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Level of Household Food Diversification: A Case Study in East Java with Shannon Index

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ABSTRACT

Food diversification is one of the efforts to ensure and maintain a balanced availability of food for each staircase. High dependence on rice causes the level of food diversification in East Java to be low. This study aims to take into account the level of household food diversification in East Java. How food diversification is assessed using the Shannon-Wiener Index, with secondary data from BPS in 2022 covering 14 food groups such as rice, tubers, fish, vegetables, and fruits. The results of the study show that the level of food diversification in East Java is in the medium category, with a diversification index of 2.3. Food groups such as fishery products (21%) and processed foods/beverages (19%) dominate public consumption, while oil and coconut (2%) and other consumption (2%) are still relatively low. Geographical, cultural, and urbanization factors influence the dynamics of consumption patterns. However, uneven distribution is one of the obstacles to increasing food diversification, especially for local agricultural products such as vegetables and fruits. The main solutions proposed to increase food diversification include the socialization of diverse food consumption and the empowerment of local food-based MSMEs. These measures are expected to increase food variety and strengthen food security in East Java. In addition, other solutions that can be considered include the development of local flour-based food products, public education about the benefits of local food, the development of agricultural technology, infrastructure improvement, and the use of home yards to grow various types of food crops.

1. Introduction

Food is a very important basic human need, and unstable handling in this aspect can have a wide impact on various social dimensions in people's lives. Challenges such as food availability, improving nutrition, adapting to climate change, and sustainability of agricultural businesses must be pursued continuously. Lack of access to and availability of food are risks that cause hunger, so governments around the world are trying to improve food security through various policies and programs.

According to FAO's The State of Food Security and Nutrition in the World report (2021), there are around 17.7 million people in Indonesia who are undernourished or about 6.5% of the national population. Dependence on one type of food, such as rice, also exacerbates the situation. Rice consumption per capita of the Indonesian people in 2023 will reach 81.23

kilograms per year, reflecting low food diversification (National Food Agency, 2023). The level of household income greatly affects food security because the greater the household income, the more quantity and quality of food they can access (Sinya et al., 2019). The community's dependence on rice is influenced by tradition and the perception that the main food without rice is considered incomplete. Programs such as Raskin (Rice for the Prosperous People) have helped strengthen this consumption pattern, especially among low-income people (Aido & Adawiyah, 2021).

In East Java, food distribution patterns still face various challenges, including inadequate infrastructure and uneven distribution (Wahyudini, 2024). East Java is one of the provinces with the largest rice production in Indonesia, but uneven distribution causes inequality in food access in various regions (Syaifullah, 2013). The demand for rice in East Java is expected to continue to increase in line with population growth, which requires efforts to increase production and distribution more efficiently. Food diversification is a strategic step to improve the quality of nutritional consumption and achieve sustainable food security. Low food diversification can hinder the achievement of sustainable food security goals. Diversifying consumption to other sources of carbohydrates such as corn, sago, and sweet potatoes still needs to be improved to reduce the risk of nutritional imbalance. This research aims to contribute to researchers, the government, and related agencies in understanding the condition of food diversification and finding out how the level of household food diversification in East Java. With the data obtained, the results of the research can be used as a basis for decision-making to improve food security in the region. This effort not only supports food security but is also expected to be able to create a more qualified society in the future. According to research by Mulyaningsih (2021), food diversification is influenced by various factors such as demographic, socio-cultural, and economic. This study explains that food production and processed food are very diverse, with variations in local food consumption patterns that are influenced by these factors. In addition, other studies show that local food diversification can increase the availability of local resource-based food and reduce dependence on one type of food. Factors such as income, education, and access to information also play an important role in determining the level of food diversification (Tarmizi, 2012).

