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Ethnobotanical study of medicinal plants in karst environment in Gunung Kidul, Yogyakarta, Indonesia

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Abstract. *Nahdi MS, Kurniawan AP. 2019. Ethnobotanical study of medicinal plants in karst environment in Gunung Kidul, Yogyakarta, Indonesia. Nusantara Bioscience 11: 133-141.* The use of traditional medicinal plants has been a culture of the people in Yogyakarta including in Gunung Kidul District. This research aims to reveal information on medicinal plants in karst environment in Gunung Kidul, Yogyakarta, Indonesia by focusing on how medicinal plants are used, managed and inherited by the community. The research was conducted in Planjan Village and Giricahyo Village in Gunung Kidul District from June to September 2018. The method used in collecting data was exploratory survey and *Participatory Rural Appraisal*. Data of community knowledge and uses of medicinal plants were obtained through in-depth interview and structured interview. The identification of species was applied to every plant used. The study found that there are 46 species from 26 families used by the people in the two villages for medical treatments with the largest number of species is from Zingiberaceae family, followed by Fabaceae and Rutaceae. The medicinal plants are mostly packaged into six herbal medicinal plants called *jamu beras kencur*, *kunir asem*, *paitan*, *kebyokan* (*uyup uyup*), *sirih* and *temu lawak* with different compositions and efficacies. The result showed that people's knowledge about medicinal plants is obtained from elders who have a long experience in making concoction and trading the medicinal plants as traditional herbal medicine. In addition, the people are also obtained additional knowledge from any sources to make the medical plants to have economic value to improve their welfare. Most of the medicinal plants are obtained from the outside of the villages since it is impossible to cultivate in karst soils. Thus, the study is expected to help develop the local potential of medicinal plants to become more modern, can support the conservation of local wisdom and plant biodiversity, as well as be used as a source of material for developing national database on medicinal plant and its usage.

Keywords: Herbal medicine, economic value, Participatory Rural Appraisal, karst soil, inheritance

INTRODUCTION

Gunung Kidul is one of five districts in Yogyakarta Province, Indonesia and located within Gunung Sewu region, which is categorized as a karst ecosystem. Gunung Sewu comprises of canonical hills that cannot be found in other karst areas in the worlds. It is a vast and unique environment that had been shaped during prehistorical era (Simanjuntak 2002). For this reason, the Asia-Pacific Forum on Karst Ecosystem and World Heritage inaugurated Gunung Kidul as the World Natural Heritage (Marfai et al. 2013). The ecosystem is characterized by its dry and infertile land which leads to poverty of people inhabiting the area due to limited livelihood options as they are mostly dependent on the availability of scarce rainfall (Sunkar 2008). Due to this reason, the people of Gunung Kidul have adapted by creating their local wisdom. The people of Gunung Kidul are traditionally a bounded community who hold a strong value of their ancestors, including the value of knowledge of utilizing plants and biological resources for medicinal purposes.

Ethnobotany is a field of study that explores the relationship between people and plants around them (Mondal et al. 2015). It is a growing interdisciplinary knowledge (Abbas at al. 2016) that seeks to document, describe and explain the complex relationship between plants, people and culture. The main focus of ethnobotany is to understand how plants are used, managed, and benefited human. As the scientific ground for ethnobiology grows, scientists start to learn about people's perception and their understanding of plants species and their management. In short, ethnobotany is a body of knowledge trying to explain the relationship between local people and their knowledge system and their relationship with plants as a valuable natural resource (Mondal et al. 2015; Purwanto 2017).

The uses of plants are widely accepted and appreciated in many communities, especially due to its importance for the development of modern medicine (Kunwar and Rainer 2008). Both in developed and developing countries, 80% of population of the world rely heavily on the use of traditional medicine (Rashid et al. 2018). Previous research on the use of medicinal plants can be massively found worldwide. For example, one of the research explores the traditional uses of medicinal plants during 2000 years of traditional practice in northern Peru. It was found that 510 species had been used for traditional medicine, and the community passed orally the knowledge from one generation to another (Bussmann dan Douglas 2006). Another research in Karnataka, India revealed that 342 species were used for curing 42 diseases (Bhandary and Chandrashekar 2014). In the community of Azad Jammu, Kashmir, Pakistan, people used traditional plants for treatment of disease with the process of extraction for

active ingredients or consumption of herbal drinks. Meanwhile, research in Dheeraa, Ethiopia showed that 92% of medicinal plants are sourced from wild native plants, indicating that local people do not domesticate medicinal plants in their gardens or fields (Wondimu et al. 2007). Also, in Burdwan Dsitrik, Bengali India it was reported that tribal communities use 25 species for treating 11 diseases. Traditional medicine was prepared in various ways, mostly by taking leaves and roots as important materials for making concoction (Mondal et al. 2015). That knowledge is important and needs to be followed up with research on the phytochemical contents and their pharmacological aspects (Rashid et al. 2018).

