EDIBLE PLANTS OF THE TRADITIONAL MARKET OF SURAKARTA, INDONESIA: AN URBAN ETHNOBOTANICAL STUDY †

[PLANTAS COMESTIBLES DEL MERCADO TRADICIONAL DE SURAKARTA, INDONESIA: UN ESTUDIO ETNOBOTÁNICO URBANO]

Santhyami[1,2*], Lina Agustina[1], Daniar Eka Nur Fauziah[1], Sekar Nur Pratiwi[1] and Ayen Vera Damayanti[1]

[1]Department of Biology Education, Faculty of Teacher Training and Education, Universitas Muhammadiyah Surakarta, Jl. A. Yani Tromol Pos I, Pabelan, Kartasura, Surakarta 57162, Jawa Tengah, Indonesia. Email: san915@ums.ac.id Phone: +6282135188756

[2]Environmental Study Centre, Universitas Muhammadiyah Surakarta, Jl. A. Yani Tromol Pos I, Pabelan, Kartasura, Surakarta 57162, Jawa Tengah, Indonesia

** Corresponding author*

SUMMARY

Background. Surakarta is a city in Central Java, Indonesia with great potential for exploration in the field of urban ethnobotany. This research was conducted at Gede Harjonagoro Market, or locally called Pasar Gede, one of Surakarta's earliest and largest traditional markets. It is also a location where locals and visitors can find various plant-based cuisines. **Objective.** To ethnobotanically study the variety of all plant-based foodstuff traded in Pasar Gede Harjonagoro. **Methodology.** Data was collected from December 2022 till July 2023 in Pasar Gede, Surakarta City, Central Java Province, Indonesia, using in-depth and semi-structured interviews with traders. The data analysis was conducted using both qualitative and quantitative methods, employing an ethnobotany approach. Taxonomic identification was conducted at the Biology Laboratory of Universitas Muhammadiyah Surakarta. **Results.** A total of 155 species from 47 families of edible plants was identified. The edible plants were classified into four distinct categories: staple foods (source of carbohydrate), fruits, vegetables, and spices. The majority of plants originate locally and are primarily cultivated. **Implications.** The findings of this study suggest that the diverse and cosmopolitan character of Surakarta has resulted in a greater need for a broader selection of food options. As a result, the majority of edible plants are grown and sourced from the surrounding satellite region of Surakarta. **Conclusion.** This demonstrates the lingering influence of the Sunanate heritage and the large variety of species demonstrates the cosmopolitan nature of Surakarta culture.

Key words: Edible plants; Ethnobotany; Foodstuff; Surakarta; Urban.

RESUMEN

Antecedentes. Surakarta es una ciudad en Java Central, Indonesia, con un gran potencial para la exploración en el campo de la etnobotánica urbana. Esta investigación se llevó a cabo en el Mercado de Gede Harjonagoro, conocido localmente como Pasar Gede, uno de los mercados tradicionales más antiguos y grandes de Surakarta. También es un lugar donde residentes y visitantes pueden degustar diversas cocinas de origen vegetal. **Objetivo:** Estudiar etnobotánicamente la variedad de todos los alimentos de origen vegetal comercializados en Pasar Gede Harjonagoro. **Metodología:** Los datos se recopilaron entre diciembre de 2022 y julio de 2023 en Pasar Gede, ciudad de Surakarta, provincia de Java Central, Indonesia, mediante entrevistas exhaustivas y semiestructuradas con comerciantes. El análisis de datos se realizó utilizando métodos cualitativos y cuantitativos, empleando un enfoque etnobotánico. La identificación taxonómica se realizó en el Laboratorio de Biología de la Universidad Muhammadiyah de Surakarta. **Resultados:** Se identificaron 155 especies de 47 familias de plantas comestibles. Las plantas comestibles se clasificaron en cuatro categorías distintas: alimentos básicos (fuente de carbohidratos), frutas, verduras y especias. La mayoría de las plantas son de origen local y se cultivan principalmente. **Implicaciones:** Los hallazgos de este estudio sugieren que el carácter diverso y cosmopolita de Surakarta ha generado una mayor necesidad de una mayor variedad de opciones alimentarias. Como resultado, la mayoría de las plantas comestibles se cultivan y se obtienen de la región satélite circundante de Surakarta. **Conclusión:** Esto demuestra la influencia persistente del legado de Sunanate, y la gran variedad de especies demuestra el carácter cosmopolita de la cultura de Surakarta.

Palabras clave: Plantas comestibles; Etnobotánica; Alimentos; Surakarta; Urbano.

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INTRODUCTION

Urban ethnobotany's dynamics increase the proportion of novelty in research space, knowledge, and practice, which should be beneficial for the study of ethnobiology and ethnobotany in particular. This discipline is relatively new (Emery and Hurley, 2016) and there is a pressing need to study and advance their research. Urbanization activities introduce a mix of cultures to urban areas. In Indonesia, urban ethnobotany research has only recently begun to be explored. Tracing the proposer revealed that urban ethnobotany researchers in Indonesia had conducted ethnobotanical research in several cities on the island of Java, including the cities of Kediri and Cikarang (Yurlisa *et al*., 2017; Sedayu and Azka, 2021).

Surakarta is a city in Central Java, Indonesia with great potential for exploration in the field of urban ethnobotany. In 2024, the population Surakarta is 528,044 people (BPS Surakarta, 2024). Surakarta is inhabited by Javanese, Chinese, and Arabs, who interact in traditional markets. This cultural diversity facilitates an exchange of information regarding the use of plants, particularly regarding the categories of edible plants. Ethnobotany plays a crucial role in accumulating and preserving information on edible plants already in existence.

Historically, the traditional markets found in the various cities throughout the island of Java have been an integral part of the unique urban fabric of the Javanese (Aliyah *et al.*, 2017; Harsasto, 2018). Markets serve the needs of the local population, heralding the establishment of new urban areas. This template of development is a wholly native concept known as the Javanese *catur sagotra*, in which the developed area will have predesignated areas for housing, commercial, temporal, and spiritual uses (Aliyah *et al.*, 2017; Harsasto, 2018; Susanti and Agustin, 2018; Suprapti, 2021). The market is thus axially located as the urban area's commercial hub. The size and scope of traditional markets correspond to the size and importance of the developed area, from the humble to the semi-urban villagess and the various regional and ducal cities, culminating in the royal capital (Alexander, 1986). Such is the case with the establishment of the cities of Surakarta, commonly known as Solo, which served as the royal capital of the Surakarta Sunanate from 1745 to 1945, ending with the ascension of the Sunanate to the newly established Republic of Indonesia (Marlina, 2018; 2020; Marlina *et al*., 2019).

Although the Sunanate monarchy has given way to the Republic of Indonesia, the lingering influence of the royal heritage is still present, with the former royal family and aristocracy playing vital social roles within the city (Sutherland, 1974; Marlina, 2018; 2020; Marlina *et al*., 2019; Palmier, 2021; Malik *et al.*, 2022) and the various surrounding regencies that still correspond to the borders and administration of the Sunanate regencies (Palmier, 2021). Surakarta, the historical capital, continues to function as the administrative center for the Greater Solo Area (GSA), which spans 576.6 ha and includes the following regencies: Surakarta, Sukoharjo, Boyolali, Klaten, Sragen, Wonogiri, and Karanganyar. The grand market of Surakarta, *Pasar Gede Harjonagoro* (commonly known as Pasar Gede), continues to function as a commercial hub, where various supply chains for goods harvested and produced within the GSA converge at Pasar Gede, subsequently redistributing these goods to the various regencies. Built directly on the banks of the Pepe River, which is a tributary of the navigable Bengawan River, it served to connect Pasar Gede to the major ports of Gresik and Surabaya (Anna *et al*., 2016; Alauddin and Pramitasari, 2023), as well as the southern regencies of Wonogiri and Sragen (Aliyah *et al.*, 2017; Harsasto, 2018). Although the Bengawan River is no longer navigable following the construction of Gajah Mungkur Dam in Wonogiri in 1976, the complex trade networks that have developed over the centuries persist to this day (Nurcahyo *et al*., 2024).

The local farmers and gatherers from each respective region traditionally sell their goods to mongers, who then make their trips to Pasar Gede (Alexander, 1986). These mongers usually make weekly trips to Pasar Gede and either sell directly to consumers or to the traders there. These traders usually inherit their business, maintaining their client base and distribution networks through intergenerational connections that mirror the strict hierarchy of the old aristocracy of the Sunanate.

This research was conducted at Pasar Gede, one of Surakarta's earliest and largest traditional markets. It is also a location where locals and visitors can sample various cuisines. There are currently 1035 merchants conducting business at Pasar Gede. The majority of them are engaged in the sale of foodstuffs, notably edible plants. The vendors obtain their products from both imported and domestically grown vegetation. Distributors deliver out edible plants on a daily basis or every two days. Some retailers obtain their products not only from distributors, but also from their own gardens or wild plants. This study aimed to determine the types of food plants, the parts that are used, and the status of cultivation.

