

Food Source Plants of Coastal Communities in Galela, North Halmahera

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ABSTRACT

This study aims to identify food source plants and parts that are utilized, as well as their processing in the Galela Community. The interview method with the help of questionnaires was carried out to collect data including; types of plants, parts of plants that are utilized and processing methods. Respondents were housewives totaling 65 respondents. The results showed that there are 34 plant species from 20 families that are used as food sources, both cultivated and found in nature, with consumed parts namely leaves, stems, flowers, fruits, tubers, rhizomes, and leaf buds. The leaves, flowers, and young stem are mostly consumed as vegetables. Bananas and yams that are consumed as staple food are usually processed by boiling, coconut milk or frying.

INTRODUCTION

Food is the most important need for survival for humans (Barwant, 2021), while staple foods are food groups to achieve balanced nutrition, which are consumed regularly in certain portions to obtain carbohydrates as a source energy. Plant diversity has for millennia supported ecosystem services essential to human health and well-being (Sacande & Muir, 2023), including many wild plants that are potential nutrients in future agriculture (Boef et al., 2017). Of the edible plants, only 8 species supply more than 50% of daily calories: rice (*Oryza sativa*), maize (*Zea mays*), wheat (*Triticum ssp.*), and potato (*Solanum tuberosum*), and only 9 species account for 66 calories of total crop production (FAO, 2019).

Indonesia has 77 types of staple foods that have the potential to be a source of carbohydrates, including cereal crops (rice, sorghum), tubers (arrowroot - *Maranta arundinacea*, ganyong - *Canna discolor*, gembili - *Dioscorea esculenta*), and fruits (breadfruit and banana) (Simanjuntak, 2018). According to Hermann, (2019) consumption of staple food sources of carbohydrates is one of the main human needs, because it contributes the greatest energy to the body.

Staple foods can vary according to local conditions and local culture (Nahak et al., 2021). According to Monterrosa et al., (2020), there are at least three factors that influence the habit of choosing or consuming food in a society, including food availability, socio-cultural patterns, and personal factors. Various types of food consumed affect the number of calories received by the human body, if the type of food is of high quality, the amount of energy produced will provide maximum results for the human body, but if the type of food consumed is of poor quality, the amount and quality of energy will be lower. Lestari et al., (2018) stated that for survival, humans need nutritious food, so every society has nutritional aspects and social aspects.

Since ancient times to meet the needs of life, humans have collected, hunted various types of food in nature (Nurmala et al., 2012). One of these food sources comes from plants that are in the vicinity. Various types of plants have benefits because they contain various ingredients needed by humans. In their research (Oramahi & Sisillia, 2020), stated that various types of forest plants have various contents including carbohydrates. Furthermore, Silalahi et al., (2018), explained that the plant parts that can be utilized include roots, stems, leaves, flowers, fruits, and seeds.

The availability of sufficient food is very important because food shortages can lead to famine. In addition, the increase in population results in an increase in food demand. According to Oramahi & Sisillia, (2020), the increase in population can be overcome by utilizing various potential natural resources. This is in line with the opinion of Margareta & Purwidiani, (2014), which explains that the availability of food in an area affects the food consumption patterns of the local community. The habit of a region to use its natural products to meet all the needs of its people, causes the food needs of people in one region with other regions to be different. Consumption of food that is carried out continuously as a habit of a region or community forms a dietary pattern.

A number of studies have been conducted to examine plants that have potential as food ingredients, but not many studies have specifically discussed food source

plants in North Halmahera, especially in the coastal area of Galela, North Halmahera Regency. The purpose and benefits of this research are to identify plants that have the potential as food sources and plant parts that are utilized as food ingredients, as well as how to process them as food for the community in coastal Galela, while the benefits of this research are the identification of plant species that are used as food sources for the community in the Galela area.