In Indonesia, similar research is also widely conducted. For instance, research about medicinal plants in Turgo, Sleman, Yogyakarta revealed 69 species from 36 families with Zingiberaceae, Asteraceae and Euphorbiaceae alone each consisted of 6 species (Maizer et al. 2016). In addition, ethnobotanical research about food and medicine in the gardens of Batak Karo people in North Sumatra was also reported by Silalahi and Nisyawati (2018).

The above research demonstrates that the uses of medicinal plants in each ethnicity or region are specific which can differ from one region to another. This difference relate to: (i) the species of plant that is used as medicine, (ii) the location where the plants are found, (iii) the status whether the plant is domesticated or wild, (iv) the parts of plant that can be used, and (v) the method on how they are prepared. Because the uniqueness of Gunung Kidul in term of social and ecological context as a karst ecosystem, research about the relationship between people in Gunung Kidul and medicinal plants is important. This research aims to reveal information on medicinal plants in karst environment in Gunung Kidul by focusing on how medicinal plants are used, managed and perceived by the community

MATERIALS AND METHODS

Study area and period

The research was conducted in July-December 2018 in the Legundi Hamlet, Planjan Village, Saptosari Sub-district and Gubug Hamlet, Giricahyo Villages, Purwosari Sub-district of Gunung Kidul District, Yogyakarta Province, Indonesia (Figure 1). The study area is bordered by the District of Sleman and Bantul in the west, and Central Java Province in the east, with elevation ranging from 0 m to 300 m asl. The area is located at 110^{O} 21' to 110^{O} 50' E dan 7^{O} 46' to 8^{O} 09' S under tropical environment with karst topography. The southern part is dominated by natural caves and underground rivers. Thus, the area is relatively infertile with poor class of agricultural land.

