The ethnobotany and local knowledge of sayur asem by the vegetable traders

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ABSTRACT

The sayur asem is one of the traditional Indonesian dishes, especially the Betawi ethnic group. This study aims to document the local knowledge of vegetable traders in the Kranggan Mas market, the diversity of plants used as an ingredient in sayur asem. The method used in this research was a survey. Data were analyzed qualitatively and descriptively. The sayur asem is a soup-like vegetable that has a sour taste with the main ingredients of melinjo (Gnetum gnemon) leaves and seeds and tamarind fruit (Tamarindus indica). The total of 13 species belonging 12 genera and 10 families used to process of making sayur asem. The part of used to process of making sayur asem is dominated by fruits (8 species), followed leaves and tubers (each 2 species). The melinjo (G. gnemon) is the main ingredient in the making of sayur asem, while Alpinia galanga, Syzygium polianthum and Tamarindus indica are the main spices with a larger volume. The main ingredients and seasonings used mostly have antioxidant and antimicrobial activity and are therefore very good at supporting digestive tract health and providing healthful effects.

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INTRODUCTION

The local people who live in Indonesia are rich in local wisdom, including traditional food. The study of local wisdom including traditional foodstuffs is one way to preserve the culture and also biodiversity (Purba, Silalahi & Nisyawati, 2018). Various local knowledge on foodstuffs tends to be degraded due to various factors such as information technology and modern food (Sujarwo, Arinasa, Salomone, Caneva & Fattorini, 2014). Those results in relatively lower local knowledge of the younger generation compared to the older ones (Silalahi, Nisyawati, Walujo & Supriatna, 2015).

Empirically, every region in Indonesia has a variety of traditional foods and varies from one region to another or from one ethnicity to another. For example, the Minangkabau ethnic group is
famous for its traditional cuisine (Nurmufida, Wangrimen, Reinalta & Leonardi, 2017), ketupat (Rianti, Novenia, Christopher, Lestari & Parassih, 2018), lemongrass (Wahyudi, Octavia, Hadipraja, Isnaeniah, & Viriani, 2017) by ethnic Malay (Rianti et al., 2018), and terites by Batak Karo ethnic (Purba et al., 2018), while the local people of Palembang have mpek-mpek. Those traditional food developed in every region and is related to the biodiversity found in the surrounding environment and due to cultural acculturation.

The Betawi ethnic is an indigenous ethnic Indonesian who mostly lives in Jakarta and surrounding areas. Biodiversity in the surrounding environment, especially plants, is used by the Betawi ethnic group as raw material for various traditional dishes, one of which is sayur asem. The sayur asem is a vegetable with a sour taste (asem), which is made from various types of the plant is processed by boiling, especially from melinjo (Gnetum gnemon) and tamarind (Tamarindus indica) (Dewiyanti & Suryani, 2017). Empirically, sometimes sayur asem is considered by groups of people (non-Betawi ethnics) as having less nutritional value, even though the plant ingredients or components used in the processing of these dishes have good nutritional value and even have a healthy effect. The seeds of Gnetum gnemon which is the main component of sayur asem have been reported to have antioxidant activity (Siswoyo, Mardiana, Lee & Hoshokawa, 2011) and antihypertension (Matra, Puspitasari & Siswoyo, 2018; Puspitaningrum, Efendi & Siswoyo, 2014).

The raw material for sayur asem is easily available in the surrounding environment and is currently being traded in many traditional markets in Indonesia (Silalahi, 2020). When traced, research on sayur asem as a food ingredient has been widely carried out but the ethnobotany study is still limited. Documentation of local knowledge is one of the steps for the conservation of biodiversity and culture (Hariyadi & Ticktin, 2012) include the ingredient of traditional food. Pawera, Khomsan, Zuhud, Hunter, Ickowitz & Polesny (2020) stated that the knowledge of the younger generation about local foodstuffs has decreased due to the entry of information technology, reduced supply so that one needs to be preserved through trading in the market. The Kranggan Mas market is a market in the Jatisampurna Sub-district, in which most vegetable traders trade the sayur asem ingredients. This study aims to reveal the local knowledge of vegetable traders in the Kranggan Mas market about sayur asem and explain their development prospects.