MATERIALS AND METHOD

Research Site

This study was conducted in Gede Hardjono Traditional Market (Pasar Gede), Surakarta City, Central Java Province, Indonesia, from December 2022 to July 2023. The market is located in Jendral Urip Sumoharjo Street, Jebres District. The western and eastern sectors of Pasar Gede Surakarta are separated by Jendral Urip Sumoharjo Street. The original building consisted of shops surrounding a square open plain measuring 10,500m^2, on which peddlers would open temporary stalls to sell their wares. The current building complex measuring 8560m^2 was built during the reign of Sunan Pakubuwono X in 1930 as the largest market in the realm, and as such is recognized as a cultural Heritage site according to the Mayoral Decree No. 646 of 1997 (Aliyah *et al.*, 2017; Harsasto, 2018). Pasar Gede is now composed of 127 shophouses, 133 kiosks, 633 market stalls, and 250 permanent traders with 212 peddlers who will sell on certain market days. This market is consisted of two sectors, eastern and western. The first level of the west sector contains fruit merchants, while the second floor houses a culinary center. In the eastern sector, there are a number of blocks: 1) blocks number I, II, III, and stall K with fruits, staple food, vegetable, mixed herbs, fresh flowers, breakfast stall, livestock, seafood product, market headquarter and prayer room; 2) block IV with fruit, meat, lunch vendor and prayer room. Figure 1 depicts several parts of the fruit, vegetable, spice and food stalls at Pasar Gede. In both sectors of Pasar Gede, edible plant varieties were examined.

Data Collection

The data collection method employed was qualitative, utilizing an ethnobotanical approach (Martin, 1995). Informants were recruited purposively for in-depth interviews or semi-structured interviews, taking into account demographic diversity factors such as gender and age. The total number of informants was 53 persons, comprising 26 males and 27 females, which accounted for 44% of the total permanent foodstuff traders in Pasar Gede. The respondents were selected via purposive sampling, specifically with the snowball approach. The selection criteria for responders include those who are permanent traders and resellers of edible plants that are traded in Pasar Gede.

Figure 1. Market scene of Pasar Gede, Surakarta City, Indonesia. a) fruit stalls; b) spice stall; c) vegetable stalls; d) food court

The interview followed established principles to investigate ethnobotany, which included gathering information on the local name, the specific plant part used, the method of consumption, and the source for obtaining food plants. Subsequently, specimen vouchers were created, identified and deposited at the Educational Herbarium of the Biology Laboratory in Universitas Muhammadiyah Surakarta. Informants also supplied supplementary demographic information, including names, genders, ages, education levels, and occupational experiences of individuals. The botanical names of the sample species were verified for accuracy by referencing authoritative sources in both printed and online sources (Ochse and Bakhuizen van den Brink, 1931; Backer and Bakhuizen van den Brink, 1968; POWO, 2023; WFO, 2023). The primary databases were utilized to track the geographic origins of plants (POWO, 2023; WFO, 2023).

Data Analysis

The data analysis was conducted using both qualitative and quantitative methods, employing an ethnobotany approach as described by Martin (1995). Ethnobotany encompassed the process of identifying medicinal plants that were recognized and utilized by the informants. This involved documenting the plants' local names, the specific parts of the plant that were used, their geographical origins, and their cultivation status. The classification of the cultivation status of species is determined by the remarks provided by collectors and market traders. We restrict the source of plants to either local varieties or those imported from outside of Indonesia. The researchers conducted a qualitative analysis by utilizing descriptive statistics to describe the outcomes of the different types of food plants (Silalahi *et al.*, 2021). The data were presented in a descriptive and quantitative manner using tables and graphs. In order to augment the dataset, other secondary data sources published in academic publications were utilized. The qualitative data was evaluated through the process of verification, summarizing, assembling, and transforming it into a narrative form. On the other hand, the quantitative data was analyzed using statistical descriptive methods with type of frequency distribution (Barirega and Van Damme, 2014).

RESULTS AND DISCUSSION

Urban Ethnobotany of Traditional Market in Surakarta

Exploring the ethnobotanical potential of edible plants in culturally rich metropolitan regions heavily relies on studying traditional markets, such Pasar Gede in Surakarta. Despite Surakarta's urban development, the enduring influence of Javanese culture, blended with Chinese and Arabic culture, remains potent. This fusion has fostered a distinctive ecology in the cultivation and commerce of edible plants. Pasar Gede, as a traditional trading center, provides detailed insight into the social and cultural processes that determine the distribution and preferences for local food products, as well as the effects of acculturation. By examining the plant varieties exchanged and the dynamics between sellers and buyers in this market, we may discover the ethnobotanical potential that demonstrate ability to adapt and innovate in the utilization of food plants. This study elucidates the role of different cultures in enhancing food diversity and highlights the significance of traditional markets as a key factor in comprehending and formulating strategies to conserve and harness biodiversity in an urban setting while upholding traditions and cultural heritage.

The urban ethnobotany in Surakarta is shaped by intricate interactions between the majority Javanese culture and the cultural impacts of Chinese and Arab communities, particularly in relation to food plants. The urban area's ethnobotanical traditions are mostly based on the long-standing Javanese culture, which extensively utilizes indigenous food plants including as rice, coconut, and other tubers. Nevertheless, the entrance of Chinese culture resulted in a greater variety of food crops, including mustard greens, cabbage, and several varieties of beans, which have now become essential components of people's dietary habits. Arabic culture has had a noticeable impact on the use of spice plants like cardamom, cinnamon, and cloves. These spices not only affect local cuisine preferences but also enhance the variety of food plants used in religious and cultural settings. The combination of local traditions and foreign cultural influences results in a vibrant urban ethnobotanical landscape, where the utilization and cultivation of food plants adapt to social and cultural shifts in the city of Surakarta.

The accessibility of culturally preferred cuisines in new locations is undoubtedly significantly influenced by the large-scale translocation of humans, particularly to urban areas. The assortment of regional gastronomic variances will enhance the array of plants utilized by the community as food ingredients. Each immigrant, with their respective cultural background, tends to uphold their preferences for the specific cuisine they introduce, albeit to varying degrees. At the further end of the spectrum, there are reports of Indian immigrants who adhere steadfastly to their local dietary preferences, leading to malnutrition (Atkin, 2016). A research done in Puerto Rico discovered the phenomenon of Culinary Cultural Conservation (CCC) among immigrants who persisted in their food

choices while facing higher costs for particular types of food (Taylor and Anderson, 2020). The phenomena in Surakarta exemplifies a further aspect, specifically cultural acculturation, which leads to the emergence of innovative culinary inventions for both the local population and immigrants. The diverse utilization of plants as a food source in Surakarta is a result of the cultural acculturation process in the city, which impacts the selection of food plants consumed. This phenomenon is commonly referred to as the notion of cultural gastronomy.

The fusion of Javanese, Chinese, and Arabic cultures enhances the intricacies of ethnobotany associated with edible plants in Surakarta. Figure 2 showcases a variety typical Surakarta cuisine. Javanese cuisine is recognized for its distinctive taste profile, characterized by a predominant sweetness. One of the most popular and authentic Javanese dishes, predominantly from Jogjakarta and Surakarta, *gudeg*, prominently features jackfruit as its major ingredient (Yudhistira, 2022). The local culinary delights are influenced by Chinese culture and adapted to complement the local culture (Sunuantari *et al*., 2019). Hokkien and Cantonese are the predominant Chinese dialects in Indonesia, particularly in Surakarta. These languages had a significant impact on the naming of cuisine, snacks, and vegetables in Indonesia. Plant-based Chinese food includes *bihun*, which are rice flour noodles, *kwetiau*, which are rice flour noodles mixed with vegetables, sausages, and shrimp, and *lumpia*, thin wheat flour sheets used to wrap fillings such as bamboo shoots, eggs, fresh vegetables, meat, or seafood. The gastronomic delicacies in Surakarta are also influenced by Arabic culture. Arabic food is typically abundant in a variety of spices. *Sate buntel* is a representative dish of Surakarta cuisine that showcases the influence of Arabic and Gujarati cultures (Priyatmoko, 2020). The dish comprises heavily spiced ground lamb encased in caul fat and secured onto bamboo skewers. The dish is traditionally served with soy sauce, sliced cayenne pepper, cabbage, tomatoes, and sliced shallots.

