

Strategy to Optimize the Utilization of Local Food Resources in the Perspective of Food Independence and Diversification of Expected Food Patterns Population of Balikpapan City

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ABSTRACT

The objectives of the study are (1) to identify the condition of local food in Balikpapan City; (2) to identify the consumption pattern and amount of Balikpapan people; (3) to develop a strategy to optimize the utilization of local food resources in Balikpapan City. The research is located in 6 sub-districts and 34 urban villages of Balikpapan City by using mixed method approach of explanatory design type, i.e. using a two-phase mixed method which aims to clarify quantitative data and form qualitative results. Samples were taken using Purposive Area Random Sampling technique. Data were analyzed descriptively, scoring the Expected Food Pattern (PPH), and interactive analysis. The results showed that the provision of vegetables and fruits in 2024 increased by 700% and tubers by 600% from the previous two years. In contrast, the supply of grains and animal food is supplied from Java & Sulawesi. The food pattern of people in Balikpapan City is still dominated by three main groups, namely from the grains group such as rice and corn, animal food group and vegetable and fruit group. The research recommends optimizing the utilization of food resources through processing tubers into analog rice and increasing public awareness about the benefits of tubers as a healthy and nutritious alternative

INTRODUCTION

Food is a human right, food also determines the quality of a nation's human resources and food is a pillar of national resilience. Indonesia is committed to realizing 17 targets in the Sustainable Development Goals (SDGs), including zero poverty (target number 1) and ending hunger, achieving food security, improving nutrition and promoting sustainable agriculture (target number 2). (<https://sdgs.bappenas.go.id>)

Article 12, paragraph 5 of Law of the Republic of Indonesia No. 18/2012 on Food states that to realize food availability through domestic food production is done by: (a) developing food production based on local resources, institutions, and culture; (b) developing the efficiency of food business systems; (c) developing facilities, infrastructure, and technology for food production, post-harvest handling, processing, and storage; (d) building, rehabilitating, and developing food production infrastructure; (e) maintaining and developing productive land; and (f) developing food production centers. Indonesia has the fourth largest population in the world at around 270 million and is classified as a lower-middle-income country. In 2021, Indonesia has a Global Hunger Index ranked 73rd out of 116 countries, with a food-insecure population of 22.9 million and an undernourished prevalence rate of 8.49% of the population (World Food Programme, 2022).

Based on the city IKP ranking, the ten cities with the best scores are Denpasar (95.80), Salatiga (94.20), Bekasi (93.55), Solok (92.87), Madiun (92.49), Surabaya (92.14), Bukittinggi (91.78), Balikpapan (91.40), Semarang (91.31), Magelang (91.18). The complete city rankings and IKP can be seen in Table 1

Table 1. Ranking and Food Security Index (FSI) of the City 2023

Rank	City	FSI
1	Denpasar City	95,80
2	Salatiga City	94,20
3	Bekasi City	93,55
4		92,87
5	Madiun City	92,49
6	Surabaya City	92,14
7	Bukittinggi City	91,78
8	Balikpapan City	91,40
9	Semarang City	91,31
10	Magelang City	91,18

Source: National Food Security Agency (2023)

Although ranked in the top 10 with the highest IKP at the city level, Balikpapan City has its own challenges in strengthening food security at the regional level. The challenges of Balikpapan City in the aspect of food security can also be seen from the decline of food affordability index as shown in Table 2 below.

Table 2. Data on Availability Index, Affordability Index, Utilization Index and Food Security Index of Balikpapan City Region

No.	Aspects	Year of 2022	Year of 2023	Rank
1	Affordability	98,01	97,13	-0,88
2	Utilization	81,06	83,20	2,14
3	Composites	88,68	89,47	0,79

Source: National Food Security Agency (2023)