LITERATURE REVIEW

Food Consumption

Food is one of the basic needs of mankind so that humans have basic rights to provide and realize food, therefore the provision of food and assistance against hunger is the most basic right for the life of mankind the right to food is classified into human rights under economic, social and cultural rights, and the essence of this category of human rights is the right to an adequate standard of living (Rostami & Yazdi, 2020).

Food consumption behavior is determined by three categories of variables, namely food properties, personal factors that influence individuals and environmental factor (Oana, 2023). According to Suharko & Hudayana, (2020), over time, staple food consumption patterns have shifted from a variety of local staple foods such as cassava, sago, corn, and various tubers to rice. This had led to the assumption that rice is the staple food in Indonesia, although people in some regions in Indonesia still consume corn, sago, cassava and sweet potatoes as staple foods. This condition is exacerbated by the fact that government policies that are formulated and implemented tend to only focus on rice (Amanto et al., 2019).

According to Oana, (2023) food consumption behavior continues to change as a result of transformations in consumer lifestyles, food purchasing, and consumption habits, and attitudes resulting from awareness of the importance of food in creating consumer well-being. As people's purchasing power increases, their staple diet tends to shift from root vegetables, tubers, plantains and bananas to cereals, and then from rice and maize to wheat products with higher fat content.

In the research conducted by Elizabeth on strategies to achieve food diversification and self-reliance, it is suggested that there is a shift in people's food patterns from non-rice to rice as happened in Madura, Maluku and other Eastern Indonesian Region. Even sago, which is the original staple food in Maluku, has switched 90-100% to rice, equivalent to northern Sumatra and West Sumatra (Amanto et al., 2019).

Alternative Staple Food

According to Bantacut, (2014) cassava and sago have similar properties to rice, especially in terms of carbohydrate and calorie content, two properties that are important criteria for a staple as a source of calories. The superiority of rice over cassava and sago is only in terms of protein content, so it can be concluded that sago and cassava can replace rice as a staple food, depending on availability and acceptance. Adaptation and habit problems are obstacles to utilization of cassava as a staple food. Cassava plants have many advantages, including; 1). Cassava can grow in unfavorable conditions, such as acidic soil and extreme climate 2) productive on

fertile land but still able to be produced on less fertile, infertile or marginal land (Howeler, 2017); 3) has a long harvest period between 10 to 30 months (Samidjo & Sarjiyah, 2020); 4) is largest staple food in the world after wheat, rice and corn (Waisundara, 2018); 5) is a significant source of carbohydrates (Bantacut, 2014).

Besides cassava, sago also has many advantages, among others, it can provide greater benefits for the group that consumes it, and can be made into sago snacks or processed noodles because it has the effect of: (a) filling with a lower calories content; (b) can prevent constipation and the risk of colon cancer; and (c) has low blood glucose levels (low glycemic index), so it can be consumed by people with diabetes mellitus (Bantacut, 2014).

Maize is the second staple source in Indonesia after rice. East Nusa Tenggara is one of provinces that use corn as its staple food. Corn borse is a native dish of the people of Timor Island, East Nusa Tenggara (Hamaisa et al., 2021). The advantage of corn as a functional food compared to other cereals is that corn can be processed into various types of food, ranging from traditional to modern processing so that it can anticipate food and nutritional deficiencies (Suarni & Aqil, 2020).

METHODOLOGY

- a) This research has been conducted in Galela, North Halmahera Regency, the research location was determined intentionally (porpositive) based on certain criteria. Data collection carried out using survey methods by giving structured questions with the help of questionnaires and observation in the field, which includes; data on plants species, plant that are utilized and how to process the food ingredients. Respondents in study were housewives in the Galela coastal area with a total of 65 respondents, who were randomly selected
- b). To analyze the data collected, descriptive statistical tools and techniques used to summarize and describe basic data, provide a simple summary of samples and measurements, including the use of frequency counts, means, and presentations. Data on the result of research and observations of food source plant species, displayed in the form of tables and graphs.

