expenditure came from fruits (2.7%).

During the pandemic, the government encouraged people to increase the consumption of fruits and vegetables for their immune systems. It was also done by most of the

Table 3. The proportion of Household Food Expenditure

Type of Food	Average Expenditure Per Year (IDR)	Percentage (%)
Rice, Tuber, and Processed	3,736,954	18.7
Meat	1,362,698	6.8
Fish	2,122,186	10.6
Egg and Milk	564,488	2.8
Vegetables	1,040,247	5.2
Fruits	546,558	2.7
Peanut	1,734,000	8.7
Spice	1,884,070	9.4
Fat and Oil	765,209	3.8
Food and Other food beverages	1,458,698	7.3
Drink	1,228,786	6.3
Tobacco	3,500,930	17.6
Total	20,059,125	100

Source: Primary Data, 2021 (Processed)

watermelon farming households in Trosono village. However, the increased consumption of fruits was not visible on the table because most farming households consume fruit from their harvest.

Following that, Table 4 illustrates the households' expenditure on non-food consumption. This research reported that education (25.2%) was the highest non-food expenditure. One possible reason is that most watermelon farmer households in Trosono Village have family members of school age, starting from kindergarten to bachelor's degree. In addition to education, communication spending (data) increased during the pandemic due to online school activities.

Table 4. The Proportion of Non-Food Expenditure of Watermelon Farmer Households in Trosono Village

Types of Non-Food Consumption	Average Expenditure Per Year (IDR)	Percentage (%)
Electricity, Water, Gas, and Lighting Household	2,370,047	19.6
Equipment and Maintenance	1,540,363	12.8
Clothing	947,319	7.8
Health and Beauty	1,076,933	8.9
Education, Recreation, and Sport	3,047,372	25.2
Transportation and Communication	2,679,102	22.2
Tax and Other Expenses	411,651	3.4
Total	16,759,415	100

Source: Primary Data, 2021 (Processed)

Suppose the proportion of expenditure is less than 60%, the household is food secure. However, when the food expenditure is more than 60%, the household is perceived as food insecure (Mulyo & Widada, 2015). The distribution of household food expenditure of watermelon farmers in Trosono Village is presented in Table 5. Table 5 below indicates that 67.4% of watermelon farmer households in Trosono Village had a high share of food expenditure. It means that the allocation of food expenditure is greater than their expenditure on non-food. Purwaningsih et al., (2015) argue that rural communities have a high proportion of rice expenditure. Thus, when the proportion of food expenditure is high, food security is low. This finding is in accordance with Table 3, which shows that grains, tubers, and their processed products occupy the highest proportion of food expenditure of total expenditure on food.

Table 5. Distribution of Household Food Expenditure Share

Food Expenditure Share Category	Household	Presentage (%)	Information
Low (<60% FES)	14	32.6	Food Secure
High (≥60% FES)	29	67.4	Food Insecure
Total	43	100	

Source: Primary Data, 2021 (Processed)

Household Energy Consumption

Food consumption can be seen in terms of food quantity using the Energy Adequacy Level and Protein Adequacy Level parameters. However, this study only calculated the energy consumption (calories) consumed by each household. Food consumption consists of rice, fish, meat, vegetables, fruit, eggs, milk, sugar, coffee, tea, and noodles. One interesting finding was that the pattern of food consumption in Trosono Village between families was not much different. The food menu in one family tends to be the same from morning to evening.

The farmer's household food consumption in Trosono Village was dominated by rice, tamarind vegetable soup, *lodeh* soup, fried tempeh, fried tofu, fried eggs, and fried fish. The type of staple food that members of the farmer's household typically consume in this research was white rice. Carbohydrate intake can affect nutritional status because the number of carbohydrates can significantly increase energy. Furthermore, the food sources of protein that were often consumed covered fried tempeh, fried tofu, fried eggs, and fried *pindang* fish. According to Saputro & Fidayani (2020), farmers often consume tempeh, so tempeh is used as a side dish for daily consumption.

Table 6 reveals that household energy adequacy level and energy adequacy level per household member in Trosono Village were moderate. These results indicate that the household and family members' energy adequacy levels in this research are quite good and varied. On average, they consumed staple

foods such as rice because it is the largest source of carbohydrates contributing great energy. In addition, the farmer households also consumed watermelon as a snack in the morning, afternoon, or evening. The households consume watermelon fruit because the research location is a watermelon fruit center in Lamongan. The availability of watermelons in large numbers makes them consume them almost daily. Consuming 100 grams of watermelon produces 32.0 kcal of energy, thereby increasing the body's energy needed. Table 7 is presented to see the distribution of the energy adequacy level of all watermelon farmer households in Trosono Village.