A decrease in the aspect of food affordability in Balikpapan City to -0.088 points compared to 2022 shows that people have difficulty in accessing foodstuffs needed daily. Currently, the realization of food security does not only focus on the macro level (national/regional) by ensuring sufficient food availability. Areas categorized as food secure cannot guarantee comprehensive food security conditions at the household level. This is because each household has different and uneven access to food (Ilham, et al., 2017). The concept of household food security is increasingly developing and has shifted from measuring food availability and utilization to measuring food access. The dimension of food access at the household level is a key factor in achieving food security (Rachman, 2010). Food security consists of three main subsystems, namely food availability, food access and food utilization, while nutritional status is an outcome of food security (Hanani, 2012). The decline in the affordability aspect in 2023 shows that the proportion of rice supply as the main food comes from outside East Kalimantan

The research objectives are: (1) to identify the amount of production & productivity of local food resources; (2) to identify the pattern & amount of consumption of Balikpapan people; (3) to design strategic optimization of local food resources utilization. While the urgency of the research are: (1) to increase food security and independence of Balikpapan people; (2) to utilize local food resources optimally so as to reduce dependence on food supply from other regions; and (3) to increase farmers' income and exchange rate.

LITERATURE REVIEW

Food security is a condition of food fulfillment for every individual, which is reflected in the availability of sufficient food, both in quantity and quality, which is safe, equitable and affordable. Food security consists of three main dimensions, namely food availability, food access and food utilization (Hanani, 2012). However, along with developments, the focus of food security has shifted from simply providing food nationally to efforts to diversify local food consumption as a form of independence and sustainability (Rachman, 2010; Ilham et al., 2017). Diversification of food consumption based on local resources has proven to be an important strategy in dealing with food security vulnerabilities due to dependence on commodities outside the region (Soesilowati et al., 2024).

Pola Pangan Harapan (PPH) as a measurement tool for the diversity and nutritional quality of community consumption is used in the formulation of local food policies. Research by Dewi & Utami (2019) and Ayuningtyas et al. (2018) mentioned that the increase in PPH score is in line with the increase in the utilization of nutritious and diverse local food. This is in line with the finding that local tubers have potential as functional food due to the content of bioactive compounds such as dioscorin and diosgenin which are beneficial for health (Prabowo et al., 2014). In this context, optimizing the utilization of local food resources not only supports food security, but also encourages local economic growth through increasing the added value of local food products (Soesilowati et al., 2018).

The implementation of strategies such as Balikpapan Agro Hub can shorten the supply chain and improve the efficiency of food distribution, while strengthening the position of local farmers in the city's food system (Sukartiningsih et al., 2014). This strategy is an innovative solution to the challenge of regional dependence on external food supplies, as well as a concrete step in realizing regional food self-sufficiency (Soesilowati et al., 2024).

METHODOLOGY

The research is descriptive with a mixed method approach of explanatory design using a two-phase mixed method that aims to clarify quantitative data and form qualitative results. Research on Strategies for Optimizing the Utilization of Local Food Resources in the Perspective of Food Security and Independence is a specific and holistic study. Specific means that the research subjects are farmers. Holistic means that the study in this research concerns not only production but also economic aspects. The researcher and the researched are interactive in a certain time and context.

The research location is in Balikpapan City with the population of household heads of 6 sub-districts and 34 villages. Samples were taken using Purposive Area Random Sampling technique @ 5 households each village, including.

Table 3. The Number of Population

No	District	Village	Total number of households
1.	Balikpapan East	Lamuru, Manggar, Manggar Baru, Tritip	20
2.	West Balikpapan	Baru Ilir, Baru Tengah, Baru Ulu, Kariangau, Manggarsari, Margamulyo	30
3.	North Balikpapan	Baru Ampar, Graha Indah, Gunung Samarinda, Gunung Samarinda Baru, Karang Joang, Muara Rapak	30
4.	Central Balikpapan	Gunungsari Ilir, Gunungsari Ulu, Karangjati, Karangrejo, Mekarsari, Sumber Rejo,	30
5.	South Balikpapan	Damai Bahagia, Damai Baru, Sepinggan, Sepinggan Baru, Sepinggan Raya, Sungai Nangka	30
6.	Balikpapan Kota	Damai, Klandasan Ilir, Klandasan Ulu, Prapatan, Telagasari	30

Primary data were obtained from surveys, interviews, questionnaires and FGDs, while secondary data were sourced from documents of the Food Service Office, the Agriculture and Fisheries Office, the Office of Cooperatives, Micro, Small and Medium Enterprises and the Trade Office. Data were analyzed using descriptive percentage, measurement of Food Expectation Pattern (PPH), and Interactive method (Miles, M.B., Huberman, 2014).

