

# The Economic Factors Affecting Food Security in Central Java

Dwi Sulihati Sri Sugiharti\*

Regional Planning Research and Development Agency of Central Java Province, Semarang, Indonesia

**Abstract:** Food security is a complex phenomenon that is encompassing in many aspects. Pursuing food security is a significant issue for most provinces, including Central Java. This study considers the prominent role of the economic dimension, shown by the share of food expenditure, in improving the level of food security. By examining the effect on food security of food expenditure in the diverse economic conditions across the districts of Central Java, this study finds that food expenditure share is the most important factor to ensure the food security status. This research study uses Johnson & Toole (1991)'s methods, following Maxwell, et al. (1995), to describe the food security status in Indonesia. It uses analysis between the share of food expenditure and calorie intake to show the level of food security. Food security status is classified into four categories (food secure, less secure, vulnerable, and insecure), which are determined using two standard requirements of calorie intake, the National Food and Nutrition Symposium Standard and the World Bank Standard.

**Keywords:** calorie intake; economic; food security

## 1 Introduction

Food security is a worldwide problem demanding the attention of governments and the scientific community. Food security not only covers the availability of food but also covers the ability to buy food. It also means that there is no dependency on food on other parties. Food security is defined by the Indonesian Food Law Number 18 the Year 2012 as adequate food, for the nation and each citizen, that is reflected by sufficient food availability, both in quantity and quality, safe, diverse, nutritious, prevalent and affordable as well as not conflicting with religion, belief, and culture, in order for the citizens to live healthy, active and productive lives sustainably. The definition of food security above implies four aspects of food security, namely availability, accessibility, utilization, and stability. Ensuring food security is one of any government's most important responsibilities, and food policies must be forcefully promoted to this end.

### 1.1 Background Concepts of Food Security

The international community began to show a major concern regarding food security only in the 1970s when the world suffered a global food crisis (Soekirman, 2000). The concept of food security gained prominence at the World Food Conference of 1974, becoming associated with the food self-sufficiency of individual countries (Scanlan, 2001). Numerous definitions of the concept have been developed as it has shifted from food production and importing capabilities at the macro level to a focus on individuals and their ability to avoid hunger and under-nutrition (Foster, 1992).

For the United Nations Development Program (UNDP, 1994), food security means that all people at all times have both physical and economic access to basic food. This requires not just enough food to go around. It requires that people have ready access to food that they have an entitlement to food by growing it for themselves, by buying it or by taking advantage of a public food distribution system. The 1996 World Food Summit adopted a still more elaborate definition: food Security, at the individual, household, national, regional and global levels is achieved when all people, at all times, have physical and economic access to sufficient, safe and nutritious food to meet their dietary needs and food preferences for active and healthy life (FAO, 1996). This definition is again refined in the following way: Food security is a situation that exists when all people, at all times, have physical, social and economic access to sufficient, safe and nutritious food that meets their dietary needs and food preferences for active and healthy life (FAO, 2002a).

McClelland & Tweeten (1997) clarifies the concept of food security. He claims that food security has three dimensions. The first dimension, food availability, refers to the supply of foodstuffs in a country from production or imports. A second dimension is food access or the ability to acquire food for consumption, through purchase, production, or public assistance. Food may be available but not necessarily accessible. Thus, Tweeten reinforces

---

\* Corresponding Author: dwi.sulihati@gmail.com

the United Nations Development Program (UNDP) notion that food security is about more than just growth in agricultural productivity; it also considers the distribution. Finally, the last dimension of food security is food utilization, which concerns the physical use of food for human consumption.

FAO (2008) identifies four main dimensions of food security as follows: The first dimension, physical availability of food, addresses the supply side of food security and is determined by the level of food production, stock levels, and net trade. The second dimension focuses on economic and physical access to food since an adequate supply of food at the national or international level does not in itself guarantee household-level food security. Concern about insufficient food access suggests a need for a greater policy focus on incomes, expenditure, markets, and prices in achieving food security objectives. In the third dimension, food utilization is commonly understood as the way the body makes the most of the various nutrients in the food. Sufficient energy and nutrient intake by individuals is the result of proper care and feeding practices, food preparation, diversity of the diet, and intra-household distribution of food. The last dimension is the stability of the other three dimensions over time.

Jrad et al. (2010) present five dimensions of food security as food availability, food accessibility, food utilization, stability of food supply, and food and nutrition safety. They show that: (1) the food availability refers to the physical presence of food which may come from own production, purchases from internal market or import from overseas; (2) food access is the ability to obtain sufficient food of guaranteed quality and quantity to meet nutritional requirements of all household members. It indicates the food should be at the right place at the right time and people should have economic freedom or purchasing power to buy adequate and nutritious food; (3) food utilization that refers to ingestion and digestion of adequate and quality food for maintenance of good health; (4) stability of food supply that refers to the continuous supply of adequate food all year round without shortages; (5) food and nutrition safety is part of a wide range of issues which go beyond the avoidance of food-borne biological pathogens, chemical toxicants, and other hazards (FAO, 2002b).