To measure the level of household food security, the Energy Sufficiency Figure approach was used. The level of energy consumption shows the food security situation of farmer households. According to Umbu et al., (2021), the household-level energy food security is grouped into two categories: food security (energy consumption is more than 80% energy adequacy) and

Table 6. Average of Energy Consumption

Description	Energy (kcal/day)	
	Household	Capita/day
Consumption	1,995.15	1,990.81
Energy adequacy rate recommend	2,158.8	2,164.2
Energy adequacy level (%)	92.42	91.99
Energy adequacy level category	Medium	Medium

Source: Primary Data, 2021 (Processed)

Table 7. Distribution of Energy Adequacy among Households.

Food Security Category	Number of Households	Percent age (%)
Less (\leq 80% energy adequacy)	13	30.23
Sufficient ($>$ 80% energy adequacy)	30	69.77

Source: Primary Data, 2021 (Processed)

food insecurity (energy consumption is less than or equal to 80% energy adequacy).

Table 7 shows that most of household are sufficient. Households that are categorized as less food insecure are typically due to a lack of consumption of other food sources. During the COVID-19 pandemic, the consumption pattern of farmer households in Trosono Village has shifted, especially regarding the portion of vegetables and fruit consumed by the households.

According to Utami (2020), nutrition and health for the body can be nourished by regulating meal portions. Balanced nutritious food and appropriate portions are useful for increasing the body's immune system. To make it happen, it is necessary to adjust the proportions of staple foods, side dishes, vegetables, and fruit. Before the pandemic, housewives bought three bunches of vegetables for twodays which turned into two bunches for one day. The pattern of fruit consumption also changed. In the past, farmers' households consumed fruit when they wanted to. Since the pandemic, the desire has increased to consume fruit every day.

Food Security Level of Watermelon Farmers in Trosono Village.

The level of household food security was obtained from a cross-combination between the share of food expenditure and the energy adequacy rate. Based on the cross-combination results, there were four categories of food security levels: food secure, food vulnerable, food less secure, and food insecure. The distribution of household food security levels of watermelon farmers is presented in Table 8.

Majority (46.5%) of households in Trosono Village are categorized as food vulnerable. It means that the household has a high share of food expenditure and consumes enough energy. A high share of food expenditure means more than 60% of the income is spent on food. This condition indicates the low income received by this household group. However, with this limited income, they can still allocate their food expenditure to meet energy sufficiency.

Table 8. Distribution of Food Security Levels

Energy Consumption per Adult Equivalent Unit	Share of Food Expenditure	
	Low (<60% Total Expenditure)	High (≥60% Total Expenditure)
Sufficient (>80% Energy Adequacy)	Food Secure 10 (23.2%)	Food Vulnerable 20 (46.5%)
Less (≤80% Energy Adequacy)	Food Less Secure 4 (9.3%)	Food Insecure 9 (20.9%)

Source: Primary Data, 2021 (Processed)

Factors that Affect the Energy Adequacy Rate

A number of factors influence household food security, including household head education, the size of the household (Ruhjana et al., 2020), income and age of the household head (Drammeh et al., 2019), rice expenditure (Safitri et al., 2017), and maternal education (Limi et al., 2021).

Table 9 shows the result of the factors that affect the energy adequacy rate. Based on the regression result, number of family, education, income, and rice expenditure have a significant effect to energy adequacy rate, while family head age doesn't have a significant effect.

The number of family members was found to reduce the value of the energy adequacy rate. An increase of family members in the household with limited income will result in reduced meal size or skipping of the main meal

Table 9. Factors Affecting Energy Adequacy Rate

Variable	Coefficient	t	Sig.
Cosntanta	1007.223	6.428	0.002
Family Head Age	5.025	1.310	0.198
Number of Family members	-112.055	-2.356	0.024*
Education of Family Head	23.855	2.123	0.041*
Income	0.110	2.308	0.027*
Rice Expenditure	1.440	2.385	0.022*
Education of Mother	26.396	2.060	0.047*

Source: Primary Data, 2021 (Processed)

to balance and ensure enough food for everyone. This may be due to more members that are economically inactive possibly children and old people signifying that such households have a higher dependence ratio (Ndhleve et al., 2021).

This research also confirmed that rice expenditure significantly affected the energy adequacy rate. In this study, rice expenditure shows how much the households will spend buying rice. According to Safitri et al., (2017), If the consumption of rice as the main energy source is less, it will result in a low level of energy consumption.

Another factor that significantly affected the energy adequacy rate of farmer households was education and income. Drammeh et al., (2019) reveal that the farmers' low income is a major cause of household food insecurity because they do not have enough money to afford balanced food. Besides, education plays a key role in household food security, particularly for females, because they prepare and serve food, so they will affect the nutritional status of their families .

CONCLUSION

Based on the analysis, this study draws several important conclusions. First, the watermelon farmers' income level still needed to be higher. Thus, it is recommended to hold agricultural technology counseling. The use of technology can reduce watermelon production costs and increase their income. Second, some households still fell into less insecure categories. There is

a need for socialization about the importance of other staple food sources and regulating balanced, nutritious, and diverse food consumption patterns. Finally, the energy adequacy rate value can be increased through informal education. Therefore, it can affect farmers' income by increasing their skills and mothers' knowledge to improve their families' nutritional status.