RESEARCH METHODS

Research Design

This research was qualitative research with a survey method. Qualitative research is widely used to provide in-depth information including the use of plants so that the information obtained is more comprehensive and in-depth. This research was conducted at the Kranggan Mas market, West Java (Figure 1). Administratively, the Kranggan Mas market is located in Jatisampurna Village, Jatisampurna Sub-District, Bekasi District, West Java. The research was conducted with an ethnobotany approach with surveys, interviews, and observations with modifications Silalahi, Nisyawati, Walujo, Supriatna & Mangunwardoyo, (2015). The survey was conducted in March-June 2020.

Respondents

The population in this study were all vegetable traders (11 respondents) in the Kranggan Mas market, Jatisampurna Sub-District, Bekasi District, West Java. Respondents in the study were sayur asem who traded its ingredients.

Instruments

The instrument in this study was an interview guide to determine the materials used in the process of making sayur asem. Interviews were conducted in semi-structured and in-depth interviews so that it was possible to obtain comprehensive information. Some of the questions that
are asked are the local name, the part used, how to use it, the function of the plants used in the making of sayur asem.

*Figure 1.* Map of Research Locations in the Kranggan Mas Market, Jatisampurna Sub-District, Bekasi District, West Java.

**Procedures**

All vegetable traders who sold *sayur asem* were interviewed. To facilitate communication, most of the ingredients used for *sayur asem* ingredients were purchased by researchers. Some of the things that were asked of the respondents were the main ingredients (local name, part used), spices (local name), and processing method. All data obtained were documented by photographing the parts used and then identified to find out the scientific name.

**Data Analysis**

The data obtained in this study were analyzed qualitatively. Stages of data analysis are carried out by processing the data into an excel table, then creating a bar graph to facilitate its presentation. The data is then described in more detail using primary and secondary data. The qualitative analysis includes grouping plants based on their benefits, families, and parts used. To complement the data on secondary metabolites and plant bioactivity, secondary data was carried out in the form of journals or pre-existing research results.

**RESULTS**

The *sayur asem* is a type of vegetable soup (similar to the soup) with a sour taste (*asem*) made from various types of plants. A total of 13 species belonging 10 families used to make *sayur asem*, consisting of 7 species as a vegetable ingredient and 6 species as spices (*Table 1 and Figure 2*). Figure 3 shows the diversity of parts used in the manufacture of tamarind vegetables, dominated by 8 species of fruit, followed by leaves and tubers (each 2 species).

The process of making or cooking *sayur asem* is very simple, through boiling all the components, but the boiling time is adjusted to the structure of the ingredients used along with all the spices. Some of the spices are ground like *C. frutescent, A. cepa* and *A. sativum* first milled until smooth. The ingredient of *sayur asem* (*Table 1*), which has a hard structure like seeds of *G. gnemon* and fruits of *A. heterophyllus* boiled longer. After the component is soft then other vegetable ingredients are added so that they are cooked.
Table 1. The plant that is used as an ingredient and spice for tamarind vegetables by traders in Kranggan Mas Market, West Java.

| Families       | Scientific name   | Local name   | Part of used | Uses            |
|----------------|-------------------|--------------|--------------|-----------------|
| Caricaceae     | Carica papaya     | Pepaya       | Young fruits | Vegetable       |
| Cucurbitaceae  | Sechium edule     | Labu siam    | Young fruits | Vegetable       |
| Fabaceae       | Arachis hypogea   | Kacang tanah | Seeds        | Vegetable       |
| Tamarindus indica | Asam jawa     |              | Fruits       | Spices          |
| Gnetaceae      | Gnetum gnemon     | Melinjo      | Young bud and fruits | Main ingredient and vegetable |
| Liliaceae      | Allium cepa       | Bawang merah | Bulbs        | Spices          |
|                | Allium sativum    | Bawang putih | Bulbs        | Spices          |
| Moraceae       | Artocarpus heterophyllus | Nangka | Young fruits | Main ingredient and vegetable |
| Myrtaceae      | Syzygium polianthum | Salam  | Leaves       | Spices          |
| Poaceae        | Zea mays          | Jagung       | Leaves       | Vegetable       |
| Solanaceae     | Capsicum frutescens | Cabe  | Fruits       | Spices          |
| Zingiberaceae  | Alpinia galanga   | Lengkuas     | Rhizomes     | Spices          |

Figure 2. Diversity of species, genus, and species used in the process of sayur asem.

Figure 3. Diversity of parts used and species have been used to processed sayur asem.
DISCUSSION

The raw material of sayur asem such as G. gnemon (leaves and seeds) more than other species so that it can be said to be the its main component. The consuming sayur asem is believed to have a healthy effect because the components used have nutritional and contain bioactive compounds that are good for health, therefore it will be discussed further, especially G. gnemon. Some of the spices such as Alpinia galanga (rhizomes), S. polyanthum (leaves), and T. indica (fruits) results from a distinctive aroma and flavor to sayur asem.