Many experts agree that food security, at least, has to consist of three main important dimensions, namely: food availability, food accessibility, and food utilization. Hence, in this analysis, those three dimensions are employed to determine food security in Central Java.

## **2 An Overview of Food Security In Central Java**

With a population of about 34.26 million people, food security is a critical and sensitive issue on the Central Java government's agenda. Although the program to increase food production provides greater food availability, the problem of food security still exists. It means that an increase in food production does not necessarily lead to improved food accessibility.

Many factors affect a region's food security, which includes food production performance, population growth, income growth, and distribution (Sombilla & Mahabub, 2000). The combined effect of these factors has an undeniable impact on food security. According to (Barichello, 2000) food security is affected by the ratio of food expenditure and income. For achieving food security, a food expenditure share of the family income must be kept below some critical percentage. Other studies indicate that economic access to food is influenced by a share of food expenditure, income, and price of food (Webb et al., 2006). Thus, the share of food expenditure is undoubtedly important for achieving food and nutrition security. Therefore, this paper proposes to examine the effect of food expenditure share and consumption on food security using (Johnson & Toole, 1991) methods that use cross-analysis between the share of food expenditure and consumption of calories. In this study, the data will show that a share of food expenditure revealed by economic factors is the prominent problem affecting Central Java's food security.

The economic dimension of food accessibility is related to purchasing power at a household or individual level (Haddad, 1997; Maxwell, Frankenberger, & others, 1995). According to Subramanian & Deaton, (1996), increasing income is effective in reducing food insecurity and malnutrition. Therefore, the Central Java government must take the right policy measures to achieve its food security. Suryana (2008) explains that policies to facilitate the achievement of sustainable food security must strengthen the food supply by sustainably maximizing available resources, improve the food distribution system to guarantee stable food supply and public access to food, encourage diversified food consumption as well as prevent and resolve food scarcity.

In order to explain the present condition of food security in Central Java, some data on food security aspects from 2013 to 2017 is provided as necessary background information for this study. Three main topics are presented: an overview of the current situation of food availability, food accessibility, and food utilization in Central Java.

### **2.1 Food Availability**

Food availability is regarded as an integral part of the food security chain. Food availability is a condition of the availability of food primarily from domestic production and national food reserves as well as imports if both main sources are unable to fulfill demand. Central Java government wants to ensure food availability for its people, and, for that, sustainable food production is the most fundamental source of food. Food production, therefore, plays a critical and increasing role in food security. Figure 1 shows the trend of productivity of paddy, maize, cassava, and sweet potatoes.

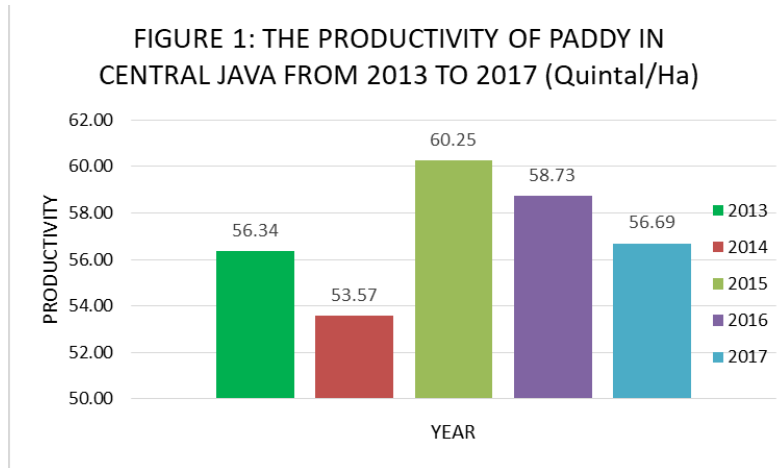


Figure 1. The Productivity of Paddy in Central Java from 2013 to 2017 (Quintal/Ha)  
(Source: Author's Analysis, 2018)

Figure 1 shows that during 2013-2017, the productivity of paddy had its peak in 2015 with the number of 60.25 Quintal/Ha. It has gradually decreased ever since. In 2017 it reached the number of 56.69 Quintal/Ha, which is almost as much paddy productivity as in 2013.

