Analysis of Household Food Security Horticultural Farmers Based on Proportion Food Expenditure and Energy Consumption

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Abstract. Food security as economic access to food availability and production to meet future food security challenges. This study research proposes to analyze the food security of horticultural farmer households based on the proportion of food expenditure and energy consumption. The method analysis uses level income, level expenditure, and household consumption horticultural farmers. Results show the average income of farmer households IDR 3.925.200 with food expenditure of IDR 1.997.700 and non-food expenditure of IDR 1.312.500 and the remaining amount of IDR 615.000 for saving. The data shows that spending on food consumption still takes up a large part of farmers' household expenditures. Furthermore, it is known that the average energy and protein consumption of horticultural farmer households is 2.227,25 kcal/capita/day and 53,50 g/capita/day. The average energy consumption rate is 106% and the food expenditure proportion is 60% so that the food security status of horticultural farmer households is vulnerable. The high proportion of household food expenditure shows that horticultural farming households in Indonesia are still relatively not yet prosperous.

Keywords: food security · horticultural · food expenditure · energy consumption

1 Introduction

Food is an important for human and nation if food needs are not met, it will cause disruption of public health, creating national economic and political instability. According to FAO, Food security refers to people having physical, social and economic access to sufficient, safe and nutritious food that meets their dietary needs and preferences for an active and healthy life. Changes in food patterns and demand for more products increase demand for land and water resources thereby increasing uncertainty about food security [1]. Understanding of food security is seen from a macro perspective where food is widely available and the stability of its supply but must include more micro considerations regarding individuals or households having regular access to food [2]. [3] show that the proportion of food-deprived households in each province is still high. In

© The Author(s) 2023
J. Sumantyo et al. (Eds.): ICoSIA 2022, ABSR 29, pp. 35–45, 2023.
https://doi.org/10.2991/978-94-6463-122-7_4

fact, the problem of food security in Indonesia still persists. Several studies have shown that sufficient food supplies nationwide have proven not to guarantee the realization of food security at the regional (regional), household or individual level. Food sufficiency is inseparable from food security so that it can avoid a decline in people's quality of life, hunger and malnutrition [4]. Food adequacy is an indicator of food security at the household level. Food security is a system consisting of subsystems of availability, distribution, and consumption. The food adequacy subsystem functions to ensure food supply to meet the needs of the entire population, both in terms of quantity, quality, diversity and safety.

Food security describes whether or not households have access to adequate quality and quantity of food [5]. Given that the consequences of poverty and hunger can be detrimental, it can also affect people's health, productivity and livelihoods [6]. Food sufficiency is an investment in the formation of higher quality human resources in the future, often an indicator of a region's food security [7]. Indicators of food security include food availability, economic and physical access to food, adequate use of food and having access to food that is quite sustainable [8]. Food security will not be achieved for everyone simply by producing more food, which is a major challenge for some developing countries.

Every country must ensure that all its citizens can fulfill their food needs by using agricultural resources for national food security [9]. However, the agricultural sector is considered still unable to meet the living needs of most farmers in Indonesia. Because food supply alone is not enough and the majority of low-income farming households must be able to buy and ensure good nutrition. Data from the Central Statistics Agency (BPS) released the results of the 2020 Agricultural Census showing that the number of agricultural business households was 26,135,469, most of the workers in the agricultural sector living below the poverty line because it was 55.33 percent or about 14,248,870 households. According to Mosher (1985), a very important benchmark for looking at the welfare of farmers is household development, because some aspects of welfare depend on the level of income of farmers. The amount of income of farmers itself will affect the basic needs that must be met, namely, food, clothing, housing, health and employment. The level of household income is an important indicator to know the level of living of the household.

Households derive their income from agricultural activities on household land and off-farm income [10]. At the household level, the development of the level of food consumption also reflects the level of income or purchasing power of households. The increase in income will result in individuals tending to improve the quality of their food consumption at a higher price. If income increases, food consumption patterns will be more diverse so that the consumption of food with higher nutritional value will also increase [11]. The level of nutritional adequacy can be used as an indicator to show the level of welfare of farmer households calculated based on the number of calories and protein consumed. In addition, indicators can measure food security at the global, regional, national, local and household levels as the basis for measuring food security in aggregate so that it becomes the focus of research. This study aims to analyze the food security of household horticultural farmers based on the proportion of food expenditure and energy consumption.