The food consumption pattern of a region's population reflects factual food consumption. Food consumption patterns ideally explain the balance of the composition and contribution of macronutrients (carbohydrates, fats and proteins) and micronutrients (vitamins and minerals) (Ayuningtyas et al., 2018; Dewi & Utami, 2019; Febriamansyah & Tarumun, 2015). The balance in question is the amount of food group contribution to the fulfillment of energy and protein consumption. Pola Pangan Harapan (PPH) is a simple measurement tool to assess the level of diversity and nutritional quality of food consumption in a region. The stages in measuring Pola Pangan Harapan (PPH) consist of the following 10 steps

Food Grouping

Table 4. Commodity Type (PPH Group)

No	Food Group	Commodity Type (PPH Group)
1.	Grains	Rice and its products, corn and its products, wheat and its products.
2.	Tubers	Cassava and its preparations, sweet potatoes, potatoes, taro, carrots and sago (including starchy foods).
3.	Animal Food	Meat and its preparations, poultry meat, fish and its preparations, eggs and milk and its preparations.
4.	Oils and Fats	Coconut oil, palm oil, corn oil, margarine and animal fats.
5.	Oily Fruit/Seeds	Coconut, candlenuts, walnuts and chocolate.
6.	Nuts	Peanuts, soybeans, mung beans, kidney beans, peas, cashews, cowpeas, tofu, tempeh, tauco, oncom, soy sauce, soy sauce.
7.	Sugar	Granulated sugar, brown sugar/palm, syrup, bottled/canned beverages
8.	Vegetable and Fruit	Fresh and processed vegetables, fresh and processed fruits, including chips
9.	Others	Various spices and beverage ingredients such as shrimp paste, cloves, coriander, pepper, nutmeg, tamarind, cooking spices, tea and coffee

Convert Shapes, Types and Units

- Grains, tubers, oily fruits/seeds and sugar are given a weight/rating of 0.5
- Fats and oils are weighted 1
- Animal foods, nuts, vegetables and fruits are given a weight of 2
- Other groups are given a weight of 0

Calculating Sub-Total Energy Content by Food Group

At this stage, the energy content of each type of food consumed is calculated with the help of the list of food ingredients composition (DKBM). The energy column in DKBM shows the energy content (kcal) per 100 grams of edible parts (BDD).

Calculate the Actual Total Energy of All Food Groups

$$\begin{aligned} \text{Total energy of 9 food groups} = & \text{ Grain group energy} \\ & + \text{ tubers +.....} \\ & + \text{ other group energy} \end{aligned}$$

Calculating the Energy Contribution of Each Food Group to Total Actual Energy (%)

$$\text{Energy contribution per food group (\%)} = \frac{\text{Food group energy}}{\text{actual total energy}} \times 100\%$$

Calculating the Energy Contribution of Each Food Group to the Energy Adequacy Score.(%AKE)

$$\text{Energy Adequacy Rate (\%AKE)} = \frac{\text{Food group energy}}{\text{AKE Consumption}} \times 100\%$$

Calculating the Actual Score

$$\text{Actual Score} = \text{actual energy contribution per food group} \times \text{weight per food group}$$

Calculating AKE Score

$$\text{AKE Score} = \% \text{ AKE per food group} \times \text{weight}$$

Calculating PPH Score

- a. If the AKE score is higher than the maximum score, the maximum score is used.
- b. If the AKE score is lower than the maximum score, the AKE score is used.