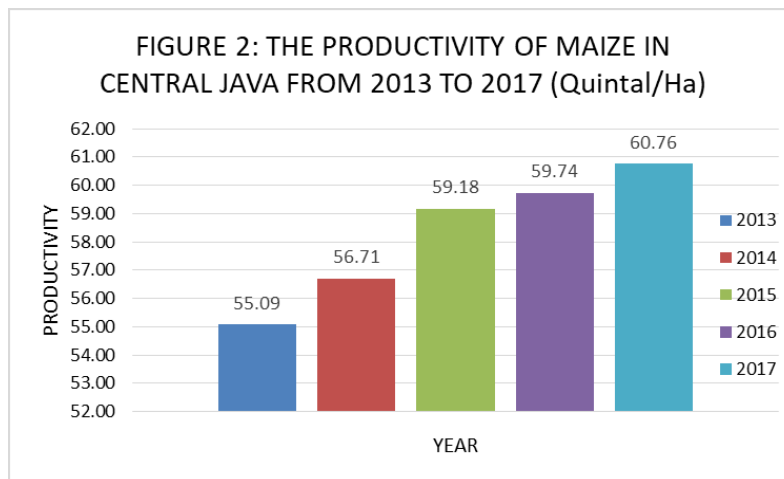


Figure 2. The Productivity of Mazie in Central Java from 2013 to 2017 (Quintal/Ha)  
(Source: Author's Analysis, 2018)

Regarding the productivity of maize, figure 2 shows that productivity of maize during 2013-2017 has increased from 55.09 quintal/ha in 2013 to 60.76 quintal/ha in 2017.

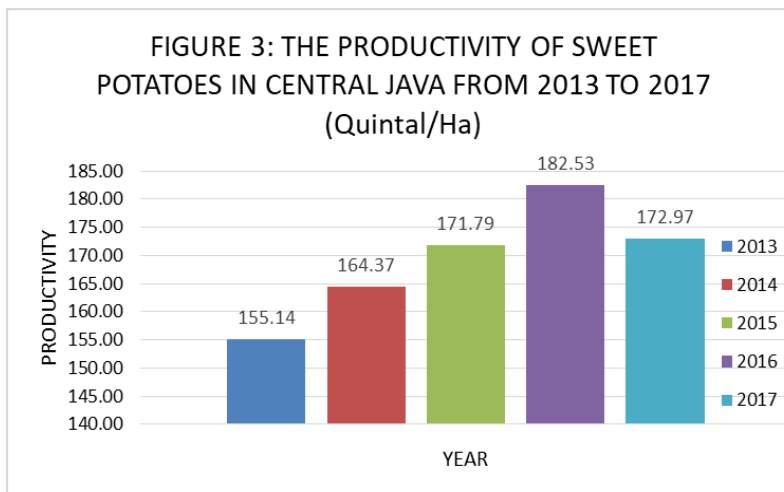


Figure 3. The Productivity of Sweet Potatoes in Central Java from 2013 to 2017 (Quintal/Ha)  
(Source: Author's Analysis, 2018)

From 2013 until 2016, the productivity of sweet potato has increased from 155.14 Quintal/Ha to 182.53 Quintal/ha. Unfortunately, it slightly decreased to 172.97 Quintal/Ha in 2017.

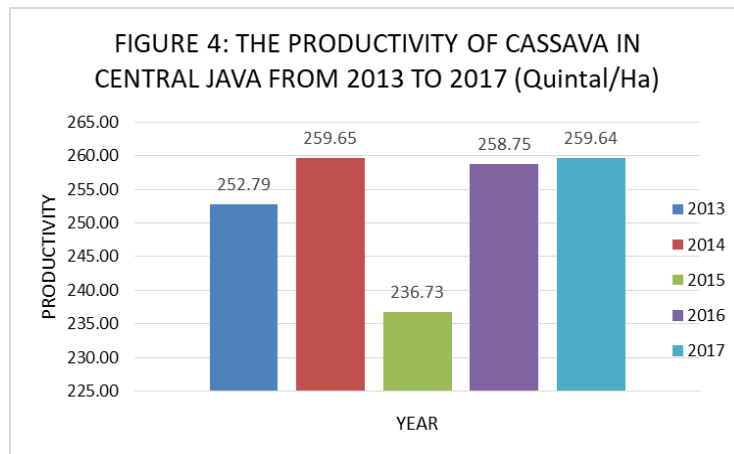


Figure 4. The Productivity of Cassava in Central Java from 2013 to 2017 (Quintal/Ha)  
(Source: Author's Analysis, 2018)

In the meantime, figure 4 shows that the productivity of cassava tends to fluctuate during 2013-2017, with its lowest level of productivity of 236.73 Quintal/Ha in 2015.

When one examines food availability, one needs to look at the availability of calories and protein. The availability of calories is calculated by converting food quantities into kilocalories. The following figures present the availability of per capita calories by the foodstuff commodity group.