RESEARCH RESULT

Types of Food Source Plants

Based on the result of field research, there are 34 plant species from 20 families that are used by the community as food sources, both cultivates and found in nature. Most plant species utilized by the community come from the Musaceae, Poaceae and Solanaceae families. The results of interviews in the field about plant species as food in detail are shown in the table below.

Table 1: Types of Plants Utilized as Food Ingredients

No	Indonesia / Local Name	Latin Name	Family	Part Used	Benefit
1	Spinach	Amarantus spp	Amaranthaceae	Leaf, stem	Vegetables
2	Kale	Ipomea aquatic	Convolvulaceae	Leaf, stem	Vegetables
3	Long beans	Vigna sinensis L	Leguminoceae	Fruit	Vegetables
4	Eggplant	Solanum melongena	Solanaceae	Fruit	Vegetables

5	Fern leaves / vegetable spikes	Diplazium esculentum	Athyriaceae	Leaves	Vegetables
6	Melinjoo	Gnetum gnemon Linn	Gnetaceae	Leaf, fruit, seed	Vegetables
7	Chili / Rica	Capsicum annum	Solanaceae	Fruit	Vegetable Seasoning
8	Curly chili	Capsicum annum L	Solanaceae	Fruit	Vegetable Seasoning
9	Tomato	Solanum lycopersicum	Solanaceae	Fruit	Vegetable Seasoning
10	Turmeric	Curcuma longa	Zingiberaceae	Rhizome, leaf	Spices
11	Lemongrass/ Garamakusu	Cymbopogon citratus	Poaceae	Stem	Spices
12	Ginger. Guraka	Zingiber offinale	Zingiberaceae	Rhizome	Spices
13	Basil	Ocimum basilicum	Lamiaceae	Leaves	Vegetable Seasoning
14	Cassava	Manihot esculenta	Euphorbiaceae	Tuber, leaf	Staple food, vegetables
15	Sweet potato / Batata	Ipomea batatas	Convolvulaceae	Tuber	Staple food
16	Taro / Bete	Colocasia esculenta	Araceae	Tuber	Staple food
17	Sukun / Amo	Artocarpus altilis	Moraceae	Fruit	Staple food
18	Rice	Oriza sativa	Poaceae	Fruit	Staple food
19	Corn	Zea mays L.	Poaceae	Fruit	Additional Food
20	Groundnut	Arachis hipogea L.	Leguminosae	Fruit	Additional Food
21	Needle Banana	Musa acuminata	Musaceae	Fruit	Fresh fruit
22	Pisang Kepok/Spatu	Musa acuminata	Musaceae	Fruit, flower	Staple food, vegetables
23	Mulu Duck Banana	Musa acuminata	Musaceae	Fruit	Staple food
24	Goroho Banana	Musa acuminata	Musaceae	Fruit	Staple food
25	King Banana	Musa acuminata	Musaceae	Fruit	Supplementary Food
26	Horn Banana	Musa acuminata	Musaceae	Fruit	Supplementary Food
27	Lime	Citrus aurantifolia	Rutaceae	Fruit	Condiments
28	Calamansi	Citrus microcarpa	Rutaceae	Fruit	Condiments
29	Papaya	Carica papaya	Caricaceae	Fruit, flower, leaf,	Fresh fruit, vegetables
30	Mango	Mangifera indica	Anacardiaceae	young stem	vegetables
31	Durian	Durio zibethinus	Malvaceae	Fruit	Fresh fruit
32	Langsat	Lansium domesticum	Meliaceae	Fruit	Fresh fruit
33	Salak	Salacca zalacca	Arecaceae	Fruit	Fresh fruit
34	Pineapple	Ananas comosus	Bromeliaceae	Fruit	Fresh fruit

Source: primary data, processed (2022)

Parts that are utilized

Based on the results of interviews, the part of plant consumed by the community vary, ranging from leaves, stems, flowers, fruits, tubers, rhizomes, to leaf buds. The leaves, flowers and young stems are most consumed as vegetables. For example, Papaya flowers and kepok banana flowers (*jantong pisang*) are used by the community as vegetables. Detailed data on the distribution of respondents who utilize various parts of plants for consumption are shown in figure 2.