Calculating the Total Score of the Expected Food Pattern

$$\text{PPH score} = \text{PPH score of grains} + \text{tubers} + \text{PPH score of other groups.}$$

RESULT

The year 2024 compared to the previous two years. Vegetables and fruits increased dramatically, reaching around 700%, and root vegetables around 600%. In contrast, the provision of grains and animal foods experienced slight fluctuations, while legumes remained relatively stable but low. These data indicate that focusing on vegetables, fruits and tubers could be a key strategy in optimizing the utilization of local food resources. Increasing the supply of these types of food can reduce food dependency from outside Balikpapan City, strengthen the local economy, and ensure the availability of diverse and sustainable food for Balikpapan people. This strategy should be supported by improvement of agricultural technology, crop processing, and public education on the importance of local food consumption.

The data shows that two local food groups that have great potential to be developed are tubers and vegetables and fruits. (Gozali, et al. 2019). The nutritional content of tubers, vegetables and fruits not only has the function of replacing rice but is a good functional food for diabetics (Soesilowati, 2018). The potential for the development of these two types of food groups can be seen from the aspect of harvest area and total production in 2023 as follows.

Table 5. Potential of Vegetable and Fruit and Tubers Groups

Group	Commodities	Harvested Area (Ha)
Tubers	Cassava	345,68
	Sweet Potato	24,75
	Taro	9,57
Fruits and Vegetables	Mustard	259,20
	Tomato	89,90
	Eggplant	99,50
	Chickpeas	72,40
	Cucumber	81,55
	Kale	288,20
	Spinach	233,05
	Celery	62,50
	Soursop	20,44
	Melinjo	23,05
	Starfruit	24,67
	Avocado	27,36
	Breadfruit	27,59
	Watermelon	28,50
	Litchi	35,80
	Guava	40,53
	Petai	55,75
	Sawo	71,40
	Dragon Fruit	72,47
	Mango	85,40
	Water Guava	92,00
	Banana	125,42
	Jackfruit/Cempedak	168,00
Rambutan	210,60	
Jengkol	219,30	
Papaya	287,10	
Durian	334,50	
Salak	1681,57	

Source: Food and Agriculture Agency of Balikpapan City (2023)

In the context of optimizing the use of local food resources for food security and self-reliance, this data can be used as a basis for identifying commodities that require increased support for agricultural technology, infrastructure and market access. Strategies that can be implemented include the development of nursery programs and planting of superior varieties that are resistant to local diseases, increased training for farmers on sustainable agricultural practices, and improved processing and storage facilities to reduce post-harvest losses. In addition, the use of information technology to open new market access and promote local products is also very important. Many food

policies are paradoxical to food consumption diversification policies, such as the Raskin policy, the dominant rice production policy that ignores local food production, and others (Ariani, et al. 2013).

Strategies to optimize local food resources can support PPH through intensification of vegetable, fruit and tuber production, as listed in local production data. These strategies include increasing production capacity through more advanced agricultural technologies and sustainable agricultural practices, as well as developing effective distribution systems to ensure accessibility and availability of food for the entire community (Soesilowati, E. et al. 2018.). (Soesilowati, E. et al. 2024.). This approach not only supports food security by reducing dependence on imports and stabilizing food supply in crisis conditions, but also encourages food self-reliance by optimizing local potential.

PPH serves as a simple evaluation tool used to assess people's food consumption patterns, both in terms of quantity and diversity of types of food consumed. This assessment is measured by the PPH score, which ranges from 0 to 100. A higher score indicates that the food consumption is more diverse and nutritionally balanced, signifying a better quality of nutrient intake for health. Thus, PPH plays an important role in promoting healthy and sustainable diets for the population.

Referring to the results of the PPH (Pola Pangan Harapan) score in Balikpapan City in 2021, it is known that the food pattern of people in Balikpapan City is still dominated by three main groups, namely from the grains group such as rice and corn, animal food group and vegetable and fruit group. When compared with the potential local food in Balikpapan City in 2022 to 2024, there are three problems that need to be corrected to improve food security through local food resources, namely: First, grains group which dominates the food pattern is not followed by the supply capability of local food sector in Balikpapan City, this is because most of the rice in Balikpapan City comes from outside the region, namely from South Sulawesi and East Java; Second, animal food group has a percentage of supply capability which continues to decline based on the data from 2022 to 2024, while in terms of food pattern expectation, people still need sufficient supply for protein fulfillment; Third, tubers group has a low score of food pattern expectation, while in terms of supply capability of local food sector in tubers group is still high.