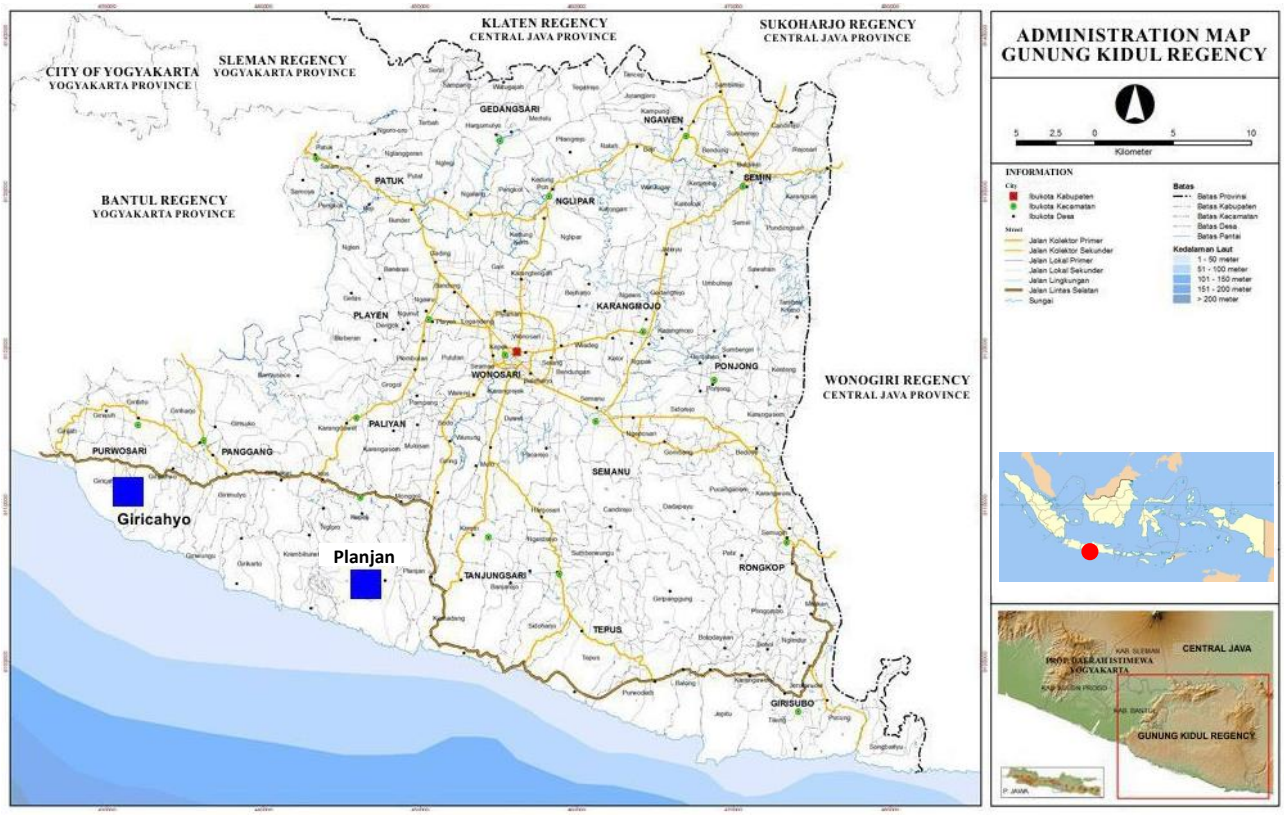

Figure 1. Research location in Planjan and Giricahyo villages, Gunung Kidul District, Yogyakarta, Indonesia

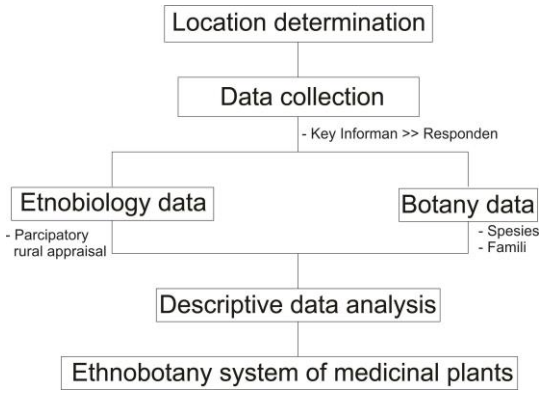

Figure 2. Analytical framework of research method used in this study

Data collection

The research used Participatory Rural Appraisal-a process of data exploration involving active participation of people. Participation was generated via in-depth interview, i.e. comprehensive and deep interview with the community that enables people to expose their knowledge. In addition, the interview was structured to follow a guide with questions such as: local names, parts that can be used, the benefit, how to process, plants status whether wild or domesticated and other questions relevant to the research (Martin 1995). Respondents were determined using snowball sampling technique, exposing the main respondents as key informants then other respondents were identified based on the information from key persons interviewed previously (Naderifar et al. 2017). The criteria of respondents included the representative of local people native to the area and the representative of traditional people that use medicinal plants (Figure 2). When choosing the respondents the guideline of the International Society of Ethnobiology (ISE 2006) was used.

Community participation here referred to the involvement of the community during the interviews about the use of medicinal plants. The scope for the interviews included botanical studies, ethnopharmacology, ethnomedicine, ethnoeconomics, ethnoecology, and ethnoanthropology (Martin 1995). The results of the interviews were then used as reference to determine the species name identified using Steenis (1972) and Becker (1973). The plants were documented by taking the pictures and the plant parts were collected for the herbarium. Data were then analyzed qualitatively. The benefit value was calculated as the proportion of the number of respondents using the plants compared with total number of respondents (Purwanto 2017).

RESULT AND DISCUSSION

The profile of 46 respondents indicated that the majority of them were women (91.3%), meaning that the knowledge and utilization of medicinal plants in Gunung Kidul were mostly dominated by women (Figure 3). The occupation of the respondents was as farmer (38.6%), *jamu* seller (36.7%), housewives (25%), merchant, tailor and massage therapist (*dukun pijat*) with a percentage of each is 1%. In term of educational background, mostly the respondents did primary school (63.6%), while junior high school and senior high school shared a percentage of 8% in each category. In relation to age, 43.2% of the respondents were of 41-50 years old, 22.7% were 51-60 years old, 13.6% were 23-30 years old.