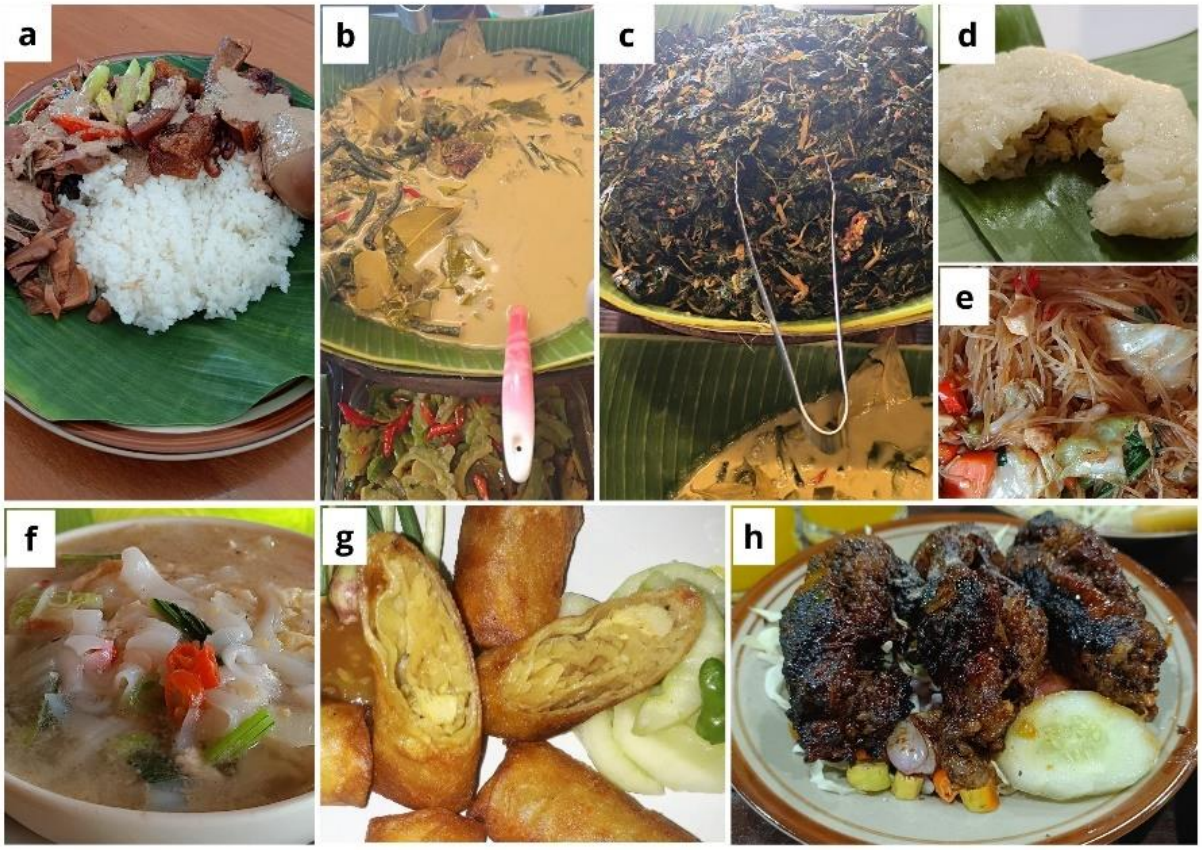

Figure 2. Surakarta cuisine –Javanese cuisine (a-d), Chinese cuisine (e-g), Arabic cuisine (h) [Caption: a) *gudeg,* b) *sayur lodeh*, c) *urap daun pepaya*, d) *lemper*, e) *bihun*, f) *kwetiaw*, g) *lumpia rebung*, h*) sate buntel*]

Number of Edible Plant Species (Variety) and Families

In Pasar Gede, a total of 155 species belonging to 47 families were recognized as edible plants available for trade. The edible plants were categorized into four distinct groups: staple foods (which serve as a source of carbohydrates), fruits, vegetables, and spices (as shown in Figure 3). It is important to highlight that in this study, different varieties of plants are considered as separate types due to their distinct uses and characteristics. The fruit food category has the biggest proportion of species, specifically 53 species or 34.19%, followed by the vegetable group with 49 species or 31.61%, spices with 35 species or 23.58%, and staple food with 18 species or 11.61%. The fruit available at Pasar Gede is sourced from many origins, including both imported and local produce. The Anacardiaceae family, specifically mango, has the highest number of varieties in Pasar Gede. There are 7 different mango varieties sold at Pasar Gede, namely *Mangifera indica* L. Var. Arumanis, *Mangifera indica* L. Var. Cengkir, *Mangifera indica* L. Var. Gedong Gincu, *Mangifera indica* L. Var. Kiojay, *Mangifera indica* L. Var. Lalijiwo, *Mangifera indica* L. Var. Mahatir, *Mangifera indica* L. Var. Okyong. The several assortments of mangoes at Pasar Gede exemplify the extensive range of mango variation in Indonesia. According to Fitmawati *et al.*, (2010), there have been 82 different types of mango cultivars identified in Indonesia based on variations in their morphological characteristics.

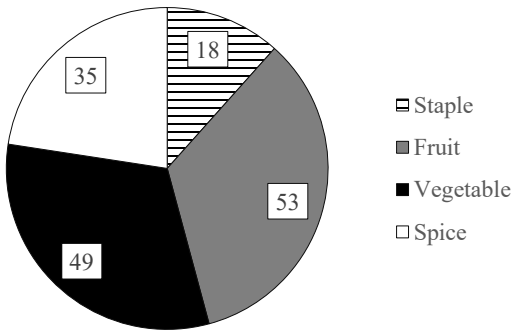

Figure 3. Species number of edible plant species based on utilization category

Nevertheless, Brassicaceae is the family with the most varieties (see Table 1). Brassicaceae species are commonly used as the source of vegetable. In addition to Brassicaceae, which has a large number of varieties, other families with a significant number of species are Fabaceae and Solanaceae (11 species each), followed by Poaceae (10 species) and Ruraceae (9 species). The Fabaceae family is worth examining due to its significant presence in urban settings worldwide. Multiple studies have found that Fabaceae is the family with the most widespread distribution of species. For example, ethnobotanical research conducted in Muang District, Kalasin Province, Thailand (Cruz-Garcia *et al.*, 2016; Phatlamphu *et al*., 2021) and Northern Thailand (Punchay *et al*., 2020) support this finding. Legume species have a close relationship with indigenous populations and play a crucial role in global public health. This family is among the most extensive families, consisting of 19,500 species (Molares and Ladio, 2012; Christenhusz and Byng, 2016).

Table 1. Edible plant families traded in Pasar Gede Surakarta, Indonesia.

Family	Number of species (varieties)
Brassicaceae	12
Fabaceae, Solanaceae	11
Poaceae	10
Rutaceae	9
Amaryllidaceae, Cucurbitacaea, Zingiberaceae	8
Anacardiaceae	7
Apiaceae, Myrtaceae, Rosaceae, Vitaceae	5
Convolvulaceae, Moraceae	4
Asteraceae, Arecaceae, Sapindaceae	3
Agaricaceae, Annonaceae, Cactaceae, Caricaceae, Euphorbiaceae, Lauraceae, Musaceae	2
Achariaceae, Actinidiaceae, Amaranthaceae, Araceae, Bromeliaceae, Butomaceae, Chenopodiaceae, Dioscoreaceae, Ebenaceae, Garciniaceae, Gnetaceae, Illiciaceae, Labiatae, Malvaceae, Melaceae, Moringaceae, Myristicaceae, Oxalidaceae, Pandanaceae, Piperaceae	1

Staple foods

Staple foods are defined as an often-eaten food that provides the primary source of the caloric intake of a certain population (Herforth *et al*., 2020; Ribeiro-Duthie *et al.*, 2021). In traditional cultures, the most influential food crops are staple foods, which provide the family's primary source of daily sustenance (Ladio and Lozada, 2004; Zhang *et al*., 2021). Health, lifestyle

awareness, and ethics affect the way people eat in the modern culture (Łuczaj *et al*., 2012; León-Lobos *et al*., 2022). Nevertheless, in these two communities, the use of sustenance plants is associated with cultural identity, people's connection to nature, and ecological knowledge of their surroundings (Wiryono *et al*., 2019).

According to this criterion, a total of 18 species from 8 families have been recognized as staple foods that are traded at Pasar Gede. Rice, in its different varieties (Table 2), is a staple foodstuff commonly consumed by people in Indonesia, selected based on their personal preferences and market availability. In Indonesia, notably in the city of Surakarta, the utilization of the *Oryza* sp species differs depending on the specific culinary style. *Oryza sativa* L spp. Japonica and *Oryza sativa* L spp. Javanica are subspecies of the Oryza genus that is commonly used as a primary source of carbohydrate known as 'white rice'. White rice is commonly paired with a variety of protein sources and vegetables. The distinction between the Japonica and Javanica kinds lies in their respective textures, with Japonica being notably softer and more delicate than Javanica. The Javanica species is predominantly used in *nasi uduk*, a common morning meal in Java, which has a thicker rice texture. *Oryza nivara* S.D.Sharma & Shastry, or red rice, is commonly included in baby porridge due to its high nutritional content. Black rice is commonly utilized to make black sticky rice porridge, a breakfast dish, and is typically combined with coconut milk and brown sugar. In addition to its use in porridge, a common Javanese culinary preparation involving black rice is called *tape*, a fermented black rice, usually served as desserts. *Oryza sativa* var. Glutinose or glutinous rice, is commonly utilized as snacks like *lemper* and *jadah*, which are traditional Javanese treats, due to its very adhesive texture. *Lemper* is a type of glutinous rice that is thoroughly cooked and then stuffed with chicken floss before being wrapped in banana leaves (Fig. 2d). *Jadah* is a snack that is prepared by steaming sticky rice, grinding it into a fine texture, and then combining it with grated coconut and salt. Typically, it is sliced into portions and accompanied by a sweet and spicy fermented soy cake or tofu. In addition to serving as a common snack, they are also essential culinary offerings at traditional gatherings and celebrations.

Pasar Gede offers three types of staple foods categorized as wild plants that might serve as alternate sources of carbohydrates. These include breadfruit (*Artocarpus altilis*), lesser yam (*Dioscorea esculenta*), and sago (*Metroxylon sago*). Breadfruit, known locally as *sukun*, is an underutilized yet very nutritious crop that is rich in complex carbohydrates and low in fat. Breadfruit is a rich source of carbohydrates, dietary fiber, and protein, and it also includes significant quantities of micronutrients (Mehta *et al.*, 2023). Breadfruit is not commonly utilized as staple food in Surakarta. Rather, it is predominantly recognized as a deep-fried snack. *Dioscorea esculenta*, sometimes referred to as the lesser yam or *gembili* by the local people, is an indigenous yam species found in Southeast Asia. *Gembili* is not extensively consumed by the residents of Surakarta, and thus far it has solely been utilized as a substitute for food. This tuber is more widely recognized on the island of Papua, located in eastern Indonesia, where it has been consumed for many generations. The tubers of this plant are necessary for various customs and rituals, including pig killing ceremonies, ear piercing, and as part of a dowry (Sabda *et al*., 2019). Sago, similar to *gembili*, is more popular in the eastern region of Indonesia compared to the island of Java. Occasionally, the utilization of a plant by a community can be complex.