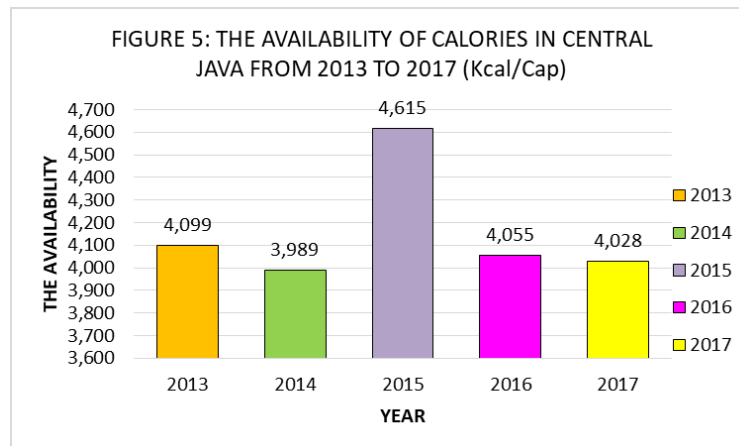


Figure 5. The Availability of Calories in Central Java from 2013 to 2017 (Kcal/Cap)  
(Source: Author's Analysis, 2018)

Figure 5 shows that for the period 2013-2014, the availability of per capita calories has increased from 4099 kcal in 2013 to 3989 kcal in 2014. Afterward, there was a significant increase to 4615 kcal in 2015. Figure 6 displays the trend of availability of per capita protein by foodstuffs commodity group from 2013 until 2017. The availability of per capita protein shows a continued increase from time to time, while the highest availability of per capita protein is 117.46 grams in 2017.

## 2.2 Food Accessibility

Food availability by itself does not ensure that everyone gets enough food, though adequate food availability is a prerequisite to food accessibility. Food access is therefore defined as a household's ability to acquire an adequate amount of food through one or a combination of own production, stocks, purchases, barter, gifts, borrowing, and food aid. Food may be available on the market but not accessible to specific households if they cannot acquire a sufficient quantity or diversity of food through these mechanisms. Food access depends on household purchasing power, which is determined by household livelihoods. Livelihoods comprise the household's capabilities, capitals/assets (natural, physical, human, economic, and social) and activities required to secure basic needs – income, food, shelter, health, and education (WFP, 2009a).

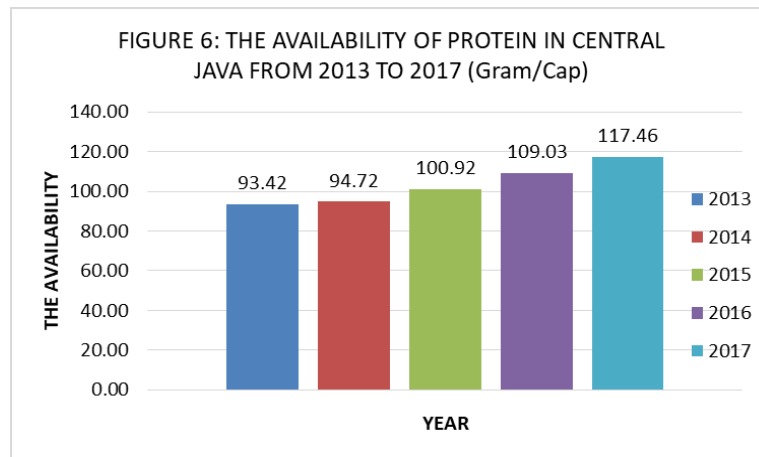


Figure 6. The Availability of Protein in Central Java from 2013 to 2017 (Gram/Cap)  
(Source: Author's Analysis, 2018)

Faridi & Wadood (2010) find that one indicator of the vulnerability of food security might be the percentage of household expenditure on food. If that percentage is high, which is typically accurate for poorer households, the household is likely to suffer some food insecurity whenever it faces some degree of an income shock. Figure 7 presents the average amount of money spent monthly per capita in urban areas in Central Java for the year 2013 to 2016. It clearly shows that the average amount of money spent monthly on non-food in rural areas is lower compared to the average amount of money spent monthly on food per capita. During 2013-2016, the percentage of monthly average food expenditure per capita in Central Java increases consistently from IDR 266.041,00 in 2013 to IDR 337.788,00 in 2016.