People's knowledge of medicinal plants in Gunung Kidul has been linked closely to the history of people in the area (Figure 4). This knowledge has embedded in people's daily routine and has been practiced as a part of the culture. This knowledge has been passed from one generation to another and has been regarded as heritage by 43% respondents, while 33% respondents said that their knowledge was enriched by the elderly who were experts in traditional knowledge and *jamu* (concoction consists of medicinal plants extract), 17% respondent got information from friends and neighbors. A small portion of respondents (only 2% of each) got knowledge from media both printed and non-printed, television, radio, government's information and; from trial and error in making their own medicinal recipe; and from a physician's advice.

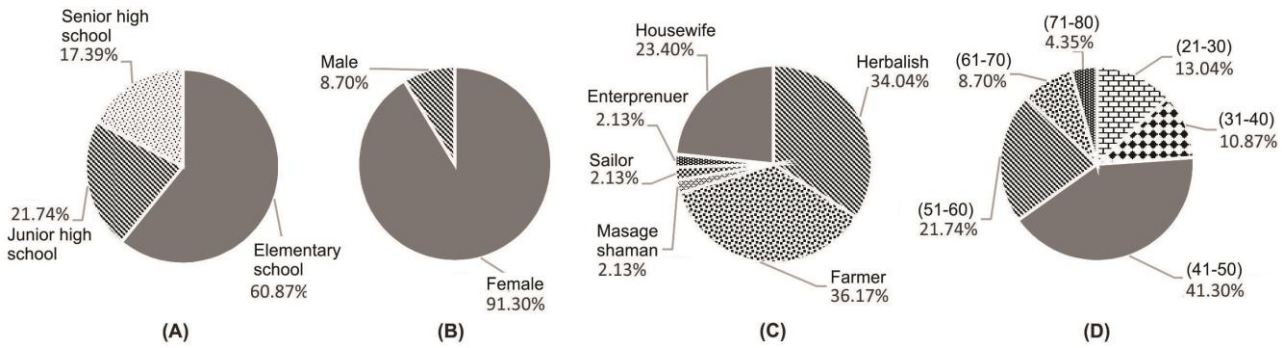

Figure 3. Profile of respondents in the two studied villages in Gunung Kidul, Indonesia based on: A. Level of education; B. Gender; C. Occupation; D. Age.

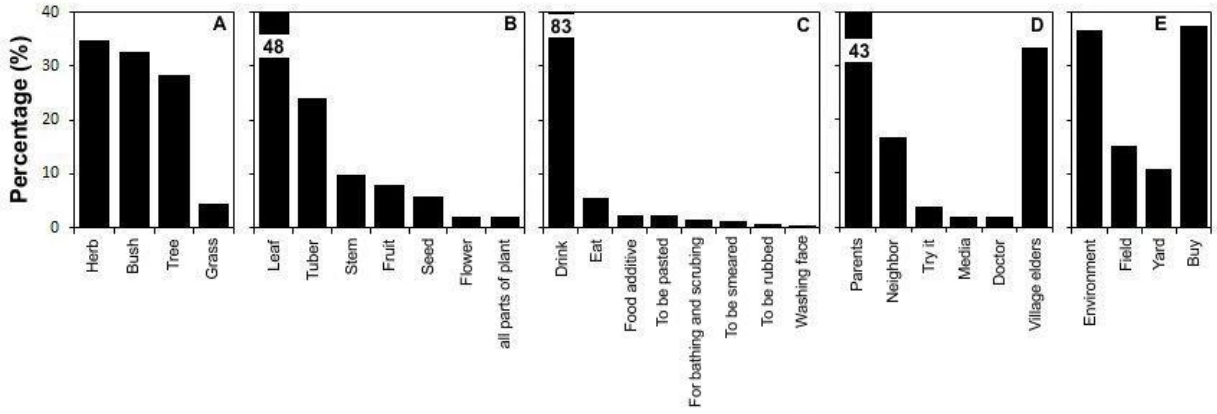

Figure 4. The summary of information on medicinal plants in Gunung Kidul, Indonesia based on: A. Habitus; B. The part of the plant being used; C. How to use; D. The source of information obtained. E. The location of the plant being collected