2. Methodology

This study used data from the Central Statistics Agency (BPS) in 2022 covering the entire Province of East Java. The location of the study was selected based on the variation of socio-economic conditions and the availability of complete data related to household income, food prices, and the level of food diversification. To measure the level of food diversification, this study used the Shannon Index. This is supported by the Shannon Index, which is able to measure diversity by capturing both wealth (number of types) and similarity (distribution of proportions) of various types of food commodities (Magurran, 2004). Furthermore, the Shannon Index is more sensitive to changes in the distribution of food commodity proportions so that it can detect small changes in consumption patterns that may not be detected by other indices (Pielou, 1966) and is suitable for use with proportion data that can support the measurement of diversification by taking into account the proportion of each type of food commodity in total consumption (Spellerberg & Fedor, 2003). The formula for the Shannon Index is as follows (Fachrul, 2007 Anjani et al., 2022):

$$H' = -\sum_{j=1}^{N} Pi \ln (Pi) \ldots\ldots\ldots\ldots\ldots\ldots (1)$$

Description:
H′ : Shannon type diversity index
Pi : The i- th food variety
N : The total number of food commodities in all food varieties

Using per capita data, the proportion of commodities for each food variety is calculated by the following formula:

$$p_i = \frac{n_i}{N} \ldots\ldots\ldots\ldots\ldots\ldots (2)$$

Description:
ni = Number of commodities in one food variety
N = Total number of food commodities recorded in the data.

The results of the calculation of the level of diversity of household food consumption will be measured through an index with the interpretation of H' < 1 indicating that the level of food diversity is low, 1 > H' < 3 indicating that the level of food diversity is moderate, and H' > 3 indicating that the level of food diversity is high.

3. Results and Discussion

The diversity of food commodities has great potential because it is supported by a large geographical area rich in fishery, agriculture, and food industry products. However, this diversification is still influenced by several factors, such as limited access, consumption patterns, and differences in geographical areas between urban and rural areas.

3.1 Analysis of Food Commodity Composition

This composition analysis aims to see the extent of the variation in commodities consumed by households in East Java. Data from BPS (2022) shows that households in this province consume 14 food variety groups. However, the contribution of each group varied, with dominance in the fish/shrimp/squid/shellfish group (21%) and finished food/beverage group (17%), while the other group had a lower proportion. This dominance reflects a consumption pattern based on necessities that have not fully shifted towards nutrition-based food diversification.

Table 1. Varieties of Household Food Types in East Java (BPS 2022)

Variety Groups	Total Varieties	Proportion (%)	Main Commodities
Grains	6	3%	Rice (local, superior quality, imported), corn, wheat flour
Tubers	7	4%	Cassava, sweet potato, potato, sago
Fish/Shrimp/Squid/ Shellfish	38	21%	Fresh fish, salted fish, shrimp, squid
Meat	9	5%	Beef, chicken, goat, pork
Eggs and Milk	9	5%	Chicken eggs, liquid milk, milk powder
Vegetables	26	14%	Spinach, kale, cabbage, carrots, mustard greens
Nuts	7	4%	Peanuts, soybeans, tempeh, tofu
Fruit	15	8%	Oranges, mangoes, bananas, durians
Oil and Coconut	4	2%	Coconut oil, cooking oil

Variety Groups	Total Varieties	Proportion (%)	Main Commodities
Beverage Ingredients	7	4%	Tea, coffee, sugar
Condiments	14	8%	Salt, pepper, candlenuts, soy sauce
Other Consumption	4	2%	Instant noodles, crackers
Ready-to-Eat Food and Beverage	32	17%	Ready-to-Eat food, packaged drinks
Cigarettes and Tobacco	5	3%	Cigarettes, tobacco

Source: BPS (processed), 2022

The fish and marine products group shows the largest proportion because the East Java region has a long coastline with a rapidly growing fisheries sector. On the other hand, the fruit and legumes group still has a low proportion, which shows that people's consumption patterns are not optimal in meeting the nutritional needs of other food source variations.

3.2 Food Diversification Index

The food diversification index is an important tool in measuring the diversity of food consumption in a region by considering the variety of commodities and the proportion of consumption. In East Java, the results of the calculation of the food diversification index showed a value of 2.3, which indicates a moderate level of diversification. This means that even though food consumption has covered various categories, the level of diversity is still not optimal. This index not only reflects the variety of food consumed but also shows the social, economic, and cultural conditions that affect people's consumption patterns.