Table 2. Staple foods in Pasar Gede, Surakarta City, Indonesia.

Scientific Name	Vernacular name *(Language origin)* *	Family	Part Used	Origin	Status	Geographic origin
Artocarpus altilis Fosberg	Sukun *(Jav)*	Moraceae	Fruit	Local	Wild	Oceania
Coleus rotundifolius (Poir.) A.Chev. & Perrot	Kentang hitam *(Ind)*	Solanaceae	Tuber	Local	Cultivated	Java, Moluccas, Sumatera, South Asia, Southeast Asia
Colocasia esculenta (L.) Schott	Tales *(Jav)*	Araceae	Tuber	Local	Cultivated	Sumatera, Southeast Asia, East Asia, Southeast Asia
Dioscorea esculenta L.	Gembili *(Jav)*	Dioscoreaceae	Tuber	Local	Wild	Java, Lesser Sunda, Borneo,

Scientific Name	Vernacular name *(Language origin)* *	Family	Part Used	Origin	Status	Geographic origin
						Sumatera, Sulawesi, Moluccas, Southeast Asia, South Asia
Ipomoea batatas (L.) Lam cv. Cilembu	Ubi jalar madu *(Ind)*	Convolvulaceae	Tuber	Local	Cultivated	Central America
Ipomoea batatas L.	Ubi jalar putih *(Ind)*	Convolvulaceae	Tuber	Local	Cultivated	Central America
Ipomoea batatas var. Ayumurasaki	Ubi ungu *(Ind)*	Convolvulaceae	Tuber	Local	Cultivated	Central America
Manihot utilissima Crantz	Telo *(Jav)*	Euphorbiaceae	Tuber	Local	Cultivated	South America
Metroxylon sagu Rottb.	Sagu *(Ind)*	Arecaceae	Stem	Local	Wild	Moluccas, New Guinea
Oryza nivara S.D.Sharma & Shastry	Beras merah *(Ind)*	Poaceae	Seed	Local	Cultivated	Southeast Asia, East Asia, South Asia, Australia
Oryza sativa L spp. Japonica var. Mentik Susu	Beras mentik susu *(Ind)*	Poaceae	Seed	Local	Cultivated	East Asia
Oryza sativa L spp. Javanica var. Mentik Wangi	Beras mentik wangi *(Ind)*	Poaceae	Seed	Local	Cultivated	East Asia
Oryza sativa L. spp. Indica	Beras hitam *(Ind)*	Poaceae	Seed	Local	Cultivated	South Asia
Oryza sativa L. spp. Javanica var. Pandan Wangi	Beras putih pandan wangi *(Ind)*	Poaceae	Seed	Local	Cultivated	East Asia
Oryza sativa L. spp. Javanica var. Rojolele	Beras putih rojolele *(Ind)*	Poaceae	Seed	Local	Cultivated	East Asia
Oryza sativa var. Glutinosa	Beras ketan *(Ind)*	Poaceae	Seed	Local	Cultivated	East Asia
Solanum tuberosum L.	Kentang *(Ind)*	Solanaceae	Tuber	Local	Cultivated	South America
Zea mays L.	Jagung *(Ind)*	Poaceae	Seed	Local	Cultivated	North America

*[Jav: Javanase language; Ind: Indonesian official language (Bahasa)]

Fruits

A fruit, according to botanical terms, refers to the fully developed ovary that contains seeds, along with its encompassing tissues such as the exocarp, mesocarp, and endocarp (Herforth *et al*., 2020; Rahayu *et al*., 2021; Ribeiro-Duthie *et al.*, 2021). However, in standard parlance, the term "fruit" often refers to the edible, sweet or sour, fleshy structures or product of plants that are connected with seeds and can be consumed in their raw form. According to the standard definition, a total of 52 species from 22 families have been documented as being traded at Pasar Gede. The presence of socio-cultural factors contributes to the wide range of fruit varieties available at Pasar Gede. The strong influence of Chinese culture in the market environment leads to a diverse selection of fruits being traded. Additionally, during the Chinese New Year season, individuals of Chinese descent continue the tradition of offering fruits to their ancestors.

The Anacardiaceae family has the most of species traded as food at Pasar Gede, with a variety of 8 species from the Mangifera genus. This was followed by the Rutaceae family with 6 species, and the Rosaceae and Vitaceae families with 5 species each (Table 3). The Mangifera genus belongs to the Anacardiaceae family and is widely known for being a prominent source of tropical fruits in Indonesia. It is highly valued for its

economic significance and popularity among consumers (Polosakan, 2016).

Based on the cultivation status assessment, approximately 85% of the fruit traded in Pasar Gede is cultivated, while the remaining 15% is wild fruit. Out of total amount of fruit that has been recorded, 32% consists of imported fruit, while the remaining portion is comprised of local fruit. According to the interview findings, the wild fruit being traded originates from the merchants' personal gardens or is occasionally purchased by collectors from multiple private gardens before being traded. Despite their wild nature, the purchasers are familiar with these wild fruits. This knowledge has been passed down through generations and also through the notion of *gethok tular* in the Javanese culture, which means information is shared orally. This includes both positive and negative aspects of an entity being communicated to others (Suwardi *et al*., 2019).

According to Khakurel *et al*. (2021), wild fruit plants have the capacity to serve as a cost-effective and nourishing alternative food source. The wild and local fruits traded in Pasar Gede include *Tamarindus indica* (asam jawa), *Spondias pinnata* (kedondong), *Garcinia mangostana* (manggis), *Alocarpus integra* (nangka), *Nephelium lappaceum* (rambutan), *Annona muricata* (sirsak), and *Annona squamosal* (srikaya) (Figure 4).

Figure 4. Some of local fruit traded in Pasar Gede, Surakarta City, Indonesia. a. Kedondong (*Spondias pinnata*), b. Asam Jawa (*Tamarindus indica*), c. Bengkoang (*Pachyrhizus erosus*)

Table 3. Fruits in Pasar Gede, Surakarta City, Indonesia.

Scientific Name	Vernacular name *(Language origin)* *	Family	Part Used	Origin	Status	Geographic origin
Actinidia chinensis (A.Chev.) A.Chev.var. Deliciosa	Kiwi *(Ind)*	Actinidiaceae	Fruit	Imported	Cultivated	East Asia
Ananas comosus Merr.	Nanas *(Jav)*	Bromeliaceae	Fruit	Local	Cultivated	South America, Central America
Annona muricata L.	Sirsak *(Ind)*	Annonaceae	Fruit	Local	Wild	South America, Central America
Annona squamosa L.	Srikaya *(Ind)*	Annonaceae	Fruit	Local	Wild	South America, Central America
Artocarpus integer (Thunb.) Merr.	Nangka *(Ind)*	Moraceae	Fruit, Seeds	Local	Wild	Borneo, Jawa, Moluccas, Sulawesi, Sumatera, Southeast Asia
Averrhoa carambola L.	Blimbing *(Jav)*	Oxalidaceae	Fruit	Local	Cultivated	Java, Moluccas, Sulawesi
Beta vulgaris L.	Buah bit *(Ind)*	Chenopodiaceae	Fruit	Local	Cultivated	Europe, Africa, Middle East, South Asia