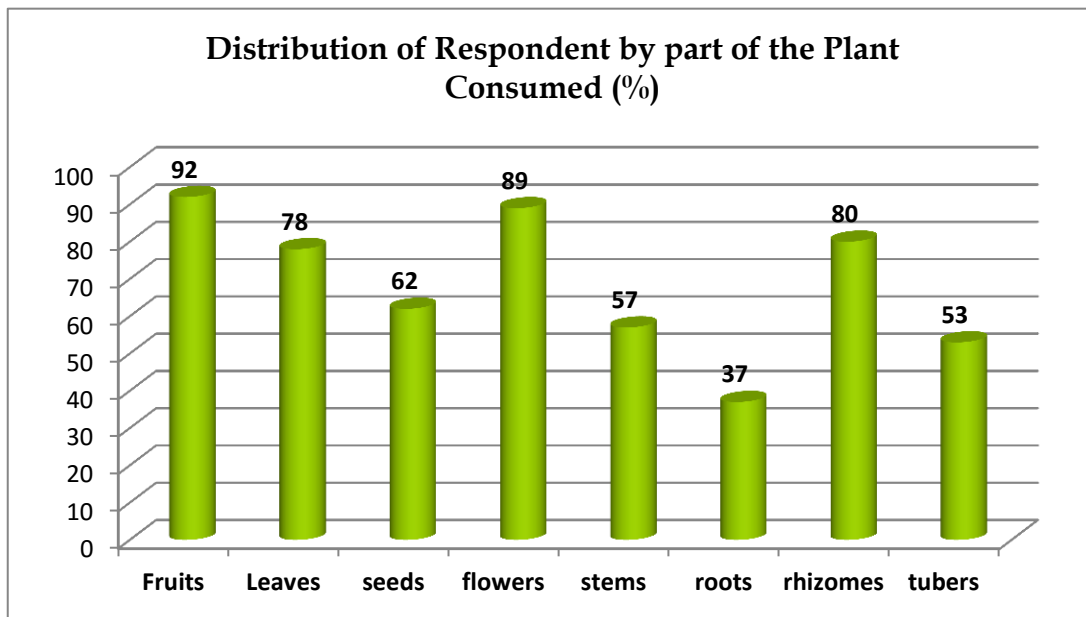


Figure 2. Distribution of Respondent by part of the Plant Consumed

Processing Method

Based on the result of the research, one of the groups that is widely utilized by the community at the location is the *Musaceae* family group or banana plant group. The following are the types of bananas that are consumed and how they are processed

Table 2. Types of Bananas and Processing Methods

Cultivar Name	Local Name	Latin Name	Processing Method
Pisang Kepok	<i>Pisang Spatu</i>	<i>Musa acuminata balbisiana</i>	Boiled, Deep-fried Coconut milk
Pisang Raja	<i>Pisang Raja</i>	<i>Musa textilia</i>	Boiled, Deep-fried Coconut milk
Pisang Mulu Bebek	<i>Pisang Mulu Bebe</i>	<i>Musa acuminata Colla</i>	Boiled, Deep-fried Coconut milk
Pisang Tanduk	<i>Pisang Tanduk</i>	<i>Musa paradisiaca</i>	Boiled, Deep-fried Coconut milk
Pisang Goroho	<i>Pisang Goroho</i>	<i>Musa acuminata, sp</i>	Boiled, Deep-fried Coconut milk

Source: primary data, processed (2020)



Figure 3: Some Species at the Research Site

Apart from bananas, several types of sweet potatoes are also often consumed by the Galela community as food substitutes for rice. These include sweet potato, taro and cassava. A description of the processing of sweet potatoes is shown in the following table.