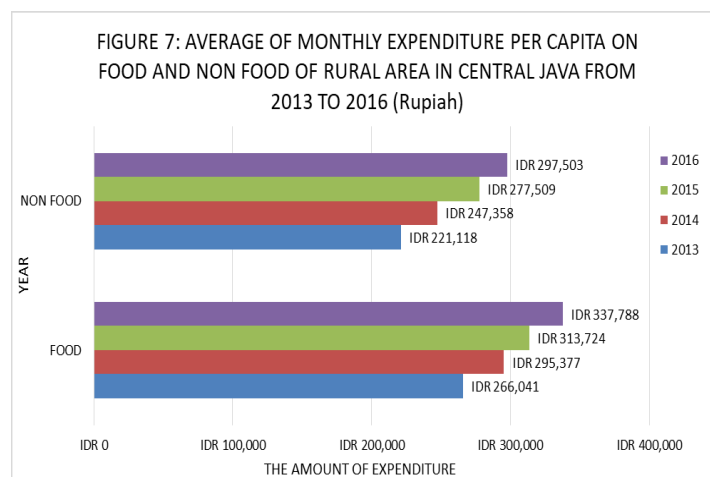


Figure 7. The Availability of Monthly Expenditure per capita on food and non-food of Rural Area in Central Java from 2013 to 2016 (Rupiah)  
(Source: Author's Analysis, 2018)

However, in urban areas, the average amount of money spent on non-food per capita is higher than the average amount of money spent on food per capita. Figure 8 shows the average amount of money spent on non-food per capita in urban areas experienced a relatively steady increase from 2013 to 2014, and it sharply rose from IDR 382.192,00 in 2014 to IDR 468.198,00 in 2015.

Those who do not have sustainable and adequate livelihoods, which in turn lead to inadequate and unstable income and limited purchasing power, remain poor and vulnerable to food insecurity. The greater the number of poor people in a region or a district is, the lower the access to food and the higher the food insecurity (WFP, 2009b).

Household expenditure consists of two groups, i.e., food and non-food expenditure. In limited income conditions, the food needs precedence, so in low-income groups, it will be seen that most of the income is used to buy food. As income increases, there will be a shift in expenditure patterns, i.e., a decrease in the share of income spent on food and an increase in the share of revenues spent on non-food (BKP, 2010). This is in line with the theory Maslow, which states that humans are motivated to meet the needs of his life. These needs have levels ranging from the lowest physiological such as eating to the highest form of self-actualization (Maslow, 1984).

Household expenditure is one indicator that can provide a picture of the welfare of the population and reflects the family income (Hayati & Sugiarti, 2009). Engle's law states that if tastes are not different, then the

percentage of spending on food will decrease with increasing income (Nicholson, 1995). This is a generalization linking the share of food and income expenditure. This condition is caused by food is a necessity that increases more slowly than income. Engle's law is an empirical discovery in which economists recommend that the proportion of income for food used as an indicator of poverty (Setiyaningsih & Wulandari, 2013).

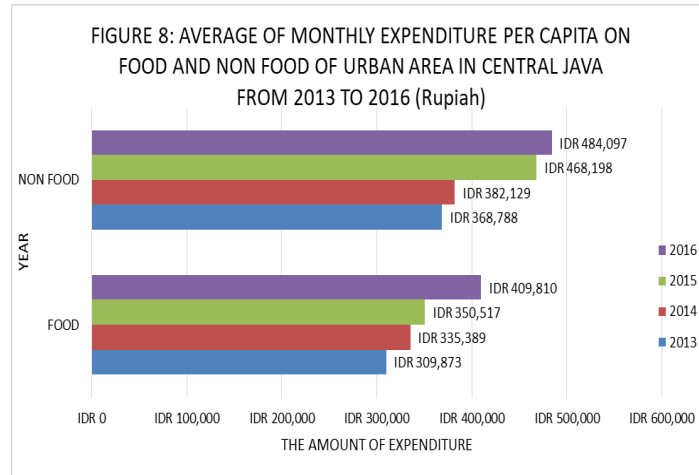


Figure 8. Average of Monthly Expenditure per capita on food and non-food of Urban Area in Central Java from 2013 to 2016 (Rupiah)  
(Source: Author's Analysis, 2018)

The share of food expenditure is one of the food security indicators. The greater of the share of expenditure for food means less food security (Harper, Deaton, & Driskel, 1986). The use of expenditure share in determining household food security is also used by Johnson & Toole (1991) in Maxwell et al., (1995) using cross-classification between the amount of caloric adequacy and the share of food expenditure.