Scientific Name	Vernacular name *(Language origin)* *	Family	Part Used	Origin	Status	Geographic origin
Carica papaya L.	Kates *(Jav)*	Caricaceae	Fruit	Local	Cultivated	South America, Central America
Cirtrus reticulata Blanco. cv. Santang	Jeruk santang *(Ind)*	Rutaceae	Fruit	Imported	Cultivated	East Asia
Citrullus lanatus Schard.	Semangka *(Ind)*	Cucurbitaceae	Fruit	Local	Cultivated	Africa
Citrus maxima (Burm.) Merr	Jeruk bali *(Ind)*	Rutaceae	Fruit	Local	Cultivated	Southeast Asia
Citrus nobilis L. Var. Microcarpa	Jeruk keprok *(Ind)*	Rutaceae	Fruit	Imported	Cultivated	Southeast Asia
Citrus sinensis L.	Jeruk baby *(Ind)*	Rutaceae	Fruit	Local	Cultivated	Southeast Asia
Citrus tangerina Tanaka	Jeruk siam *(Ind)*	Rutaceae	Fruit	Imported	Cultivated	Thailand
Citrus × limon (L.) Osbeck	Jeruk lemon *(Ind)*	Rutaceae	Fruit	Imported	Cultivated	South Asia, East Asia
Cucumis melo L.	Melon *(Ind)*	Cucurbitaceae	Fruit	Local	Cultivated	South Asia, Africa, Middle East, Australia
Cucurbita moschata Duch.	Waluh *(Jav)*	Cucurbitaceae	Fruit	Local	Wild	Central America
Diospyros kaki L.	Kesemek *(Ind)*	Ebenaceae	Fruit	Local	Cultivated	South Asia, East Asia, Southeast Asia
Euphoria longana L. Steud.	Kelengkeng *(Ind)*	Sapindaceae	Fruit	Local	Cultivated	Southeast Asia, East Asia, South Asia
Fragraria anannasa L.	Stroberi *(Ind)*	Rosaceae	Fruit	Local	Cultivated	North America, Europe
Garcinia mangostana L.	Manggis *(Ind)*	Garciniaceae	Fruit	Local	Wild	Southeast Asia
Hylocereus polyrhizus (F.A.C.Weber) Britton & Rose	Buah naga daging merah *(Ind)*	Cactaceae	Fruit	Local	Cultivated	South America
Hylocereus undatus (Haw.) Britton & Rose	Buah naga daging putih *(Ind)*	Cactaceae	Fruit	Local	Cultivated	Central America
Lansium domesticum Correa	Duku *(Ind)*	Melaceae	Fruit	Local	Cultivated	Borneo, Java, Lesser Sunda, Sulawesi, Sumatera, Southeast Asia
Litchi chinensis Sonn.	Leci *(Ind)*	Sapindaceae	Fruit	Imported	Cultivated	Java, Papua, Southeast Asia, East Asia, South Asia
Malus domestica Borkh. cv. Fuji	Apel fuji *(Ind)*	Rosaceae	Fruit	Imported	Cultivated	Central Asia
Malus domestica Borkh. cv. Granny smith	Apel hijau *(Ind)*	Rosaceae	Fruit	Imported	Cultivated	Central Asia
Malus domestica Borkh. cv. Red delicious	Apel merah *(Ind)*	Rosaceae	Fruit	Imported	Cultivated	Central Asia
Mangifera indica L. Var. Arumanis	Mangga arumanis *(Ind)*	Anacardiaceae	Fruit	Local	Cultivated	South Asia, East Asia
Mangifera indica L. Var. Cengkir	Mangga cengkir *(Ind)*	Anacardiaceae	Fruit	Local	Cultivated	South Asia, East Asia
Mangifera indica L. Var. Gedong Gincu	Mangga gedong gincu *(Ind)*	Anacardiaceae	Fruit	Local	Cultivated	South Asia, East Asia

Scientific Name	Vernacular name *(Language origin)* *	Family	Part Used	Origin	Status	Geographic origin
Mangifera indica L. Var. Kiojay	Mangga kiojay *(Ind)*	Anacardiaceae	Fruit	Imported	Cultivated	South Asia, East Asia
Mangifera indica L. Var. Lalijiwo	Mangga lalijiwo *(Ind)*	Anacardiaceae	Fruit	Local	Cultivated	South Asia, East Asia
Mangifera indica L. Var. Mahatir	Mangga mahatir *(Ind)*	Anacardiaceae	Fruit	Local	Cultivated	South Asia, East Asia
Mangifera indica L. Var. Okyong	Mangga okyong *(Ind)*	Anacardiaceae	Fruit	Local	Cultivated	South Asia, East Asia
Musa paradisiaca L. Var. Formatipyca	Gedhang kepok *(Jav)*	Musaceae	Fruit	Local	Cultivated	Southeast Asia
Musa paradisiaca L. Var. Sapientum	Gedhang ambon *(Jav)*	Musaceae	Fruit	Local	Cultivated	Southeast Asia
Nephelium lappaceum L.	Rambutan (Ind)	Sapindaceae	Fruit	Local	Wild	Java, Sumatera, Borneo, Sulawesi, Southeast Asia, East Asia, South Asia
Pachyrhizus erosus L.	Besusu *(Jav)*	Fabaceae	Tubers	Local	Cultivated	Central America
Persea Americana Mill.	Alpukat *(Ind)*	Lauraceae	Fruit	Local	Cultivated	Central America
Phoenix dactylifera L.	Kurma *(Ind)*	Arecaceae	Fruit	Imported	Cultivated	Middle East
Psidium guajava L. cv. Red fleshed	Jambu biji merah *(Ind)*	Myrtaceae	Fruit	Local	Cultivated	Central America
Psidium guajava L. Var. Kristal	Jambu kristal *(Ind)*	Myrtaceae	Fruit	Local	Cultivated	Central America
Pyrus communis L.	Pir *(Ind)*	Rosaceae	Fruit	Imported	Cultivated	Europe, Middle East
Salacca edulis Reinw.	Salak *(Ind)*	Arecaceae	Fruit	Local	Cultivated	Java, Sumatera
Spondias pinnata Kurtz.	Kedondong *(Ind)*	Anacardiaceae	Fruit	Local	Wild	Java, Lesser Sunda, Sumatera, Sulawesi, Molucas, Southeast Asia, East Asia, South Asia
Syzygium aqueum Burm. f. Alston	Jambu air *(Ind)*	Myrtaceae	Fruit	Local	Cultivated	Borneo, Java, Lesser Sunda, Molucas, Sulawesi, Sumatera, Papua, Australia
Tamarindus indica L.	Asam jawa *(Ind)*	Fabaceae	Fruit	Local	Wild	Africa
Vitis vinifera L. cv. Black seedless	Anggur hitam *(Ind)*	Vitaceae	Fruit	Imported	Cultivated	Mediterranean
Vitis vinifera L. cv. Flame seedless	Anggur merah *(Ind)*	Vitaceae	Fruit	Imported	Cultivated	Mediterranean
Vitis vinifera L. cv. Sweet Sapphire	Anggur panjang *(Ind)*	Vitaceae	Fruit	Imported	Cultivated	Mediterranean
Vitis vinifera L. cv. Thompson seedless	Anggur hijau *(Ind)*	Vitaceae	Fruit	Imported	Cultivated	Mediterranean
Vitis vinifera L. Var. Ninel	Anggur ninel *(Ind)*	Vitaceae	Fruit	Imported	Cultivated	Mediterranean

*[Jav: Javanase language; Ind: Indonesian official language (Bahasa)]

Vegetables

A vegetable is defined as the edible non-fruit portion of a plant that can be consumed in part or entirely to provide the necessary nutrition for a healthy diet. Typically, vegetables undergo processing before being consumed as food (Herforth *et al*., 2020; Ribeiro-Duthie *et al.*, 2021). Vegetables typically possess a higher content of starch and carbs, which fulfill the daily dietary requirements (Azka and Buyana 2021). This encompasses the various components of a plant, such as the stems, roots, rhizomes, leaves, and bulbs. From a cultural standpoint, it is recognized that some fruits, such as tomatoes, peppers, cucumbers, and eggplants, are classified as vegetables. A total of 49 species and cultivars belonging to 18 families of vegetables have been identified to be traded in Pasar Gede, as shown in Table 4. The abundance of diverse vegetable varieties at Pasar Gede can be credited to ecological factors. Boyolali and Tawangmangu, located in the satellite region of Surakarta, are noted for being highland areas (Santhyami et al., 2024) that provide ideal ecological conditions for vegetable cultivation. These conditions include optimal temperature and fertile soil.

The family with the most species traded as food was Brassicaceae with 12 types of vegetable. This was followed by Leguminosae with 9 species, Cucurbitaceae with 5 species, and Solanaceae with 4 species (Table 4). According to Gordi, et. al (2022), the majority of vegetables sold in both traditional and modern markets in urban society are primarily from the Brassicaceae family. The Brassicaceae family is a tribal group that has been consumed and cultivated by farmers for a long time. This family includes a variety of vegetables, such as mustard greens and cabbage. Anggraini, et. al (2022) conducted study indicating that the Brassicaceae family, particularly cabbage, is highly favored as a vegetable due to its affordability and rich content of vitamins, minerals, protein, and carbohydrates. Urban individuals tend to consume cultivar vegetables like cabbage and carrots more than wild vegetables *(*Yurlisa *et al*., 2017). Based on interviews conducted with traders in Pasar Gede, cabbage and mustard greens are in great demand among consumers because of their convenient preparation and wide availability.

Based on the cultivation status, around 67% of vegetable species are grown by planned cultivation, while the remaining 33% are discovered in the wild. The vegetables that are consistently in stock in Pasar Gede are cultivated vegetables. Each morning, the supplier reliably delivers fresh vegetable commodities to meet the relatively high demand for vegetables. A study in the traditional markets of the Regency and City of Kediri revealed that 61% of cultivated vegetables and 39% of vegetables were sourced from nature (Yurlisa *et al*., 2017).

Cultivated vegetables make a significant contribution to plant conservation goals and are readily accessible. To guarantee food security, it is crucial to safeguard indigenous types and variations that are less genetically advanced by promoting the diversification of crop varieties (Wiryono *et al*., 2021). Nevertheless, there is still a consumer demand for vegetables of wild species. Wild vegetables that are traded in Pasar Gede are rebung (bamboo shoot) (*Dendrocalamus asper*), bunga turi (*Sesbania grandiflora*), genjer (*Limnocharis flava*), jengkol (*Pithecellobium lobatum*), kecipir (*Pshophocarpus tetragonolobus*), kecombrang (*Nicolaia speciosa*), kelor (*Moringa oleifera*), kemangi (*Ocimum basilicum*), kenikir (*Cosmos caudatus*), kluwih (*Artocarpus camansi*), lamtoro or mlanding (*Leucaena leucocephala*), leunca or terong ranti (*Solanum nigrum*), melinjo (*Gnetum gnemon*), nangka (*Alocarpus integra*), pepaya (*Carica papaya*), and petai (*Parkia speciosa*). The Javanese eats a variety of wild vegetable varieties that are typical Javanese recipes that are frequently unavailable elsewhere. One example is the salad dish known as *urap* which is made of grated coconut that has been seasoned and combined with sections of papaya leaves and flowers that have been briefly boiled (Fig. 2c). Typically, wild vegetables are sold directly by individuals who harvest them from their own gardens. Additionally, certain wild vegetables are also sold to permanent vegetable vendors. Various varieties of wild vegetables serve as the fundamental components of traditional Javanese gastronomic delights, including *sayur bobor*, *sayur lodeh* (Fig. 2b), and *sayur bening*. The term *sayur* in Indonesian languange (called Bahasa) or *janganan* in Javanese language refers to vegetables.