Table 3. Types of Tubers and Processing Methods

Types of Tubers	Local Name	Tuber Meat Colour	Processing Method
Sweet potato	<i>Batata</i>	Purple, Orange, beige, Yellow	Boiled, Fried, coconut milk
Taro	<i>Bete</i>	White,	Boiled, Fried, coconut milk
Cassava	<i>Kasbi</i>	yellowish white	Boiled, Fried, coconut milk

Source: primary data, processed (2020)

DISCUSSION

Types of Food Source Plants

The staple foods of the Galela community are rice, yams, and bananas, where rice is obtained by buying from retailers in a village and in the district center. In addition, rice is also obtained from the harvest of field rice, called “*beras baru*” which is planted by the community. In addition to rice, the types of carbohydrate and protein-producing plants consumed by the Galela community are Cassava (*Manihot esculenta*), Taro (*Colocasia esculenta*), Sweet Potato (*Ipomea batatas*), Breadfruit (*Artocarpus altilis*), Banana (*Musa spp*). These types of yams in the research location are consumed as staple food instead of rice. This condition contradicts the results of research by (Maman et al., 2017) located in Jakarta which found that the consumption of cassava, sweet potatoes, and corn is only as a complement, not as a staple food.

Some banana species they are utilized by the community as food sources include kepok banana (*Muza acuminata balbisiana*), plantain (*Musa textilia*), mulu bebek banana (*Musa acuminata*) goroho banana (*Musa acuminata, sp*) and horn banana (*Musa paradisiaca*). Types of bananas that are processed into a staple food substitute for rice include kepok banana (*Muza acuminata balbisiana*), mulu bebek banana (*Musa acuminata*), and plantain (*Musa textilia*), which is processed before eating with several processing methods. Burkhart et al., (2022) found similar conditions in the Pacific Islands region, where bananas are usually grown for house use and considered a traditional staple food.

The results also show that there are 3 types of sweet potatoes consumed, namely sweet potatoes, cassava and taro. The three types of yams have varying fruit flesh colors. Sweet potato flesh is purple, orange, cream and yellow, with cream to purplish skin color. According to Amoanimaa et al., (2020) the color of sweet potato flesh and skin varies from white, cream, yellow, orange to purple, which is caused by the pigment contain antioxidants that are able to counteract free radicals and provide protection against many age-related degenerative diseases and other chronic disorder. Apart from sweet potatoes, there are also 2 types of taro that are consumed by the community as a source of carbohydrates with white and yellowish-white flesh color. Another type of yam that was also found in the research location is cassava. Cassava consumed has yellow and white flesh color

Plants that are used as vegetables include Spinach (*Amaranthus spp*), Water Spinach (*Ipomea aquatica*), Long Bean (*Vigna sinensis L.*), Eggplant (*Solanum melongena*), Fern Leaves (*Diplazium esculentum*), Melinjo (*Gnetum gnemon Linn*), Papaya flower (*Carica papaya*), Banana bud (*Musa acuminata*). The types of herbs or spices as food flavor enhancers that are planted include Cayenne pepper (*Capsicum frutescent L*), Curly chilies (*Capsicum annum L*), Tomato (*Solanum lycopersicum*), Turmeric (*Curcuma longa*), Lemongrass (*Cymbopogon citratus*), Ginger (*Zingiber officinale*), Basil (*Ocimum basilicum*), Lime (*Citrus auratifolia*), Calamansi orange (*Citrus microcarpa*). Types of fruits plants that are utilized by the community as a source of vitamins and minerals are green coconut (*cocos nucifera*), needle banana (*Musa acuminata*), papaya (*Carica papaya*), mango (*Mangifera indica*), durio (*Durio zibethinus*), langsat fruit (*Lansium domesticum*) and snake fruit (*Salacca edulis*)

Food Processing Methods

The result shows that the Galela community generally consumes rice, sweet potatoes and bananas. Some types of half-ripe bananas as a staple food to replace rice, which is usually processed by boiling with water, boiled by coconut milk or fried, which is then eaten together with various types of vegetables and other protein sources. According to Dewi & Purwidiani, (2015), bananas consumed raw or processed, whether green, half-ripe, or ripe fruit is one of the most significant sources of calories for diet, besides that banana are also the best source of potassium. According to Kumari et al., (2023) at the green stage, Bananas have abundant starch content and little sugar content. The sugar content increase significantly while the starch content decrease during the full ripening procces. Dewi & Purwidiani, (2015) further explained that bananas with yellow and orange flesh color are rich in provitamin A and carotenoids. The result showed that only needle banana (*Musa acuminata var Jarum*) is often consumed in the form of table fruit by the Galela community.