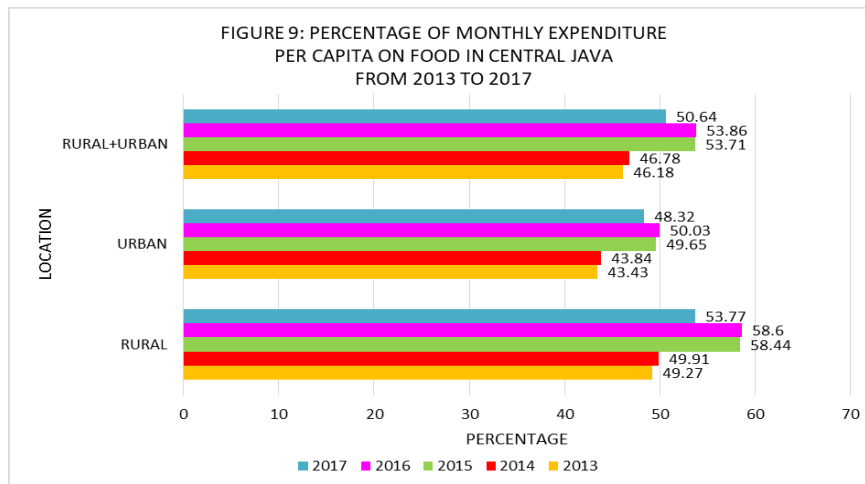


Figure 9. Percentage of Monthly Expenditure per capita on food in Central Java from 2013 to 2017  
(Source: Author's Analysis, 2018)

Figure 9 shows that the portion of income spent on food in Central Java is still high. The trend is even getting higher and higher from time to time. It means that the share of food expenditure, which is the ratio of food expenditure per capita to total expenditure per capita for a month, is still highly prioritized. As a share of food expenditure become greater, it indicates lower food security. When most of the household budgets should be allocated to finance food expenditures, a slight disruption to income or food prices will greatly affect the ability of a household to access food.

### 2.3 Food Accessibility

Improving availability and access to food are necessary but not sufficient conditions to ensure that people will be secure in having the food necessary for leading active and healthy lives. Therefore, food utilization is necessary to ensure food security. Food utilization means being able to assimilate the food consumed to enjoy a healthy life. Food utilization deals with the consumption of food that is defined as the appropriate use of food based on knowledge of basic nutrition. Food consumption here is indicated by the level of the calorie intake of the

population which is expressed in calories (kcal) per person per day, and protein intake expressed in grams per person per day.

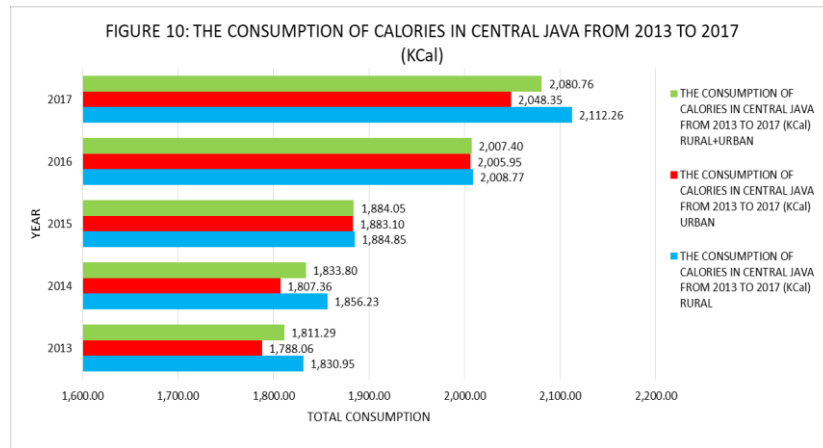


Figure 10. The Consumption of Calories in Central Java from 2013 to 2017 (Kcal)  
(Source: Author's Analysis, 2018)

Figure 10 describes the total calories consumed by people living in Urban and Rural areas in Central Java from 2013 to 2017. There was a significant increase in calorie consumption either in Rural or Urban areas in 2016. In 2017 while the calorie consumption in urban areas remained at the previous level, the calorie consumption in rural areas rose sharply from 2008.77 Kcal in 2016 to 2112.26 Kcal in 2017.