2 Material and Methods

The location of the study was determined by multistage sampling. First, determine the location of the province and 2 regencies, namely Malang and Kediri Regencies, which were determined deliberately, considering that the average population has a job as a farmer and is a horticultural commodity center area, namely chili. Second, the determination of sub-district sampling is carried out randomly based on information from the regional Agriculture Office in the 2 districts, 2 villages in each of these sub-districts will be randomly selected.

The respondents in this study were chili horticultural farmers. Determination of respondents using the simple random sampling method. The first conducts a census of chili farmers in two districts, so that a sample frame will be obtained. Furthermore, based on census data, 50 farmers were randomly selected in two villages of each district so that a total sample of 200 respondents would be obtained.

2.1 Farmers' Household Expenditures

The total expenditure of farmer households can be known by calculating food and non-food expenditures. The formula used is:

$$HEF = E_f + E_n \tag{1}$$

Information:

HEF : Total household expenditures of farmers (IDR)
$E_{f:}$: Food expenditure (IDR)
En : non-food expenditures (IDR)

In his research added the calculation of food expenditure to the totale expenditure of farmer households [11] which can be calculated using the following formula:

$$PF = \frac{EF}{HEF} \times 100 \tag{2}$$

Information:

PF : Proportion of food expenditure (%)
E_f : food expenditure (IDR)

2.2 Farmer's Household Income

Farm income is the difference between total receipts and total expenses. Analysis of farm revenues is used to determine the amount of revenue obtained in the red chili farming business. Farm revenue is a multiplication between total production and selling price, or it can be written as follows:

$$TR = P \times Q \tag{3}$$

Information:

TR : Total revenue
P : Price
Q : Quantity

Analysis of farm costs aims to find out the overall costs incurred in chili farming. Costs are divided into two, namely fixed costs and variable costs. Fixed costs are costs that are fixedly incurred even if the amount of production is large or small. Therefore, the amount of fixed costs is not affected by the size of production. Meanwhile, variable costs are costs incurred in accordance with the amount of production to be produced. In farming, which includes variable costs consisting of expenses for the purchase of inputs, including; seeds or seedlings, fertilizers, pesticides, land rent, land processing costs, and harvesting costs. Thus, the total *cost (total cost*) is the sum of fixed costs and variable costs, can be formulated as follows:

$$\mathrm{TC} = \mathrm{TFC} + \mathrm{TVC} \tag{4}$$

Information:

TC : Total Cost (IDR)
TFC : Total Fixed Cost (IDR)
TVC : Total Variable Cost (IDR)

Furthermore, if you have taken into account the costs that are complained about, it can be used to calculate income:

$$\pi a = \mathrm{TR} - \mathrm{TC} \tag{5}$$

$$\pi \mathrm{t} = \pi \mathrm{a} + \pi \mathrm{n} \tag{6}$$

Information:

πt : Total income (IDR)
πa : Agriculture income (IDR)
πn : Non-Agriculture income (IDR)

2.3 Food Consumption

The consumption of food in-farmer households can be seen from the quantity and quality of food consumption. Food quality indicates the presence of nutrients needed by the body while food quantity is the amount of nutrients in a food ingredient. This objective was analyzed using an analysis of farmers' household food consumption based on adequacy dietary energy and protein consumption.

Quantitatively assess food consumption, the parameters of Energy Consumption Rate (ECR) and Protein Consumption Rate (PCR) are used.

$$\mathrm{ECR} = \frac{\sum \text{Energy consumption}}{2.100} \text{ x } 100\% \tag{7}$$

Table 1. Measurement of Household-Level Food Security Rate

Energy Consumption Rate	Proportion of Food Expenditure	
	Low (< 60% Total expenditures)	High (≥60% Total expenditures)
Adequacy (>80% Energy Adequacy	1. Food Security	3. Food Vulnerable
Less (≤80% Energy Adequacy)	2. Food Less Secure	4. Food Insecurity

Source: Jonsson and Toole in Maxwell et al. (2000)

$$\text{PCR} = \frac{\sum \text{Protein consumption}}{57} \text{ x } 100\% \quad (8)$$