Food provision in Balikpapan City must use a holistic and collaborative approach to ensure food availability for all people of Balikpapan City, which is one of the economic and industrial centers in East Kalimantan.

Referring to the figure, it is known that the province of East Kalimantan is highly dependent on rice supplies from outside regions, especially Java and Sulawesi (Achmad Zaini, 2018). This dependence has several significant impacts, both in terms of economic, social, and environmental aspects. Economically, the dependence on rice supplies from outside regions leads to high price fluctuations at the consumer level. When distribution or production disruptions occur in Java and Sulawesi, the price of rice in East Kalimantan can jump dramatically due to limited supply. This dependency also makes East Kalimantan vulnerable to policy changes in producing regions, such as restrictions on inter-island rice

exports or food distribution policies that prioritize regions of origin. Socially, this instability in food prices can affect people's welfare, especially for low-income groups who are more sensitive to changes in staple food prices. In addition, this dependency also hampers the development of the local agricultural sector in East Kalimantan, which could have contributed more to food security in the region.

The long supply chain is also a challenge in providing rice in East Kalimantan. The distribution process of rice from Java or Sulawesi involves several complex stages, from production in the fields, milling, packaging, to distribution by land and sea to East Kalimantan. Each of these stages has the potential to face various obstacles, such as bad weather affecting the delivery, increased logistics costs due to fluctuating fuel prices, and the risk of deteriorating rice quality during the time-consuming delivery process.

Utilization of local food resources in Balikpapan can be done with strategies: first, expanding the planting area and increasing the production yield of tubers; second, using superior varieties that are pest-resistant and productive; third, processing tubers into products that resemble rice, flour or granules with a taste close to rice, so that consumers can easily adapt; and fourth, education helps people recognize the benefits of tubers as a healthy source of carbohydrates.

Local inferior tubers besides containing high carbohydrates also contain a number of bioactive compounds that have physiological effects as antioxidants. The bioactive compounds found in inferior local tubers are dioscorin, diosgenin, and phenol. These three types of bioactive compounds have been proven to have the ability to ward off free radicals, prevent metabolic diseases (hypercholesterolemia, dyslipidemia, diabetes and obesity) inflammation and cancer (Prabowo et al., 2014).

On the one hand, to overcome the obstacles that occur in the rice supply chain, the research recommends the need to design supply chain management through Balikpapan Agro Hub as described in the following picture

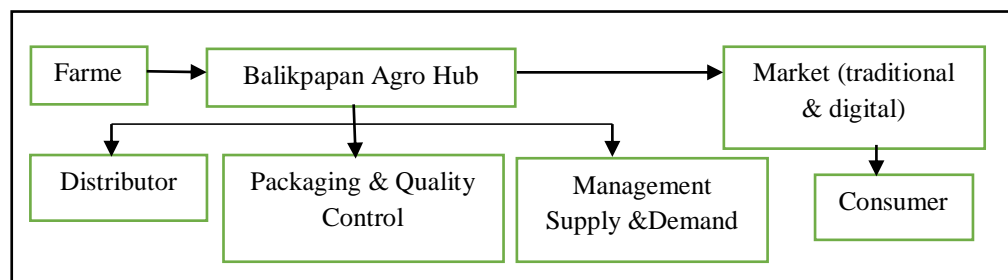


Figure 5. Supply Chain Flow through Balikpapan Agro Hub Concept

Balikpapan Agro Hub is an important innovation in an effort to shorten the food supply chain in Balikpapan City, which has been highly dependent on food distribution from outside the region. The Agro Hub concept creates a local distribution center that integrates various aspects of food production, processing, packaging, and distribution. The Agro Hub acts as a central point that collects agricultural products from local farmers and urban farming, processes them into ready-to-consumer products, and distributes them directly to traditional and modern markets. The existence of Agro Hubs not only helps accelerate the flow of food to local markets, but also provides direct economic benefits to local

farmers by cutting long distribution channels. Through this approach, Agro Hubs also contribute to local economic development, create jobs, and improve food quality. In addition, the use of digital technology in stock management and distribution enables a more efficient and transparent system, thereby reducing the risk of supply and price imbalances in the market. Balikpapan Agro Hub becomes a sustainable strategic solution to strengthen the city's food security and reduce the risk of out-of-region supply dependency.