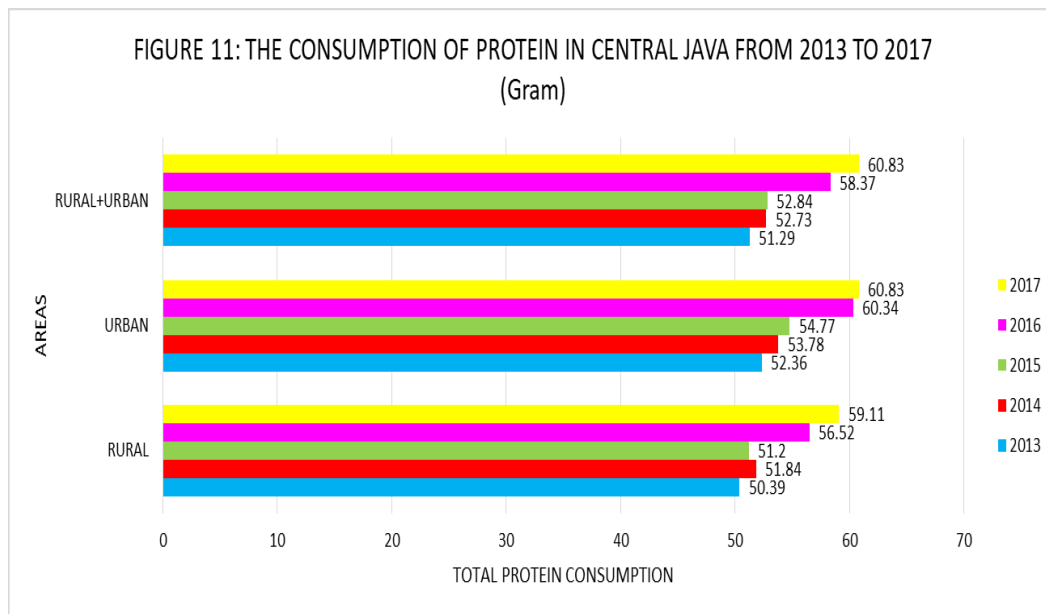


Figure 11. The Consumption of Protein in Central Java from 2013 to 2017 (Gram)  
(Source: Author's Analysis, 2018)

Figure 11 shows protein consumption either in rural or urban areas in Central Java during 2013-2017. There has been a consistently steady increase in consuming protein in both areas from 2013 to 2014. However, the rise increased highly in 2016 and continued in 2017

### 3 Analysis

This paper applies a method to determine food security status, which was conducted by Johnson & Toole (1991). They developed a method applied by (Maxwell et al., 1995) using a combination of the two indicators, (1) share of food expenditure and (2) calorie intake, to classify household food security into four categories: food secure, vulnerable, less secure and food insecure.

Households that have a food share of 60 percent or less and the adequacy of calorie intake above 80 percent of recommended amounts are categorized as food secure; if the share of food is above 60 percent and calorie intake is less than 80 percent of standard requirement, they are categorized as vulnerable; if the food share is 60 percent or less and the adequacy of calorie intake is 80 percent or less, they are categorized as less

secure; and if the households have a share of over 60 percent of food and adequacy of the calorie intake of 80 percent or below, they are categorized as food insecure.

Table 1: Classification of Food Security

Consumption of calorie by adult	Share of food expenditure	
	Low (≤60% of expenditure)	High (>60% of expenditure)
Sufficient (>80% of requirement)	Secure	Vulnerable
Not sufficient (≤80% of requirement)	Less secure	Insecure

Source: Maxwell et al. (1995)

In other words, a secure food area is an area which has enough income and adequate calorie intake; a food less secure area is an area that has enough income but lacks adequate calorie intake; a vulnerable food area is an area that has not enough income but adequate calorie intake; a food-insecure area is an area that has not enough of either income or calorie intake.

Another method is used by comparing the availability of calories and protein to their intake by the people living in Central Java. In this paper, the author compares figure 5 about the availability of per capita calories to figure 10 about the total calories consumed by people living in Urban and Rural areas in Central Java. Moreover, the author also compares figure 6 about the availability of per capita protein to figure 11 about the total protein consumed by people living in Urban and Rural areas in Central Java.

#### 4 Results

By applying the Classification of Food Security in Table 1 above, we can confirm that Central Java is positioned at the level of security based on the consumption of calories by adults combined with a share of food expenditure. The average calorie consumption by an adult in Central Java from 2013 to 2017 is 1,923.46 KCal/Cap/Day, while 80% of calorie consumption requirement is 1,720 KCal/Cap/Day. It means Central Java is sufficient in the consumption of calories by an adult. Furthermore, the average percentage of food expenditure in Central Java from 2013 to 2017 is 50.234%, which is less than 60% set by the Classification of Food Security in Table 1. It means that Central Java has a low share of food expenditure.

As previously mentioned, another method used is by comparing the availability of calories and protein to their intake by the people living in Central Java. The availability of per capita calories from 2013 to 2017 is always more than the total calories consumed by people living in Urban and Rural areas in Central Java during the same periods. Similarly, the availability of per capita protein from 2013 to 2017 is always more than the total protein consumed by people living in Urban and Rural areas in Central Java during the same periods. The result of these comparisons clearly shows that Central Java is a secure food area.

Based on the results of the Central Java Food Balance (NBM) analysis from 2013 - 2017, the availability of calorie and protein in Central Java calculated from production data, output and food intake and use for non-food have exceeded the standard recommended by WNPG X of 2012, which is 2.400 kcal/capita/day for calorie availability and 63 grams of protein/capita/day for protein availability. The data are shown in Figures 5 and 6, which depicts that the availability of calorie and protein in Central Java has surpassed the recommendation issued by WNPG. The average calorie availability for 2013 - 2017 is 4,157.20 kcal / cap / day and protein availability is 102.51 grams / cap / day.