Gnetum gnemon (Figure 4a) is an indigenous Indonesian plant that is easily found in the surrounding environment, especially on the island of Java, and has been processed with various vegetables and snacks (Siregar, Mishima, Kawakami, Ito, Inoue, Hirota, Sharmin, Kato, Harada, Misumi, Orii, Suetsugu, Irie, Mishima, Sakai, Sakai, Kawamura, Zahroh, Nurelela, Riyadahi, Putri & Salim, 2016). By the local community, Indonesia is a multi-functional plant and almost all parts of melinjo are used as food ingredients ranging from leaves, easy fruit, fruit skins, and seeds to use as food ingredients. Use of leaves and seeds G. gnemon has a healthy effect because it contains various bioactive compounds. Gnetum gnemon has potential as a natural source for resveratrol which has anti-cancer activity as well as a chemopreventive activity for cancer (Raharjo, Rustanti, Ethica, Rizki & Nugroho, 2012). Gnetum gnemon It also has antioxidant and anti-hypertensive activity. G is reported to have antioxidant activity (Siswoyo et al., 2011) and anti-hypertension (Matra et al., 2018; Puspitaningrum et al., 2014). The compound 3,4-dimethoxychlorogenic acid, resveratrol, and 3-methoxyresveratrol is a phenolic compound that is isolated from the skin of the fruit, which is a compound that has antioxidant activity (Atun, Arianingruma & Masatake, 2007). Pericarp of G. gnemon contains stilbene derivative compounds (isorhapontigenin, resveratrol, gnetin D, gnetifolin K, gnetol) and a lignan compound (+)-lirieoresinol B) demonstrated a comparable and slightly lower antioxidant effect of natural stilbene structures and showed moderate activity against murine leukemia b P-388 cells (Cahyana & Ardiantsah, 2016).

Figure 4. The plant as main ingredient to processed of sayur asem. A. Melinjo (Gnetum gnemon); B. Tamrind (Tamarindus indica); C. Bay leaf (Syzygium polianthum).

The G. gnemon has invitro antidiabetic and showed α-amylase and α-glucosidase inhibitory activity. The hydrolyzate of green seeds was found to be more effective than yellow seeds and red of old seeds with red color (Supriyadi, Arum, Nugraha, Ratnadewi & Siswoyo, 2019). Those showed that G. gnemon young seeds better than older seeds. The seed of G. gnemon also has antimicrobial activity against Bacillus cereus or Gram-positive bacteria (Soehendro, Manuhara &
Nurhartadi, 2015), so it is the potential to be used as a natural preservative. Parhusip & Sitanggang (2011) reported that seed extract G. geninmon inhibits bacterial growth of Aspergillus flavus, Bacillus careus, Staphylococcus aureus, and Enterobacter aerogenes. They further stated that the inhibition of melinjo extract showed almost the same ability as 10 ppm penicillin G against the sample bacteria Bacillus aureus and S. aureus. On the other hand G. geninmon seed flour is also rich in protein (19.0 g / 100 g), crude fiber (8.66 g / 100 g), carbohydrates (64.1%), total dietary fiber (14.5%) and includes adequate amounts of essential, amino acids, fatty acids and minerals (Bhat & Yahya, 2014).

Tamarindus indica (Figure 4b) is commonly found in Indonesia, especially on Java Island. Silalai & Mustaqa (2020) stated that T. indica is a native plant in Africa, but has naturalized in Indonesia, especially in Java. Addition of pericarp extract of T. indica in a variety of foods and drinks it gives a refreshing effect and gives a distinctive aroma that enhances the taste. The T. indica fruits has a sweet and sour taste associated with a high content of tartaric acid and reducing sugars (De Caluwé, Halamová & Van Damme, 2010). The T. indica contains high levels of B vitamins, low carotene, and vitamin C content. The T. indica leaves are a source of vitamin C and \( \alpha \)-carotene and also have high mineral content, especially P, K, Ca, and Mg (De Caluwé et al., 2010).