DISCUSSION

Optimizing the utilization of local food in Balikpapan City is an important strategy in supporting sustainable food security and self-reliance. The study shows that although Balikpapan is among the top 10 cities with the highest Food Security Index (FSI) nationwide by 2023, the food affordability aspect is still declining, indicating challenges in food access at the household level. For this reason, focusing on the development of local foods such as tubers and vegetables and fruits, whose production increases dramatically in 2024, is considered strategic. This is in line with research by Gozali et al. (2019) and Soesilowati (2018), which emphasize the great potential of tubers not only as a substitute for rice but also as a functional food with health benefits, including for diabetics.

The food consumption pattern of Balikpapan people is still dominated by cereals and animal food, whereas these two groups are mostly supplied from outside the region such as Java and Sulawesi. This dependency extends the supply chain and is vulnerable to distribution disruptions (Zaini, 2018; Sukartiningsih et al., 2014). Therefore, strengthening local food is crucial, one of which is by innovating food products such as making analog rice from local tubers and educating the public about the nutritional value and sustainability of local food consumption (Soesilowati et al., 2024). In addition, agricultural technology development, post-harvest infrastructure, and opening market access through digitalization and integrated distribution concepts such as Balikpapan Agro Hub are needed to shorten the supply chain, as described in the local agro-industry distribution model.

The Pola Pangan Harapan (PPH) assessment is an important tool in evaluating the diversity of people's food consumption. An ideal PPH indicates a balanced consumption of macronutrients and micronutrients (Ayuningtyas et al., 2018; Dewi & Utami, 2019). However, the PPH score for the tuber group is still low despite its high availability, indicating a mismatch between local production and consumption patterns. Therefore, future food policies need to lead to food diversification that emphasizes not only production aspects, but also people's preferences and consumption habits. This strategy will strengthen overall food security and improve the welfare of local farmers.

CONCLUSIONS AND RECOMMENDATIONS

The results showed that the supply of vegetables and fruits in 2024 increased significantly by 700%, and tubers by 600% compared to the previous two years. However, the supply of grains and animal food still depends on outside regions such as Java and Sulawesi. The food pattern of Balikpapan people is still dominated by three main groups: grains (such as rice and corn), animal food, and vegetables and fruits. The research recommends an optimization strategy through processing tubers into analog rice and increasing public awareness about the benefits of tubers as a healthy and nutritious alternative carbohydrate. To overcome dependence on food supply from outside the region, innovations such as Balikpapan Agro Hub are needed that can shorten the local food supply chain. The implementation of this strategy is expected to improve food security, reduce dependence on out-of-region supplies, and provide economic benefits for local farmers through strengthening the regional agricultural sector.

FURTHER STUDY

Further research is recommended to use the Geographic Information System (GIS) approach to provide a more comprehensive mapping of the distribution of local food resources and their accessibility in various sub-districts and villages. Secondly, this study has not fully explored the dynamics of the food supply chain longitudinally, so future research could develop time-series analysis to understand the pattern of food supply and consumption in the long term. Third, despite having used mixed methods, this study still has room to expand the depth of qualitative analysis, especially in understanding the socio-cultural factors that influence people's consumption preferences for local food. Further research could incorporate ethnographic approaches to gain deeper insights into daily food consumption practices. Fourth, the development of the proposed Balikpapan Agro Hub model requires further feasibility studies, including cost-benefit analysis and small-scale implementation trials before it is fully implemented. Further research could also expand the exploration of the potential of developing processed products from local tubers into rice substitution products, as well as the impact on consumer acceptance and economic added value for local farmers.

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from all parties can be an important part of efforts to support food security and optimization of local food resources in Balikpapan City.

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