Taro is usually consumed in processed forms such as boiled, fried or coconut milk. This is because taro cannot be consumed raw because it contains calcium oxalate, which causes throat inflammation and burning. In addition, taro can also be processed into chips, starch, flour and is an important ingredient in many baby food products because of its nutritional value (Aditika et al., 2022). The same processing method is also carried out on cassava. Cassava with yellow flesh color is highly preferred by the public because more chewy texture and very sweet. In addition, cassava is a tuber plant that has a high nutritional content with a total calorie of 160 kcal, 38.06g carbohydrates, 1.36g protein, 0.28g total fat, and 1.8g fiber, (Utama & Rukismono, 2018).



Cassava in coconut milk



Boiled sweet potato



Banana in coconut milk

Figure 4. Various Processed Carbohydrate Sources in Galela Community

The Galela community is accustomed to consuming vegetables as a complement to rice. Vegetables that are often consumed include spinach, kale, long beans, eggplant, cassava leaves, fern leaves, Melinjo leaves and papaya leaves and flowers. Vegetables consumed by the community can be classified into 3 types of vegetables, namely leaf vegetables, flower vegetables and fruit vegetables. Leaf vegetables consist of spinach, kale, ferns, melinjo, cassava leaves, and papaya leaves. Flower vegetables include papaya flowers and banana flower (*jantong pisang*), while fruit vegetables include eggplant and long beans.

The processing of various types of vegetables varies, including by mixing two or several types of vegetables and cooked by stir-frying together with other spices. Vegetables are usually cooked first before being consumed by the community. Cooking can be done by boiling and steaming, roasting, grilling, roasting and frying with oil. According to Sundari et al., (2015), one of the food processing processes is using heating, either sautéed, boiled or coconut milk, where all of these methods can reduce the nutritional content of food or cause large nutrient losses in food. Figure 5 shows some types of vegetables processed by the community.



Figure 5. Various Mixed Vegetable in Galela Community

In addition to bananas and yams, fruit trees are also consumed by the Galela community. The fruit plants are consumed by people on Galela coast are fruit plants that are cultivated by local farmers or sold around the village. Some types of fruit plants that are widely consumed include papaya, mango, durian, langsung / duku and pineapple. The types consumed in the Galela area are very few when compared to the types of fruit circulating and consumed in Tobelo. The results of research Kastanja & Patty, (2018) showed that there are 16 types of fruit traded and consumed by people in Tobelo. The different types of fruit in the Galela area are because the types of fruit circulating in Tobelo City also come from other areas outside Tobelo, including imported fruits.

The habit of consuming vegetables and fruits in the community is very good. According to Halimah et al., (2022), vegetables and fruits are good sources of micronutrients containing, fiber, vitamins and minerals. Vegetables and fruit for adolescents can nourish the digestive system, increase bone growth, and nourish the

eyes increase brain and nerve cell development. In addition, vegetables and fruits contain many vitamin, mineral, simple sugars and pectin that are necessary for the body, including vitamin C, B, provitamin A, folic acid, carotenoid and minerals such as potassium, calcium, magnesium, selenium and iron as well as phytochemicals (Nurhayati, 2014).

CONCLUSIONS

There are 34 species of plant from 20 families which are a source of food for the Galela community, both from cultivated and plants found in nature. The plants parts used consist of leaves, stems, flowers, tubers, rhizomes and leaf buds. The plant parts are consumed as a staple food as well as vegetables and other snacks. The parts that are consumed are processed by boiling, frying and coconut milk.

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