The literature review that T. indica has anti-microbial activity. Bioactivity as an antimicrobial can be used as a food preservative. Kuru (2014) stated that T. indica has long been used to treat various diseases caused by microbes such as stomachache, diarrhea, dysentery, bacterial infections, and wounds. The ethanol and water extracts (hot and cold) of the pulp, bark and leaves of T. indica have antibacterial activity, to treat Gram-negative and Gram-positive bacteria (Nwodo, Obiyeke, Chigor & Okoh, 2011). The T. indica pericarp extract inhibits bacterial growth Staphylococcus aureus, Escherichia coli (Prabhu & Teli, 2014), while the leaf extract inhibits growth of the Klebsiella pneumoniae, Micrococcus luteus, Pseudomonas aeruginosa, Staphylococcus aureus (Gumgumjee, Khedr & Hajar, 2012), fruit extract inhibits Salmonella paratyphi, Bacillus subtilis, Salmonella typhi dan Staphylococcus aureus (Doughari, 2006). The water extract of T. indica fruit pulp has different sensitivity to Staphylococcus aureus > Escherichia coli > Pseudomonas aeruginosa but not sensitive to Salmonella typhi (Abubakar, Ukwuani & Shehu, 2008).

Shahraiki, Harati & Shahraiki (2011) stated that T. indica was used as a traditional treatment for diabetes mellitus. The administration of T. indica seed aqueous extract prevented an increase in fasting serum insulin, triglycerides, total cholesterol, very low-density lipoproteins, low-density lipoproteins, in the group of rats treated with fructose treated with and T. indica extract. The T. indica extract supplementation might improve metabolic syndrome due to increased insulin (Shahraki et al., 2011). The single and multidose dose of T. indica hydroethanol seed coat extract significantly reduced blood glucose levels in normoglycemic and glucose levels in alloxan-induced hyperglycemic animals. The extract of T. indica hydroethanol seed coat exerted a protective effect on pancreatic \( \beta \) cells in experimental animals. Increased hydroethanol extract of T. indica seed coat will also increase glucose absorption in rat hemi-diaphragm and prevent weight loss (Bhadoriya Ganeshpurkar, Bhadoriya, Sahu & Patel, 2017).

Dietary modifications can significantly reduce risk factors for cardiovascular disease, including cholesterol and atherosclerosis (Martinello, Soares, Franco, Santos, Sugohara, Garcia, Curti & Uyemura, 2006). Dry pulp and powdered T. indica fruit, at a dose of 15 mg/kg body weight, were found to significantly reduce total cholesterol levels and low-density lipoprotein cholesterol levels (Iftekhar, Rayhan, Quadrir, Aktheruzzaman & Hasnat, 2006). Treatment of hypercholesterolemic hamsters with the pulp of T. indica fruit extract (5%) led to a decrease in

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serum total cholesterol (50%), non-high-density lipoprotein cholesterol (73%) and triglycerides (60%), and to increase high-density cholesterol levels. Lipoprotein (61%) (Martinello et al., 2006).

Bay leaf or *S. polyanthum* (Figure 4c) is a type of spice that is widely used in various traditional Indonesian dishes including sayur asem. The addition of bay leaf to sayur asem resulted from a distinctive aroma, thereby enhancing its taste. Based on a survey I conducted in the area around the research, bay leaf plants are very easy to find in the yard and garden near house or home garden. In the Kranggan Mas market, the branch with fresh leaves of *S. polyanthum* in the form of ties or together with other spices. The price for one bunch of bay leaves varies greatly between 1,000 - 3,000 IDR depending on the supply and volume. Before being used, the fresh leaves are dried and aired and it is believed that the aroma of the dry leaves is stronger than the fresh leaves. The dried bay leaves used are generally the result of a wind-dry process (Wartini, Harijono, Susanto, Retnowati & Yunianta, 2007).

The *S. polyanthum* leaves are also the main ingredient for various local Indonesian dishes such as udik rice, yellow rice, and rendang. The food added with *S. polyanthum* has a distinctive aroma. Apart from giving an aroma, it turns out that *S. polyanthum* has a healthy effect. As a traditional medicinal ingredient, *S. polyanthum* is used as a medicine for diabetes mellitus (Agoes, 2010), stomach disorders, hypertension, and cholesterol (Suharti, Banowati, Hermana & Wiryawan, 2008).

The bioactivity of *S. polyanthum* is related to its secondary metabolite content such as essential oils, tannins, flavonoids, terpenoids (Widyawati, Yusof, Asmawi & Ahmad, 2015). The leaves of *S. polyanthum* are estimated to contain about 17% essential oil, with the main content of eugenol and methyl chavicol. Essential oils on the leaves of *S. polyanthum* such as citric acid, eugenol, methyl chavicol (Sumono & Agustin, 2008), cis-4-decenal (27.12%), octanal (11.98%), α-pinene (9.09%), farnesol (8.84%), β-ocimene (7.62%) and nonanal (7.60%) (Wartini, 2009).