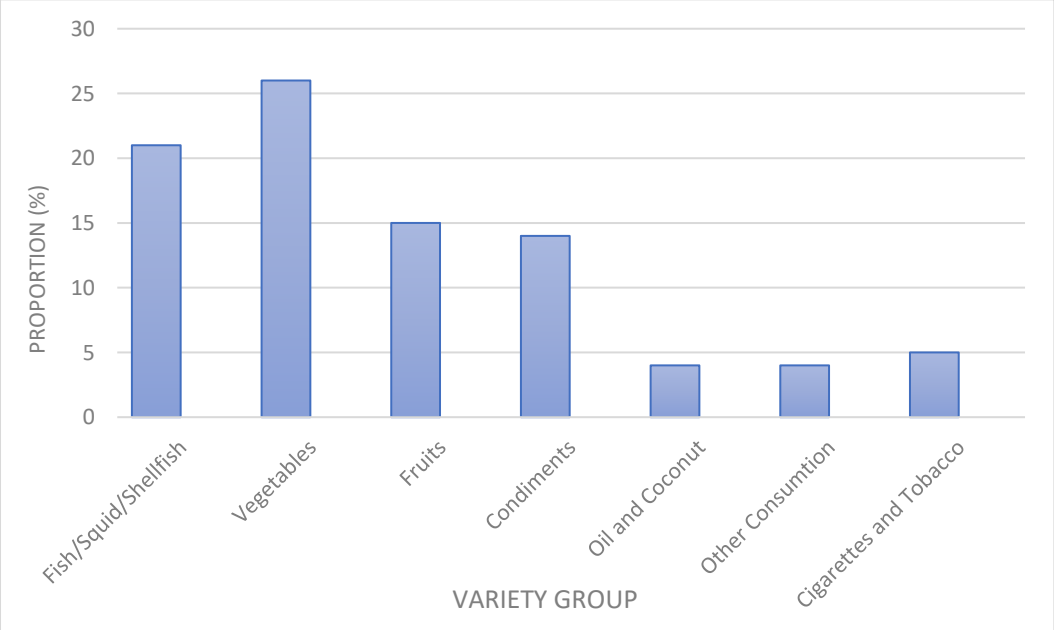

Figure 1. Proportion of Food Diversification in East Java

Fishery commodities such as fish, shrimp, and squid play a central role in the food consumption of the people of East Java. This is not only driven by the geographical availability and abundant potential of the fisheries sector but also by people's preference for fish as the

main source of protein (Hidayat & Kurnia Priambodo, 2023). In addition to geographical factors, people's consumption habits for a type of food. Freshwater aquaculture technology, such as catfish and tilapia, also supports this high level of consumption in several inland areas. The areas with the highest levels of fish consumption are on Madura Island as well as areas along the North Coast of Java such as Lamongan, Tuban, Gresik, Surabaya, Sidoarjo and also the East Coast of Java, including Banyuwangi, Situbondo, and Probolinggo (Diskanlajatim, 2024). This reflects the community's increasing dependence on animal protein sources from marine products.

On the other hand, the consumption of finished food/beverages shows the influence of urbanization and modern lifestyles, especially in urban areas such as Surabaya and Malang. Easy access to ready-to-eat food, practicality, and changes in the eating habits of urban communities are the main driving factors. The rapid growth of the culinary industry and application-based delivery services has also affected the increase in the consumption of processed foods. However, with this lifestyle shift, new challenges have emerged in the aspects of health and food security, where the low nutritional content and people's dependence on instant or ready-to-eat food tend to be higher.

Vegetables and fruits make an important contribution to food diversification, but there is still room for improvement. Vegetable production in highland areas such as Batu and Pujon is quite abundant, but the distribution is not evenly distributed. Fruit consumption is also still relatively low due to fluctuating prices and a lack of innovation in processed products such as juice or fruit chips (Khorniawati, 2014). If the innovation of vegetables and fruit-based products is more developed, consumption can increase sustainably. Some categories, such as cooking oil and coconut (2%) and cigarettes and tobacco (3%), have low proportions, indicating limited diversification in this sector. Coconut-based products and vegetable oils have great potential to be developed, both as direct consumption ingredients and as processed products. Cigarette consumption shows a shift towards e-cigarettes among the younger generation, which also needs attention because of its impact on public health (Elsa & Najib, 2019; Sriyanto & Pangestu, 2022).