Information:

ECR : household energy consumption rates (%)
$\sum$ Energy Consumption : amount of household energy consumption (Kcal/capita/day)
PCR : household protein consumption rates (%)
$\sum$ Protein Consumption : amount of household protein consumption (gram/capita/day)

2.4 Food Security

The food security assessment is measured by looking at the degree of household food security in Table 1. The first step in measuring food security is to look at the level of energy insufficiency. If the percentage of per capita energy consumption level is above 80 percent of the energy adequacy figure, it is said to be sufficient, on the other hand, if it is less than 80 percent, it is said to be less. Assessment of the proportion of food expenditure compared to total expenditure. The second rare is to look at the proportion of food expenditure. The proportion of food expenditure is categorized as low and high, categorized as low if the proportion of expenditure is less than 60 percent of total expenditure, on the contrary it is categorized as high if it is less than 60 percent of total food expenditure. The third step is to compare the level of energy consumption with the proportion of food expenditure, so that it can be categorized whether an area is food security, food less security, food vulnerable, food insecurity.

3 Result and Discussion

3.1 Household Expenditures

Household expenditures are expenses incurred for the consumption of all household members. Household expenditures are classified into 2, namely food and non-food expenditures. There are 8 food groups analyzed according to the type of food consumed by the people in the area. The food group includes tubers, grains, oils and fats, animal foods, oily seed fruits, sugars, nuts, fruits and vegetables. Expenditures on food

consumption were calculated over the past week, subsequently each of them was converted into an average expenditure per month. Meanwhile, non-food expenses include electricity, water, children's education, transportation, clothing needs, and other needs incurred by farmers for one month.

Based on Table 2 it can be known that the total expenditure is IDR 3.310.200 per month consisting of food expenditure of IDR 1.997.700 and non-food expenditure IDR 1.312.500. Food expenditure has a greater expenditure value than non-food expenditure, meaning that respondent households still use most of their income to meet their basic needs first, namely their food needs rather than non-food. Food needs through the use of yards with horticultural cultivation and can save on food expenses and ensure the fulfillment of household food needs which are always available, easy to reach and can be used at any time [12].

The household decides what share of expenditure it will devote to the selected food product [13]. In addition, most non-food expenditures are for housing, transportation and other services [14].

Household income obtained from farming and outside the farming business, the first priority is expenditure on consumption in the form of food needs with the proportion of food expenditure reaching 60%. Expenditure data for food is obtained from food purchases including food purchased and consumed away from home [14]. In addition, households can obtain food by having sufficient financial capacity to buy it and require efforts to make food affordable through controlled price fixing or continuously increasing household financial capacity [15]. These findings are in accordance with the results of research conducted by [16–19] regarding the proportion of food expenditure of farmer households in Indonesia, which is 60–63 percent of total income. Household expenditure decision makers are needed to improve household welfare conditions and consumption decisions to achieve a high standard of living [20].

3.2 Household Income

Household income is an amount of money earned from each member of the household from work done in one month that is used to meet his needs. The source of income for farmer households is obtained from farming and outside the farming business. Farm income is income obtained from rice fields, moorlands and yards. Outside farming income is obtained from the work of household members as civil servants, private employees, factory workers, construction workers, drivers, parking workers and trading in markets and stalls.

Family income is one of the determining factors for the quality and quantity of food consumption. Families with high incomes will be more concerned with the quality of food than low-income families. Households with limited income, in the selection of food consumption is still dominated by how to obtain sufficient food in quantity and has not attached importance to the nutrients contained in it.

Based on Table 3, it can be seen that most of the income earned by farmer households is used for food and non-food expenditures, and the remaining IDR 615.000 is for savings. The low savings of farmers in developing countries such as Indonesia is due to the low income received by farmers so that farmers do not focus on saving [21]. The

Table 2. Respondents' Average Household Expenditure Table

Expenditure	Amount (IDR/month)	Proportion (%)
Food Expenditure	1.997.700	60
Non-Food Expenditures	1.312.500	40
Total	3.310.200	100

Source: Primary Data Analysis, 2022

relative proportion of income spent on food, farmer households can be classified as low-income and moderately food insecure households [22]. In addition, agricultural activities depend on nature, such as climate, weather, and season, which causes the income of farm households to become erratic so that the level of income causes differences in the pattern of income distribution with high-income households [23]. This is reinforced by the real difference in savings owned by large farmers, which is IDR. 1.000.000.- per year greater than traditional farmers [24] In fact, farmers' savings are important things that can be used to prepare for farmers' cultivation in the next season, and the preparation of reserve funds in the future, so that the income that farmers will receive next can increase [25, 26].