The results above indicate that the traditional knowledge of medicinal plants is owned by the old generation, which could potentially be lost if not preserved. Moreover, people have limited habit to write and document their knowledge on paper. This result is quite different to similar research in Bali and Pakistan as in both research, the respondents were men (100%) while the respondents mostly had age above 40 years old (Sujarwo et al. 2015; Rashid et al. 2018). Similarly, in Ethiopia, the number of male respondents was more dominant than women (men 61.9% and women, 38.1%) (Checole 2017). Since it is located in dryland region, Gunung Kidul mostly depends on rainwater when doing agriculture (*tadah hujan*), hence it is impossible for the people to cultivate medicinal plants during the dry season. Due to this condition, the people in Gunung Kidul must create a creative way of producing medicinal plants. This premise is confirmed by the fact that the respondents obtained medicinal plants from yards (37%), fields (16%), garden (10%) and also a possibility to buy from local markets (37%) (Figure 4).

This study found that people in Planjan and Giricahyo villages, Gunung Kidul District have been using 46 species of medicinal plants that belong to 27 families (Table 1). These species were used to cure diseases and to maintain fitness. The number of species recorded in this study is fewer than that in Batak Karo with is 85 species (Silalahi and Nisyawati 2018) and is fewer than that in Bali in which 51 species belong to 32 families are commonly used as *loloh*, traditional herbal drinks to prevent and to cure diseases (Sujarwo et al. 2015). This number is also fewer than that in Bukit Turgo Yogyakarta with 69 species of 36 families (Maizer et al. 2016).

The research also explored the methods of preparation including fresh consumption of plant parts, boiled in water, and crushed and extracted in water, or being made as concoction (*jamu*). Making *jamu* is considered to be a skill that can result in economic benefits. People sell *jamu* door-to-door and is famously known *jamu gendong* as the seller bring the *jamu* in bottles are carried on the back (*gendong*). Most of the *jamu* are made to prevent sickness and to cure ailments.

We also found that most medicinal plants used by the people in the two villages belong to the family of Zingiberaceae (8 species): *kunir/kunyit* (*Curcuma longa* L.), ginger (*Zingiber officinale* Roscoe), *kencur* (*Kaempferia galangal* (Linn.), *temu ireng* (*Curcuma aeruginosa* Roxb), *temu lawak* (*Curcuma xanthoriza* Roxb), *bengle* (*Zingiber cassumunar* Roxb), *laos* (*Alpinia galanga* (L.) Willd) dan *temu giring* (*Curcuma heyneana* Val. Et van Zip). The result is quite different from that of Karnataka, India in which the majority of medicinal plants are from family Fabaceae, then Euphorbiaceae dan Rubiaceae (Bhandary and Chandrashekar 2014). Meanwhile, in Kashmir Pakistan the majority are categorized as family Asteraceae (Rashid et al. 2018). Similarly, in Jeju, Korea, Asteraceae and Rutaceae are the dominant families used as medicinal plants (Song et al. 2013).

Some species were also considered to be more popular than others, because they are thought to have more healing properties, such as: *kunyit/kunir* (*Curcuma longa* L.), *jeruk nipis* (*Citrus aurantifolia* (Christm.) Swingle), *temu lawak* (*Curcuma xanthorrhiza* Roxb.), *temu ireng* (*Curcuma aeruginosa* Roxb), *sirih* (*Piper betle* L), *asem* (*Tamarindus indica L)*, *kencur* (*Kaempferia galanga* (Linn.), Sambiloto (*Andrographis paniculata* Burm. f. Nees), *kayu putih* (*Melaleuca leucadendra* (L.) L. dan *jambu biji* (*Psidium guajava* L.). All of them have various uses expressed as the benefit value (see method).

Kunir or *kunyit* (*Curcuma longa* L) is the most common species used for medicine, prepared as extract or the main ingredients of a concoction (*jamu*). This species is known to cure ailments such as gastritis, bloating, abdominal pain, menstruation pain, diarrhea, and muscle pain. When combined with *asam*/tamarind, the concoction is named *kunir asam*, and is well known for treating menstrual pain, abdominal pain and bloating, and to increase appetite (Table 1).