Figure 5. Some of wild vegetables in Pasar Gede, Surakarta City, Indonesia: (a-b) seed and sprout of *lamtoro* (*Leucaena leucocephala*); (c-d) flower and leaf of papaya (*Carica papaya*); (e-f) leaf and rind of *melinjo* (*Gnetum gnemon*)

Table 4. Vegetables in Pasar Gede, Surakarta City, Indonesia.

Scientific Name	Vernacular name *(Language origin)* *	Family	Part Used	Origin	Status	Geographic origin
Abelmoschus esculentus L. Moench.	Okra *(Ind)*	Malvaceae	Fruit	Local	Cultivated	South Asia
Agaricus bisporus (J.E.Lange) Imbach	Jamur kancing *(Ind)*	Agaricaceae	Stems	Local	Cultivated	Eurasia and North America
Allium fistulosum L.	Onclang *(Jav)*	Amaryllidaceae	Leaves	Local	Cultivated	East Asia
Allium tuberosum Rottler ex Spring.	Kucai *(Ind)*	Amaryllidaceae	Leaves	Local	Cultivated	South Asia
Alternanthera amoena Voss.	Bayam merah *(Ind)*	Amaranthaceae	Leaves	Local	Cultivated	South America
Apium graveolens L.	Seledri *(Ind)*	Apiaceae	Leaves	Local	Cultivated	Europe, Central Asia, Middle East, South America, Oceania
Artocarpus camansi Blanco	Kluwih *(Jav)*	Moraceae	Fruit	Local	Wild	Oceania
Artocarpus integer (Thunb.) Merr.	Nangka *(Ind)*	Moraceae	Fruit, seeds	Local	Wild	Borneo, Java, Moluccas, Sulawesi, Sumatera, Southeast Asia
Benincasa hipsida (Thunb.) Cogn.	Bligo *(Jav)*	Cucurbitaceae	Fruit	Local	Cultivated	Java, Lesser Sunda, Moluccas, Borneo,

Scientific Name	Vernacular name *(Language origin)* *	Family	Part Used	Origin	Status	Geographic origin
						Sulawesi, Oceania
Brassica rapa L. Var. Chinensis	Pakcoy *(Chin)*	Brassicaceae	Leaves	Local	Cultivated	East Asia
Brassica juncea (L.) Czern.	Sawi hijau *(Ind)*	Brassicaceae	Leaves	Local	Cultivated	Europe
Brassica rapa L. Var. Narinosa	Sawi pagoda *(Ind)*	Brassicaceae	Leaves	Local	Cultivated	East Asia
Brassica oleracea L. Var. Botrytis	Kembang Kol *(Ind)*	Brassicaceae	Inflorescence	Local	Cultivated	Europe
Brassica oleracea L. Var. Capitata	Kubis putih *(Ind)*	Brassicaceae	Leaves	Local	Cultivated	Europe
Brassica oleracea L. Var. Capitata frubra	Kubis ungu *(Ind)*	Brassicaceae	Leaves	Local	Cultivated	Europe
Brassica oleracea L. Var. Italica	Brokoli *(Ind)*	Brassicaceae	Inflorescence	Local	Cultivated	Europe
Brassica oleracea L. Var. Sabellica	Kale *(Ind)*	Brassicaceae	Leaves	Local	Cultivated	Europe
Brassica rapa L. Var. Pekinensis	Sawi putih *(Ind)*	Brassicaceae	Leaves	Local	Cultivated	East Asia
Capsicum annum L. Var. Grossum	Paprika *(Ind)*	Solanaceae	Fruit	Local	Cultivated	Central America
Carica papaya L.	Kates *(Jav)*	Caricaceae	Leaves, flowers	Local	Wild	Central America, South America
Cosmos caudatus Kunth.	Kenikir *(Jav)*	Asteraceae	Leaves	Local	Wild	Central America, South America
Cucumis sativus L.	Timun *(Ind)*	Cucurbitacaea	Fruit	Local	Cultivated	Southeast Asia, East Asia, South Asia
Daucus carota L.	Wortel *(Ind)*	Apiaceae	Tubers	Local	Cultivated	Europe, Central Asia, Middle East, Africa
Dendrocalamus asper (Schult.) Backer	Pring petung *(Jav)*	Poaceae	Shoots	Local	Wild	Java, Lesser Sunda, Sumatera, Borneo, Sulawesi, Papua, Southeast Asia, East Asia, South Asia
Gnetum gnemon L.	Melinjo *(Ind)*	Gnetaceae	Leaves, seeds, flowers, fruit	Local	Wild	Moluccas, Lesser Sunda, Sulawesi, Southeast Asia, East Asia, South Asia, Oceania
Ipomoea aquatic Forssk.	Kangkung *(Ind)*	Convolvulaceae	Leaves	Local	Cultivated	Java, Lesser Sunda, Sumatera, Borneo, Sulawesi, Moluccas, Papua, Oceania, Southeast Asia, East Asia, South Asia, Middle East, Africa
Lactuca sativa L.	Selada *(Ind)*	Asteraceae	Leaves	Local	Cultivated	Iraq
Lactuca sativa L. Var. Capitata	Letus *(Ind)*	Asteraceae	Leaves	Local	Cultivated	Europe

Scientific Name	Vernacular name *(Language origin)* *	Family	Part Used	Origin	Status	Geographic origin
Leucaena leucocephala (Lam.) de Wit	Lamtoro/Mlanding *(Jav)*	Fabaceae	Seeds	Local	Wild	Central America, South America
Limnocharis flava (L.) Buchenau	Genjer *(Ind)*	Butomaceae	Leaves, flowers, stems	Local	Wild	Central America, South America
Luffa acutangula (L.) Roxb.	Oyong *(Jav)*	Cucurbitacaea	Fruit	Local	Cultivated	South Asia
Momordica charantia L.	Pare *(Jav)*	Cucurbitacaea	Fruit	Local	Cultivated	Java, Lesser Sunda, Sumatera, Borneo, Sulawesi, Moluccas, South Asia, Africa
Moringa oleifera Lam.	Kelor *(Jav)*	Moringaceae	Leaves	Local	Wild	India, Pakistan
Nicolaia speciosa (Blume) Horan.	Kecobrang *(Jav)*	Zingiberaceae	Flowers	Local	Wild	Borneo, Java, Lesser Sunda, Sumatera, Southeast Asia
Ocimum basilicum L.	Kemangi *(Ind)*	Labiatae	Leaves, seeds	Local	Wild	Java, Lesser Sunda, Sumatera, Borneo, Moluccas, Sulawesi, Southeast Asia, South Asia, East Asia, Oceania
Parkia speciosa Hassk.	Petai *(Ind)*	Fabaceae	Fruit, seeds	Local	Wild	Borneo, Jawa, Sumatera, Southeast Asia
Phaseolus mungo L.	Kacang hijau *(Ind)*	Fabaceae	Seeds	Local	Cultivated	South Asia
Phaseolus vulgaris L.	Buncis *(Ind)*	Fabaceae	Fruit	Local	Cultivated	Central America, South America
Pisum sativum L.	Kapri *(Ind)*	Fabaceae	Fruit	Local	Cultivated	Australia
Pithecellobium lobatum Benth.	Jengkol *(Ind)*	Fabaceae	Seeds	Local	Wild	Borneo, Java, Sumatera, Southeast Asia, South Asia
Pleurotus ostreatus (Jacq) (P. Kumm)	Jamur tiram *(Ind)*	Agaricaceae	Stems	Local	Cultivated	East Asia
Psophocarpus tetragonolobus (L.) DC.	Kecipir *(Jav)*	Fabaceae	Fruit	Local	Wild	Africa
Raphanus sativus L. Var. Longipinnatus	Lobak *(Ind)*	Brassicaceae	Tubers	Local	Cultivated	Europe
Sechium edule Jacq.Sw.	Jipan/Labu siam *(Jav)*	Cucurbitaceae	Fruit	Local	Cultivated	Central America
Sesbania grandiflora (L.) Poir.	Kembang Turi *(Ind)*	Fabaceae	Flowers	Local	Wild	Java, Papua, Southeast Asia
Solanum lycopersicum L.	Tomat *(Ind)*	Solanaceae	Fruit	Local	Cultivated	South America
Solanum melongena L.	Terong *(Ind)*	Solanaceae	Fruit	Local	Cultivated	Java, Lesser Sunda, Borneo, Sulawesi, Southeast Asia, East Asia, South Asia
Solanum torvum Sw.	Pokak *(Jav)*	Solanaceae	Fruit	Local	Wild	Central America, South America

Scientific Name	Vernacular name *(Language origin)* *	Family	Part Used	Origin	Status	Geographic origin
Vigna sinensis (L.) Savi ex Hassk.	Kacang panjang *(Jav)*	Fabaceae	Fruit	Local	Cultivated	Africa

* [Jav: Javanase language; Ind: Indonesian official language (Bahasa); Chin: Chinese languange]

Spices

Spices are variously defined as vegetables used for aromatic and flavoring in various culinary traditions (García-Casal *et al.*, 2016; Herforth *et al*., 2020). Culturally spices are considered beneficial due to the various extracts, essential oils, and phytomedicines that are derived from spices. As per that definition 35 species from 16 families has been identified traded in Pasar Gede. It is noted that various cuisines are not indigenous to Java, having been introduced by various Chinese, Arab and Indian traders and their descendants, known as the *peranakan*, that have become an integral part of social fabric of Surakarta (Breman, 2020; Santhyami et al., 2024). Various European cuisines were also introduced during the Dutch colonial period leading to the unique fusion of Javanese, Chinese, Middle Eastern, and European cuisine that still serves as a major tourist attraction in Surakarta (Achmad *et al.*, 2018; Firdiansyah *et al*., 2024).