3.3 Food Consumption

Food consumption is a number of foods and drinks that the population/person eats/drinks in order to meet their physical needs. Food consumption is calculated from the food/drink eaten by each household member without considering the origin of the food (cook it yourself or buy it). The food consumption assessed is energy consumption and protein consumption. Energy consumption is a certain amount of food energy consumed per person per day expressed in kcal/capita/ day and protein consumption is a certain amount of food protein consumed expressed in gram/capita/day. Household nutrition consumption is known by calculating household consumption 24 h ago with the guidelines of the Food Ingredient Composition List (DKBM).

Based on Table 4 It can be known the level of food security of respondents based on the level of energy and protein consumption. The assessment of the level of food security refers to the National Nutritional Adequacy Rate Standard where the Energy Adequacy Rate is 2,100 kcal/capita/day, while protein is 57 g/capita/day [27]. Based on the level of per capita energy consumption, all regions are classified as food secure with an average of 2,227.25 capita/day exceeding the national nutritional adequacy standard. Meanwhile, the level of household protein consumption per capita is not yet food secure with an average value of 53.50 g/capita/day less than the national nutritional adequacy standard. This high energy consumption is due to the consumption pattern of the Indonesian people consuming more carbohydrate food sources which are dominated by the grain food group and the availability of food in that food group is also a lot [28–30]. An important input to food and nutrition policy initiatives by providing estimates of how food consumption is likely to change with changes in prices, incomes and taxation [31].

Table 3. Respondents' Average Household Income, Expenses and Savings

Expenditure	Total (IDR/month)
Income	3.925.200
Total Expenditure	3.310.200
Saving	615.000

Source: Primary Data Analysis, 2022

Table 4. Average Household Food Security of Horticultural Farmers

Number	Village	Energy consumption (kcal/capita/day)	Protein consumption (gram/capita/day)
1	Pujon	2122	52,3
2	Pandesari	2190	54,4
3	Kebonrejo	2342	51,2
4	Kencong	2255	56,11
	Average	2227,25	53,50

Source: Primary Data Analysis, 2022

Table 5. Food Security Status

Description	Score	Status
Food Consumption	2.227,25 kkal/capita/day	
NAR	2.100 kkal/capita/day	
% NAR	106%	Vulnerable
% Food Expenditure	60%	

Source: Primary Data Analysis, 2022

3.4 Respondents' Household Food Security

Assessment of the food security of an area based on a cross-classification between the proportion of food expenditure and the level of household calorie consumption. Based on Table 5, it is known that the food security status of horticultural farmer households is vulnerable. This is due to the high proportion of food expenditure which is 60%, while the proportion of nutritional adequacy in terms of calories is 106%.

The high proportion of expenditure for food groups can be an indicator of declining farmer welfare. The welfare of farmers greatly affects household economic access to food so that it also affects the quantity and quality of food consumed [32]. As the level of household welfare decreases, the household will prioritize meeting their food needs which are useful for overcoming hunger, so that food quality is less considered. On the other hand, households with a high level of welfare will be able to meet their needs not only for food, but also for non-food. This is like what applies to Engel's law, that the proportion of total expenditure allocated to food will decrease with increasing incomes [33, 34] In addition, with the increase in income, households can buy good food, so that it not only serves to overcome hunger, but also to meet the nutritional needs of their household members.

4 Conclusion

Based on the results of the study, it can be concluded that the average household food expenditure per month is IDR 1.997.700 or 60% of the total expenditure. This means that spending on food consumption still takes up a large part of farmers' household expenditures. The average household energy and protein consumption of horticultural farmers is 2.227,25 kcal/capita/day and 53,50 g/capita/day. The average energy consumption rate is 106%, and the food expenditure is 60% so that the food security status of horticultural farmer households is vulnerable.

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