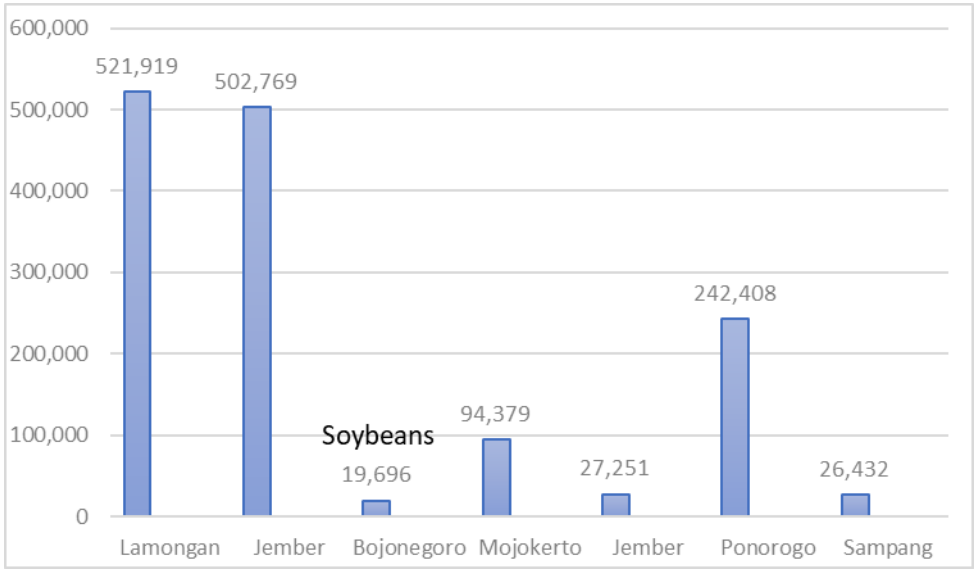

Figure 2. Distribution of Food Production in Regencies in East Java (BPS, 2022)

The graph above shows that Lamongan has high rice production, and Jember also has significant corn production. This shows that the two districts can be said to be rice and corn barns in East Java. The graph above shows the food diversity of the districts in East Java that share different types of food. Ponorogo, with the most superior type of food, is cassava, Mojokerto is the type of sweet potato food, and other districts in the production of soybeans, peanuts and tobacco.

The diversification index value of 2.3 indicates that there is flexibility in food consumption patterns in East Java. However, this diversity does not reflect the ideal nutritional balance. Urbanization factors, economic structure, and government policies play an important role in shaping people's consumption patterns. Urbanization is driving a shift in consumption from traditional foods to processed foods, especially in urban areas. The economic structure also affects people's purchasing power, where low-income households are more dependent on staple foods such as rice and simple side dishes, while middle- and high-income households have greater flexibility in choosing more diverse foods.

The role of the government is very important in ensuring public access to diverse and nutritious food. The food security program, which has been focusing on rice production, needs to be expanded to include various commodities such as tubers, beans, and vegetables. Diversification of local food production, provision of subsidies for nutritious food, and nutrition education to the community are strategic steps that need to be implemented comprehensively. With this effort, the level of food diversification in East Java can increase to a more optimal stage, thereby supporting sustainable food security and public health in general.

4. Conclusion

This study shows that household food diversification in East Java is in the medium category, with a Food Diversification Index of 2.3. Household consumption includes 14 major variety groups with a total of 183 commodities that vary in their respective contributions. Fisheries and processed food/beverages dominate consumption, with proportions of 21% and 19%, respectively. This indicates that in addition to rice, people have a preference for animal protein sources and practical foods. Although the vegetable (14%) and fruit (8%) groups have an important role in supporting healthy diets, uneven distribution and limited access are the main obstacles to fulfilling balanced nutrition in the community. The consumption of nuts (4%) and tubers (4%) shows that people still do not utilize local food sources as an alternative to protein and carbohydrates.

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