Table 1. Medicinal plant species used in Planjan and Giricahyo villages, Gunung Kidul District, Yogyakarta, Indonesia

Families	Latin name	Local name	Benefit	Benefit value
Acanthaceae	*Strobilanthes crispa* Blume	Kejibeling	Bloody urine	0.22%
	Andrographis paniculata (Burm.f.) Wall. Ex Nees	Sambiloto	Stomach ache, diarrhea, appetite, bloating, cold, and stamina diarre	4.64%
Acoraceae	*Acorus calamus* L.	Dlingo	Appetite, preventing cold in children	0.22%
Amaryllidaceae	*Allium sativum* L	Bawang putih	Preventing cold in children	0.22%
	Allium cepa L	Brambang	Nose congestion in children, cold and flu	0.44%
	Allium cepa L	Brambang Poyang	Apetite	0.22%
Annonaceae	*Annona muricata* L.	Sirsak	Uric acid, muscle pain, bloating, rheumatic, hypertension, fatigue, kidney stone	2.21%
Apocynaceae	*Alstonia scholaris* L. R. Br.	Kliko pule	Stomach ache, nausea	0.22%
Arecaceae	*Cocos nucifera* L.	Kelapa	Ulcer, antidote	0.44%
Asteraceae	*Blumea lacera* L.	Brondot	Bloody urine	0.22%
	Cosmos caudatus Kunth	Kenikir	Salad	0.22%
Caricaceae	*Carica papaya* (L.)	Pepaya	Appetite, worm infection, itchy skin, stamina, nausea, helping bowel movement	1.77%
Convolvulaceae	*Ipomoea mauritiana* Jacq.	Widosari	Lactating booster	3.31%
Dracaenaceae	*Dracaena angustifolia* (Medik.) Roxb.	Suji	Bleeding cough	0.22%
Euphorbiaceae	*Jatropha multifida* L.	Yodium	Ulcer	0.22%
	Ricinus communis L.	Jarak	Toothache	0.22%
	Manihot esculenta Crantz	Singkong	Vitamin, dish, hypotension	0.22%
Fabaceae	*Tamarindus indica* L.	Asem	Menstrual pain, lactating booster, stomach pain, appetite	5.96%
Fabaceae	*Erythrina variegata* L.	Dadap	Lactating booster, fever	3.97%
	Leucaena leucocephala (Lamk.) de Wit	Mandingan	Bloating, ulcer, diabetes	0.66%
Lamiaceae	*Orthosiphon aristatus* (Blume) Miq.	Kumis kucing	Bloody urine	0.22%
Lauraceae	*Persea americana* Mill.	Alpukat	Hypertension	0.22%
Meliaceae	*Swietenia macrophylla* King	Mahoni	Itchy, nausea	0.44%
Menispermaceae	*Tinospora crispa* (L.) Miers ex. Hoff.f	Brotowali	Bloating	0.44%
Musaceae	*Musa paradisiaca* L.	Pisang kepok	Heart pain	0.22%
Myrtaceae	*Psidium guajava* L.	Jambu biji klutuk	Diarrhea, fever, stomach pain, lactating booster	4.19%
Myrtaceae	*Melaleuca leucadendra* (L.) L.	Kayu putih	Stomach ache, diarrhea, appetite,	4.19%
	Syzygium polyanthum (Wight) Walpers	Salam	Hypertension, cholesterol, muscle pain, bloating, uric acid	0.88%
Phyllanthaceae	*Sauropus androgynus* (L.) Merr.	Katuk	Lactating booster	3.31%
Piperaceae	*Piper betle* L.	Sirih	Vaginal discharge, body smell, stomach pain, stomach ache, bowel movement	5.96%
Poaceae	*Oryza sativa* L.	Padi	Bloating, muscle pain	4.19%
	Cymbopogon citratus (DC.) Stapt,	Sereh	Bloating, stamina, muscle relaxant, spices, uric acid, cough, hypertension, cholesterol, muscle pain	1.99%
Rubiaceae	*Morinda citrifolia* L.	Pace	Hypertension, nausea	0.44%
	Paederia foetida L.	Sembukan	Bloating	0.22%
Rutaceae	*Citrus aurantifolia* (Christm.) Swingle	Jeruk nipis	Menstrual pain, stomach pain/bloating, muscle pain, vaginal discharge, body smell, stomach pain, cough	9.27%
	Citrus grandis Osbeck	Jeruk bali	Fever	0.22%
Sapotaceae	*Manilkara kauki* (L..) Dubard	Sawo kecik	Diarrhea	0.22%
Zingiberaceae	*Curcuma longa* L.	Kunir	Stomach pain, bloating, stomach ache, menstrual pain, diarrhea, abdominal pain, muscle pain, vaginal smell after menstruation	12.80%
	Zingiber officinale Roscoe	Jahe	Bloating, muscle pain, sprain, muscle relaxant, muscle strain, spices, hypertension	1.77%
	Kaempferia galanga (Linn.)	Kencur	Bloating, muscle pain, spices	4.64%
	Curcuma aeruginosa Roxb.	Temu ireng	Bloating, stomach pain, appetite, diarrhea, nausea, stamina, and muscle pain	6.84%
	Curcuma xanthorrhiza Roxb.	Temulawak	Stomach pain, diarrhea, appetite, bloating, stomach ache, nausea, headache	9.05%
	Zingiber cassumunar Roxb.	Bengle	Preventing cold for grown-up, stamina	0.22%
	Alpinia galanga (L.) Willd	Laos	Fungal infection in skin, warm up the body, hypertension	0.66%
	Curcuma heyneana Val. Et van Zip.	Temu giring	Bloating	0.22%