The methanol extract of *S. polyanthum* leaves has antihyperglycemic activity by inhibiting glucose absorption from the small intestine and increasing glucose uptake in muscle tissue (Widyawati, Yusof, Asmawi & Ahmad, 2015). Quercetin of the *S. polyanthum* leaves inhibit low density lipoprotein (LDL) oxidation by reducing the tocopherol content contained in LDL particles (Michael, 2017). This indicates that the addition of *S. polyanthum* leaves to sayur asem is thought to reduce human blood cholesterol levels. To lower blood cholesterol levels, 10 - 15 g of bay leaves are used, boiled in 750 ml of water to 250 ml of bay leaf water, consumed 250 ml/day (Khan, Zaman, & Anderson, 2009).

Compounds from *S. polyanthum* leaves can inhibit the growth of pathogenic bacteria such as *Escherichia coli*, *Bacillus cereus* (Setiawan, 2002; Lau & Rukayadi, 2015), *Salmonella* sp., *Staphylococcus aureus*, *Pseudomonas fluorescens* and *Bacillus subtilis* (Setiawan, 2002), *Candida albicans* (Sumono & Agustin, 2008), *Fusarium oxysporum* (Noveriza & Miftakhurohmah, 2010). The *S. polyanthum* leaf extract has antibacterial activity to Gram-positive bacteria (Bacillus subtilis, Enterococcus faecalis) and Gram-negative bacteria (Escherichia coli, Pseudomonas aeruginosa, Salmonella typhi) (Ahmad, 2014).

*Alpinia galanga* is a species belonging to the Zingiberaceae and local names such as laos (Javanese), laja (Sundanese), and kelawas (Karoneese). Empirically, the addition of *A. galanga* rhizome will give it a distinctive aroma and a longer dishes, including sayur asem. The addition of *A. galanga* rhizome has a healthy and traditionally have been used to treat gastrointestinal disorders such as carminatives and gastric disorders (Pornpimon & Devahastin, 2008). Plants are used to treat digestive tract disorders are associated with their bioactivity as anti-microbial.

The rhizoma of *A. galanga* bioactivity as anti-microbial, associated to its essential oil (Jantan, Ahmad & Ahmad, 2004). The *A. galanga* essential oil has antibacterial properties such as pathogenic bacteria in humans and bacteria that cause food spoilage. *Alpinia galanga* has the
activity of inhibiting the growth of microbes found in foods such as *S. aureus* (Oonmetta-aree, Suzuki, Gasalucka & Eumke, 2006). *Alpinia galanga* contains 1,8-cineole essential oil, β-farnesene, trans-caryophyllene, zingiberene inhibits the growth *Bacillus cereus* (Phanthong, Lomarata, Chomnawang & Bunyapraphatsar, 2013).

The *A. galanga* essential oil, which is the most common in rhizomes is 1,8-cineole (28.4%), α-fenchyl acetate (18.4%), camphor (7.7%), (E)-methyl cinnamate (4.2%), and guaiol (3.3%) are the main essential oil found in its rhizomes (Jirovetz, Buchbauer, Shafi & Leela, 2003). Inhibition of microbial growth of *A. galanga* essential oil results in damage to the inner membrane, outer membrane and the occurrence of cytoplasmic coagulation (Oonmetta-aree et al., 2006). The essential oil of galangal inhibited the growth of microbes that cause food debris in seafood such as *Escherichia coli*, *Staphylococcus aureus*, and *Salmonella typhimurium*. This indicates that the essential oil found in *A. galanga* has the potential to be developed as a natural food preservative (Sripor & Jinda, 2014).

**CONCLUSION**

The *sayur asem* is a soup-like vegetable that has a sour taste with the main ingredients of leaves and seeds melinjo (*Gnetum gnemon*) and tamarind fruit (*Tamarindus indica*). A total of 13 species belonging to 12 genera and 10 families used processed *sayur asem*. The part of used to process *sayur asem* is dominated by fruits (8 species), followed by leaves and tubers (each 2 species), which anti-microbial activity. The *sayur asem* is a vegetable that is rich in nutritional value and benefits in health, so it is very good for consumption. It is to develop the presentation of *sayur asem* so that they have a higher economic value.

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