With eight spice plant species in the Zingiberaceae family and six in the Solanaceae family, these are the two spice plant families that are most frequently encountered (Table 5). The Zingiberaceae family offers a variety of spice plants for sale, including ginger, turmeric, galangal, white turmeric, fingerroot, and cardamom. This plant family has many health benefits (Sayekti and Fadhilah, 2023). Spice plants belonging to the Solanaceae family encompass various types of chilies, such as big chilies, curly chilies, and cayenne peppers. The Zingiberaceae species is commonly utilized as supplementary components or spices in culinary preparations. The primary role of this substance is to improve flavors, neutralize tastes, remove fishy odors, provide fragrance, and act as a coloring agent in food (Silalahi *et al*., 2023; Spence, 2023).

Table 5. Spices in Pasar Gede, Surakarta City, Indonesia.

Scientific Name	Vernacular name *(Language origin)* *	Family	Part Used	Origin	Status	Geographic origin
Aleurites moluccana (L.) Willd.	Kemiri *(Ind)*	Euphorbiaceae	Seeds	Local	Cultivated	Java, Borneo, Sumatera, Sulawesi, Lesser Sunda, Moluccas, Papua, Oceania, Southeast Asia, East Asia, South Asia
Allium ascalonicum L.	Bawang merah india *(Ind)*	Amaryllidaceae	Tubers	Imported	Cultivated	Middle East
Allium cepa L.	Bawang Bombay *(Ind)*	Amaryllidaceae	Tubers	Imported	Cultivated	Central Asia
Allium cepa L. Var. Aggregatum	Brambang *(Jav)*	Amaryllidaceae	Tubers	Imported	Cultivated	Central Asia
Allium fistulosum L.	Daun bawang *(Ind)*	Amaryllidaceae	Leaves	Local	Cultivated	East Asia
Allium sativum L.	Bawang *(Jav)*	Amaryllidaceae	Tubers	Imported	Cultivated	Central Asia
Allium sativum var. Solo Garlic	Bawang lanang *(Jav)*	Amaryllidaceae	Tubers	Imported	Cultivated	Central Asia
Alpinia galanga (L.) Willd.	Lengkuas *(Ind)*	Zingiberaceae	Rhizomes	Local	Wild	Java, Sumatera, Borneo, Southeast Asia, East Asia, South Asia
Amomum cardamomum L.	Kapulaga *(Ind)*	Zingiberaceae	Rhizomes	Local	Cultivated	Jawa, Sumatera
Boesenbergia pandurata (Roxb.) Schltr.	Kunci *(Jav)*	Zingiberaceae	Rhizomes	Local	Wild	Java, Lesser Sunda, Sumatera,

Scientific Name	Vernacular name *(Language origin)* *	Family	Part Used	Origin	Status	Geographic origin
						Southeast Asia, South Asia, East Asia
Capsicum annuum L. Var. Longum	Cabai keriting *(Ind)*	Solanaceae	Fruit	Local	Cultivated	Central America
Capsicum annuum L. Var. Tanjung	Cabai merah besar tanjung *(Ind)*	Solanaceae	Fruit	Local	Cultivated	Central America
Capsicum annuum L. Var. Annuum	Cabai hijau besar *(Ind)*	Solanaceae	Fruit	Local	Cultivated	Central America
Capsicum pubescens Ruiz & Pav.	Cabai gendot *(Ind)*	Solanaceae	Fruit	Local	Cultivated	South America
Capsicum frutescens L.	Cabai rawit *(Ind)*	Solanaceae	Fruit	Local	Cultivated	Central America, South America
Cinnamomum verum J.Presl.	Kayu manis *(Ind)*	Lauraceae	Bark	Local	Wild	Java, Borneo, Sumatera, Sulawesi, Lesser Sunda, Papua, Oceania, Southeast Asia, East Asia, South Asia
Citrus × *aurantiifolia* (Christm.) Swingle	Jeruk nipis *(Ind)*	Rutaceae	Fruit	Local	Cultivated	South Asia, Southeast Asia, Oceania, Africa, South America
Citrus × *limonellus* Hassk. var. Amblycarpa	Jeruk sambal *(Ind)*	Rutaceae	Fruit	Local	Cultivated	South-east Asia, New Caledonia and Australia
Citrus hystrix DC.	Jeruk purut *(Ind)*	Rutaceae	Leaves	Local	Wild	Borneo, Sumatera, Sulawesi, Lesser Sunda, Papua, Oceania, Southeast Asia, East Asia, South Asia
Coriandrum sativum L.	Ketumbar *(Ind)*	Apiaceae	Seeds	Local	Cultivated	Middle East
Cuminum cyminum L.	Jintan *(Ind)*	Apiaceae	Seeds	Local	Cultivated	Middle East
Curcuma longa L.	Kunyit *(Ind)*	Zingiberaceae	Rhizomes	Local	Cultivated	India
Cymbopogon citratus (DC.) Stapf	Serai *(Ind)*	Poaceae	Stems	Local	Wild	South Asia
Illicium verum Hook.f.	Bawang lawing *(Ind)*	Illiciaceae	Flowers	Imported	Cultivated	East Asia, Southeast Asia
Kaempferia galanga L.	Kencur *(Ind)*	Zingiberaceae	Rhizomes	Local	Cultivated	South Asia, Southeast Asia
Kaempferia rotunda L.	Kunir putih *(Ind)*	Zingiberaceae	Rhizomes	Local	Cultivated	Souteast Asia, East Asia, Southeast Asia
Myristica fragrans Houtt.	Pala *(Ind)*	Myristicaceae	Fruit	Local	Wild	Java, Borneo, Sumatera, Sulawesi, Lesser Sunda, Papua, Oceania, Southeast Asia, East Asia, South Asia
Pandanus amaryllifolius Roxb.	Daun pandan *(Ind)*	Pandanaceae	Leaves	Local	Wild	Moluccas
Pangium edule Reinw. ex Blume	Kluwak *(Jav)*	Achariaceae	Seeds	Local	Wild	Java, Borneo, Sulawesi, Sumatera, Lesser

Scientific Name	Vernacular name *(Language origin)* *	Family	Part Used	Origin	Status	Geographic origin
						Sunda, Papua, Oceania
Pimpinella anisum L.	Adas manis *(Ind)*	Apiaceae	Seeds	Local	Wild	Central Asia
Piper nigrum L.	Merica *(Ind)*	Piperaceae	Seeds	Local	Cultivated	India
Syzygium aromaticum L.	Cengkeh *(Ind)*	Myrtaceae	Flowers	Local	Wild	Moluccas
Syzygium polyanthum Walp.	Daun salam *(Ind)*	Myrtaceae	Leaves	Local	Wild	Java, Borneo, Sumatera, Lesser Sunda, Southeast Asia
Zingiber officinale Rosc.	Jahe gajah *(Jav)*	Zingiberaceae	Rhizomes	Local	Cultivated	Southeast Asia
Zingiber officinale var. Rubrum	Jahe emprit *(Jav)*	Zingiberaceae	Rhizomes	Local	Cultivated	Southeast Asia

*[Jav: Javanese language; Ind: Indonesian official language (Bahasa)]

Organ Plant Part of Edible Plant Used

Figure 6 presents a map illustrating the proportionate distribution of plant parts used in each food type category. There is a total of nine plant organs that serve as edible sources, specifically fruit, leaf, flower, rhizome, tuber, stem, shoot, bark, and seed. Seeds and tubers make up the majority (44%) of the principal components utilized as staple food. The primary component of the plant that is consumed in the fruit category is the fruit, accounting for 93% of the consumption. Compared to the categories of fruit and staple foods, the plant organs utilized are more varied in the vegetables and spices group.