Also is widely known as turmeric, *kunir* or *kunyit* is valuable material in modern pharmacy. In the modern world, turmeric has been attributed to contain anti-inflammatory properties and antioxidant that are rich in polyphenolic compounds, flavonoid, tannin and ascorbic acid (Mondal et al. 2015; Tanvir et al. 2017). Besides these properties, curcumin in turmeric is also familiarly known to be anti-mutagenic, anti-bacterial, hepatoprotective, expectorant and anti-cancer. It works by inhibiting inflammatory process (Krup et al. 2013; Mondal et al. 2015). In addition to *kunyit*, the second most used plant is *jeruk nipis* (*Citrus aurantifolia* (Chrimstm) S.), that is used as an additive substance that tastes sour. This plant is a member of the family of Rutaceae, and is widely known to cure ailments such as abdominal disease, menstrual pain, muscle pain, cramping, and to reduce body odor and cough. *Jeruk nipis* has the following pharmacological activities: anti-bacterial, anti-fungal, anti-oxidant anti-diabetic, anti-hypertension, and anti-inflammatory. All of these properties are due to alkaloid, carotenoid, coumarin, and flavonoid acid that may protect heart, liver, and bones (Narang and Wannee 2016). This information is equal to information derived from Mecca, that *Citrus* sp has been used as an ingredient in 17 herbal drinks drink (Alqethami et al. 2017). It is also interesting that *bengle* (*Zingiber cassumunar Roxb)* is also used as medicine for increasing man's stamina and treating cold (Table 1). This plant belongs to Zingiberaceae family and is now hard to find. *Bengle* is used among Javanese to reduce sore skin because it has compounds such as terpenoid, volatile oils, and phenolic compounds that act as anti-inflammatory and anti-fungi. The compounds are also useful to reduce pain associated with junction-ailments and asthma (Wulansari et al. 2018). However, the clinical effects of *bengle* as anti-histamine and anti-inflammatory is not clear (Bunchai et al. 2017).

Temu lawak (*Curcuma xanthorrhiza* Roxb.), from the family of Zingiberaceae, has been widely used to treat abdominal pain, diarrhea, eating disorder, bloating, ulcer, and nausea. Based on research, the extract of this rhizome is a natural antioxidant (Rosidi et al. 2016). Moreover, it is known as anti-cancer, anti-inflammatory, anti-osteoarthritis, and anti-cholesterol (Asnam and Sri Atun 2017).

People in Gunung Kidul have been developing skills of making traditional herbal drinks-well known as *jamu gendong* since long time ago. This knowledge has passed from one generation to another. One of the persons known to have this profession is a late Ibu Partinem. She started her business in 1990s. In 1996, people developed business cooperation called Manunggal Asih that has 63 members. All of the members were above 40 years old (Figure 3). The programs of this cooperation were to provide loans, sell seeds, and build people's awareness about the importance of medicinal plants. The members attended a gathering once every 35 days (*selapan*) with the agenda includes discussion about medicinal plants and the members' welfare.