REFERENCES

- Drammeh, W., Hamid, N. A., & Rohana, A. J. (2019). Determinants Of Household Food Insecurity And Its Association With Child Malnutrition In Sub-Saharan Africa: A Review Of The Literature. *Current Research in Nutrition and Food Science*, 7(3), 610–623. <https://doi.org/10.12944/CRNFSJ.7.3.02>
- Kuwornu, J. K. M., Suleyman, D. M., & Amegashie, D. P. K. (2013). Analysis of Food Security Status of Farming Households in the Forest Belt of the Central Region of Ghana. *Russian Journal of Agricultural and Socio-Economic Sciences*, 13(1), 26–42. <https://doi.org/10.18551/rjoas.2013-01.04>
- Lamongan Regency Food Security Service. (2020). *Rancangan Akhir Rencana Kerja 2020*. <https://Lamongankab.Go.Id/Documents/Dkp/4.%20RENJA%202020.Pdf>
- Limi, M., Zani, M., & Selvi, S. (2021). Factors Affecting The Food Security of The Bajo Community Households In West Muna District During The Covid-19 Pandemic. *Habitat*, 32(2), 74–81. <https://doi.org/10.21776/ub.habitat.2021.032.2.9>

- Mohamed, A. A. (2017). Food Security Situation in Ethiopia: A Review Study. *International Journal of Health Economics and Policy*, 2(311), 86–96. <https://doi.org/10.11648/j.hep.20170203.11>
- Mulyo, J. H., & Widada, A. W. (2015). Households' Food Security and Food Self Sufficiency in the Rural Marginal Area of Bojonegoro Regency. *Agro Ekonomi*, 26(2), 121–128. <https://doi.org/10.22146/agroekonomi.17265>
- Ndhleve, S., Dapira, C., Kabiti, H. M., Mpongwana, Z., Cishe, E. N., Nakin, M. D. V., Shisanya, S., & Walker, K. P. (2021). Household Food Insecurity Status And Determinants: The Case Of Botswana And South Africa. *Agraris*, 7(2), 207–224. <https://doi.org/10.18196/agraris.v7i2.11451>
- Purwaningsih, Y., Hartono, S., Masyhuri, M., & Mulyo, J. H. (2015). Pola Pengeluaran Pangan Rumah Tangga Menurut Tingkat Ketahanan Pangan Di Provinsi Jawa Tengah. *Jurnal Ekonomi Pembangunan: Kajian Masalah Ekonomi Dan Pembangunan*, 11(2), 236–253. <https://doi.org/10.23917/jep.v11i2.327>
- Puspita, M. A. (2017). An Analysis of Farmer Household Food Security: Case Study in Patuk Village, Wajak, Malang Regency. *Agricultural Socio-Economics Journal*, 17(01), 16–22. <https://doi.org/10.21776/ub.agris.e.2017.017.1.3>
- Ruhyana, N. F., Essa, W. Y., & Mardianis. (2020). Sociodemographic Factors Affecting Household Food Security in Sumedang Regency West Java Province. *AGRARIS*, 6(1), 38–51. <https://doi.org/10.18196/agr.618>
- Safitri, A. M., Pangestuti, D. R., & Aruben, R. (2017). Hubungan Ketahanan Pangan Keluarga Dan Pola Konsumsi Dengan Status Gizi Balita Keluarga Petani. *Jurnal Kesehatan Masyarakat (Undip)*, 5(3), 120–128. <https://doi.org/10.14710/jkm.v5i3.17181>
- Saputro, W. A., & Fidayani, Y. (2020). Analisis Faktor-Faktor Yang Mempengaruhi Angka Kecukupan Energi Rumah Tangga Petani Di Kabupaten Klaten. *Vigor: Jurnal Ilmu Pertanian Tropika Dan Subtropika*, 5(2), 51–55. <https://doi.org/10.31002/vigor.v5i2.3039>
- The Statistic Indonesian. (2020). *Berita Resmi Statistik: Ekonomi Indonesia Triwulan II 2020 Turun 5,32 Persen*. In <https://www.bps.go.id/pressrelease/2020/08/05/173/-ekonomi-indonesia-triwulan-ii-2020-turun-5-32-persen.html>.
- Umbu, Y., Sabaora, O., Priyanto, S. H., & Prihtanti, T. M. (2021). The Food Security Of The Household Recipient Of Food Independent Village Program In Central Sumba Regency. *SOCA: Jurnal Sosial Ekonomi Pertanian*, 15(2), 334–344. <https://doi.org/10.24843/SOCA.2021.v15.i02.P09>
- Utami, D. W. (2020). *Ketahanan Pangan dan Ironi Petani di Tengah Pandemi COVID-19 - Pusat Riset Kependudukan BRIN*. <https://Kependudukan.Brin.Go.Id/Mencatatcovid19/Ketahanan-Pangan-Dan-Ironi-Petani-Di-Tengah-Pandemi-Covid-19/>