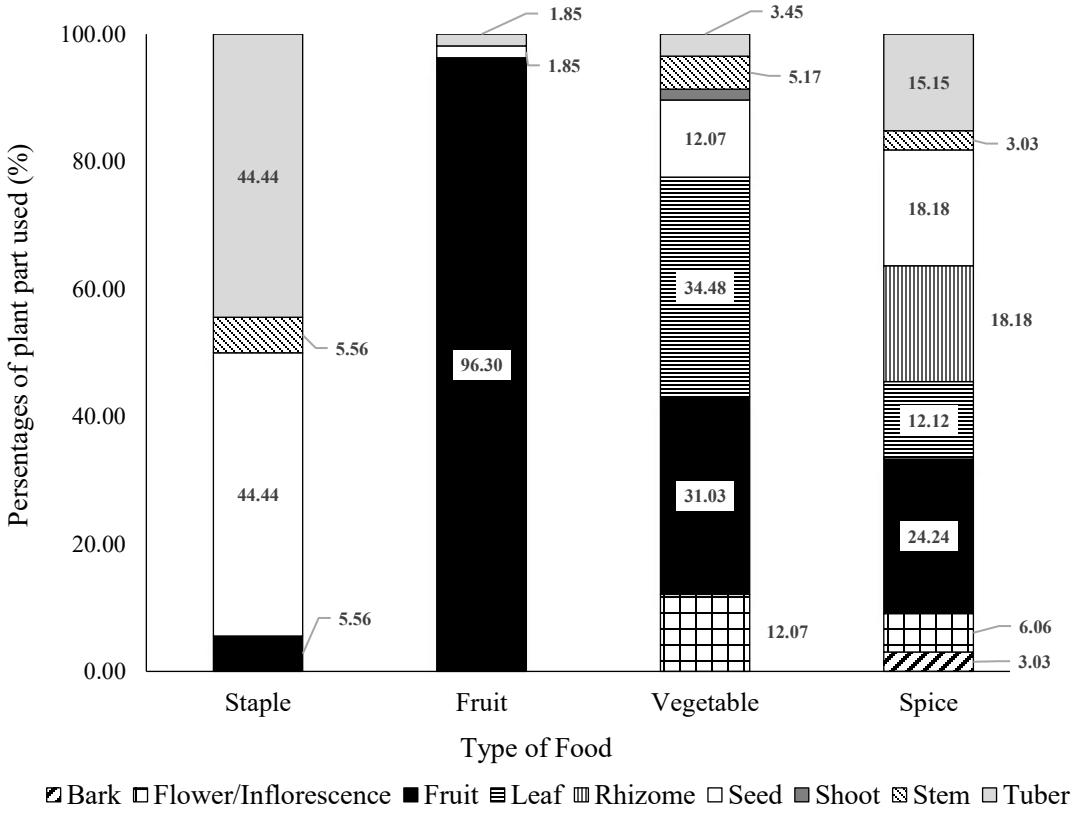

Figure 6. Plant part percentages on type food traded in Pasar Gede, Surakarta City, Indonesia.

In Indonesia, the most often consumed plant-based staples consist of seeds such as rice and maize, as well as starchy tubers including potato, sweet potato, cassava, yam, and taro (Treche, 1996; Purwidiani et al., 2018; Utami et al., 2019; Sugeng and Fitria, 2023; Santhyami and Yunita, 2024). In the fruit category, the fruit parts are the most consumed component, followed by seeds and tubers. Buyers lack familiarity with the seeds consumed in the fruit category. *Bengkoang*, often known as jicama and scientifically referred to as *Pachyrhizus erosus*, is a plant whose tuberous portions are commonly consumed as fruit. *Bengkoang* is normally consumed raw and is frequently used as a component in *lotis*, a Javanese salad that incorporates mango, guava, water guava, papaya, and kedondong (Putri *et al.*, 2014; Erawan *et al.*, 2018; Silalahi *et al.*, 2021; Iskandar *et al*., 2023). The portion of the plant that is consumed under the vegetable category exhibits considerable diversity. The largest component utilized is leaves, accounting for 34% of the total, closely followed by fruit at 31%. The Javanese people utilize certain flower parts as vegetables, such as the flowers of *Sesbania grandiflora, Limnocharis flava, Nicolaia speciosa, Gnetum gnemon,* and *Carica papaya*. Another distinctive vegetable traded in Pasar Gede is the seed of *Leucaena leucocephala*, which is utilized as a primary ingredient for bean sprouts, alternative ingredient of *tempeh* (a fermented bean product, typically made from soybeans) (Figure 7), or consumed as a fresh vegetable

Origin and Status of Cultivation

Most of the species that are traded come from local sources, although there are 23 species that are imported. It is essential to comprehend the terminology used in this study, which is that local plants are those that are obtained or planted in the vicinity of Surakarta or Greater Solo Area (GSA), while imported plants are those that are imported from outside of Surakarta, such as grapes and pears. Nevertheless, the geographic origin of the plant also contributed to the research results in determining its origin. In general, the majority of edible plants in Pasar Gede are cultivated, with wild species contributing to 23% of the total (Figure 8). The majority of imported plants belong to the fruit category, whilst wild plants are primarily utilized as vegetables (16 species) and spices (11 species).

Figure 7. *Tempeh* – A fermented of *lamtoro* (*Leucaena leucocephala*) bean.

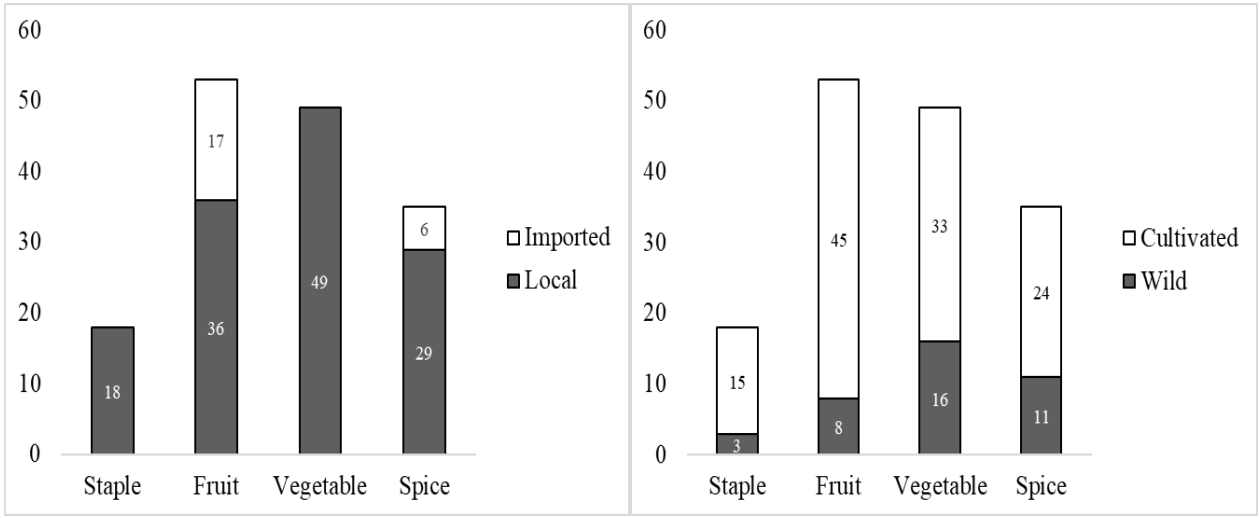

Figure 8. The origin and status of cultivation of edible plant traded in Pasar Gede, Surakarta City, Indonesia.

The classification of cultivation status is limited to two categories: wild plants and cultivated plants. Given the extensive expanse of the rural region as a satellite region of Surakarta city, it frequently poses challenges to discern if a certain species is wild or not. Wild plant species refer to individual plants that thrive in their natural environment without any human intervention or control. Semi-domestic species refer to wild species that have undergone a minor shift, with some being purposefully controlled by humans, albeit not extensively (Shirai and Terry Rambo, 2014; Hernández *et al*., 2020). Informants categorized several species as wild species, which were actually farmed but thrived on area not privately managed. These species originated from the forest periphery or were accidental occurrences of perennial plants in their mixed gardens. For instance, certain spices derived from perennial plants like the *kluwak* tree (*Pangium edule*) and the *salam* tree (*Syzygium polyanthum*) are classified as wild plants due to their natural growth in gardens.

CONCLUSION

This paper presents a thorough ethnobotanical investigation of edible plants carried out at Pasar Gede, Surakarta, Indonesia. It can be used as a valuable resource for future research in the Greater Solo Area (GSA). The urban ethnobotany of Surakarta is influenced by complex interactions between the predominant Javanese culture and the cultural influences of Chinese and Arab communities, particularly in regards to food plants. We discovered a total of 155 species from 47 families of edible plants. The edible plants were classified into four distinct categories: staple foods (source of carbohydrate), fruits, vegetables, and spices. The fruit category contains the largest amount of species, namely 34.19%, followed by the vegetable group with 31.61%, spices with 23.58%, and staple food with 11.61%. A total of nine plant parts is used as food, namely fruit, leaf, flower, rhizome, tuber, stem, shoot, bark, and seed. The fruits were the most commonly utilized plant parts. Seeds and tubers provide the largest proportion (44%) of the main components used as staple food. The fruit component is the primary element of the plant that is consumed under the fruit category, comprising 93% of the total consumption. The vegetables and spices category has a greater variety of plant parts used comparing to staple foods and fruit. The majority of plants originate locally, specifically from the GSA area, and are primarily cultivated. The cosmopolitan nature of Surakarta has led to an increased demand for a wider range of cuisine items. The introduction and naturalization of numerous species in Java have been driven by market demand, resulting in increased biodiversity. However, the long-term impact on native species has to be observed.

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Conflicts of Interest. The authors have no conflicts of interest to declare.

Compliance with ethical standards. This is a first-time publication that has not been previously published to any other journal. This study was conducted in accordance with ethical standards, and all participants provided informed consent prior to their inclusion in the study.

Data availability. The data used to support the findings of this study are available from the corresponding author upon reasonable request.

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