According to the National Food and Nutrition Symposium of 2004, the rate of nutrient adequacy at the individual level is for a calorie intake of 2000 kcal/day and protein intake of 52 grams/day. It applies in this paper for data from 2013 until 2016. And then, for data of 2017, the standard is renewed into 2.150 KCal/Capita/Day and protein intake of 57 grams/day (WNPG X, 2012). This indicator measures the level of food sufficiency in terms of both quantity and quality of food consumption. Therefore, in examining the recommended calorie intake and protein intake, this paper follows this standard requirement.

In general, Central Java has more than enough resources to ensure food availability for all people living in the province, and Central Java's performance on food availability is quite good. In the context of food security, it is also essential to consider the prominent role of food accessibility.

According to the World Bank (2005)(Sen, 1981) food affordability is the most important element of food security, which is ensuring that the poor can afford to obtain food; and to reduce the volatility of availability at the household and national level. The three objectives are interrelated and require a two-pronged strategy at the macro and micro level to maintain a peaceful situation at the grassroots level.

#### References

- Barichello, R. (2000). Evaluating government policy for food security: Indonesia. *University of British Columbia, Berlin*.
- FAO. (1996). *Rome declaration on world food security*. Rome, Italy.
- FAO. (2008). *An introduction to the basic concepts of food security*. the EC-FAO Food Security Programme.



- Faridi, R., & Wadood, S. N. (2010). An econometric assessment of household food security in Bangladesh. *The Bangladesh Development Studies*, 97–111.
- Foster, P. (1992). *The world food problem: tackling the causes of undernutrition in the third world* (Subsequent). Lynne Rienner Pub.
- Haddad, L. J. (1997). *Achieving food security in Southern Africa: New challenges, new opportunities*. Intl Food Policy Res Inst.
- Harper, I. J., Deaton, B. J., & Driskel, J. A. (1986). *Food, nutrition, and agriculture* (Suhardjo, translator). UI Press, Jakarta.
- Hayati, M., & Sugianti, T. (2009). Prospek agribisnis tanaman melati dan peran wanita Madura. *Jurnal Embryo*, 6(1).
- Johnson, U., & Toole, D. (1991). *Household food security and nutrition: A conceptual analysis*. New York: UNICEF.
- Jrad, S., Nahas, B., & Baghasa, H. (2010). Food security models. *Ministry of Agriculture and Agrarian Reform, National Agricultural Policy Center. Policy Brief*, 33, 32.
- Maslow, A. H. (1984). *Motivasi dan kepribadian (Terjemahan)*. Pustaka Binaman Pressindo (Terjemahan). Jakarta: Pustaka Binaman Pressindo.
- Maxwell, S., Frankenberger, T. R., & others. (1995). *Household food security: concepts, indicators, measurements: a technical review*. Unicef.
- McClelland, D. G., & Tweeten, L. G. (1997). *Promoting third-world development and food security*. Praeger Westport, CT.
- Nicholson, C. F. (1995). *Mexico's Dairy Sector in the 1990S: a Descriptive Analysis*.
- Scanlan, S. J. (2001). Food availability and access in lesser-industrialized societies: A test and interpretation of neo-Malthusian and technoecological theories. In *Sociological Forum* (Vol. 16, pp. 231–262).
- Sen, A. (1981). *Levels of poverty, policy and change* (No. 401).
- Setiyaningsih, R. F., & Wulandari, R. (2013). Determinant of poverty using islamic value approach: A Contribution to economy policy for oic member countries and non member countries in Southeast Asia.
- Soekirman. (2000). Beberapa catatan mengenai konsep ketahanan pangan (Notes on the concept of food security). In *round table of food security, Food Security Board*. Jakarta.
- Sombilla, M. A., & Mahabub, H. (2000). Rice and food security in Asia: a long-term outlook. *Food Security in Asia: Economics and Policies*, 35–59.
- Subramanian, S., & Deaton, A. (1996). The demand for food and calories. *Journal of Political Economy*, 104(1), 133–162.
- Suryana, A. (2008). Sustainable food security development in indonesia: policies and its implementation. *highlevel regional policy dialogue, UN-ESCAP and the Government of Indonesia*, 9–10.
- Webb, P., Coates, J., Frongillo, E. A., Rogers, B. L., Swindale, A., & Bilinsky, P. (2006). Measuring household food insecurity: why it's so important and yet so difficult to do. *The Journal of Nutrition*, 136(5), 1404S–1408S.