In Gunung Kidul, planting medicinal plants could be quite difficult despite the availability of lands and gardens. As a karst area, people depend on rain to water their lands. They cannot always produce their own medicinal plants so 37% of the respondents buy the raw materials from a local market (Figure 3). *Jamu gendong* in Planjan Village has been taken as a priority by the government. The government provides tools and machinery to make *jamu*. Unfortunately, these machines cannot be used by local people, because they are on an industrial scale. Moreover, people prefer to not using additive substances and preservatives in their *jamu.* Because of this reason, people have tried to register their product in BPOM (the Government Agency for Protection of Food and Medicine). However, the process has not yet been successful as the *jamu* is still considered to be not meeting the standards of processing and hygiene.

People's skills in making *jamu* have grown to be profitable home industries. At least, there are six common types of *jamu*: *beras kencur*, *kunir asem*, *paitan*, *kebyokan* (*uyup uyup*), *sirih* and *temu lawak* (Table 2). These, however, are fewer than those in Mecca Saudi Arabia with 67 types of herbal drink with each contains 2-4 species (Alqethami et al. 2017). Meanwhile, in Ethiopia, all of herbal drinks are consumed with sugar or honey (Rashid et al. 2018)

The six types of *jamu* are commonly used to cure ailments related to gastrointestinal diseases, reproduction, and supplements. *Beras kencur* is used to reduce bloating and muscle pain, *kunir asem* is commonly consumed to treat menstrual pain, abdominal pain, bloating and eating disorder. *Paitan*-taste bitter-is derived from leaves and rhizomes. It is used to treat bloating, diarrhea, abdominal pain, and eating disorder. *Uyup-uyup* is very common as a supplement of nursing mothers. Lastly, *temu lawak* is believed to cure gastritis.

Jamu also has economic potential, especially as a source of income for housewives. The consumers are from other areas such as Playen, Parangtritis and a market in Planjan Village. Each seller has a signature in terms of taste and recipes. People do not normally have a standard recipe and dosage, so it depends on the consumers' preferences. It is important to note that people do not have their packages for *jamu*, usually, the sellers put their *jamu* in re-used plastic bottles. These bottles are boiled to maintain hygiene. Actually, the sellers have been trained to gain knowledge about packaging and hygiene in which the trainer suggests they use bottles made of glass. However, the sellers feel that the price of this type of packaging is too expensive, heavier and more vulnerable than plastics.

Habitus, plants part and processing

The habitus of medicinal plants used by the people in the studied areas was dominated by herbs (34.78%), then followed by bush (32.6%), trees (28.26%) and grass (4.35%). This data is similar to the results of research on medicinal plants on the coast of Karnataka, India, which mostly uses herbs followed by trees, vines, and shrubs (Bhandary and Chandrashekar 2014).

Table 2. The composition of concoction of *jamu* and *ramuan*, and its benefit

Name of *jamu*	Local name of plant used	Latin name of plant used	Benefits
Jamu			
Beras kencur	Kencur	*Kaempferia galanga* (Linn.)	Bloating, muscular pain
	Padi	*Oryza sativa* L.	
	Jeruk nipis	*Citrus aurantifolia* (Christm.) Swingle	
	Temulawak	*Curcuma xanthorrhiza* Roxb.	
	Gula aren	*Arenga pinnata* (Wurmb) Merr.	
Kunir Asem	Kunir	*Curcuma longa* L.	Menstrual pain, abdominal pain, bloating, increasing appetite
	Asem	*Tamarindus indica L.*	
	Jeruk nipis	*Citrus aurantifolia* (Christm.) Swingle	
	Sirih (gabug)	*Piper betle* L.	
	Gula aren	*Arenga pinnata* (Wurmb) Merr.	
	Garam		
Paitan	Temulawak	*Curcuma xanthorrhiza* Roxb.	Bloating, diarrhea, abdominal pain, increasing appetite
	Temu ireng	*Curcuma aeruginosa* Roxb.	
	Brotowali	*Tinospora crispa* (L.) Miers ex. Hoff.f	
	Jahe	*Zingiber officinale* Roscoe	
	Temu giring	*Curcuma heyneana* Val. Et van Zip.	
	Kayu putih	*Melaleuca leucadendra* (L.) L.	
	Sambiroto	*Andrographis paniculata* (Burm.f.) Wall. Ex Nees	
Kebyokan/ uyub-uyub	Dadap	*Erythrina variegata* L.	Lactating booster
	Jambu biji	*Psidium guajava* L.	
	Widosari	*Sauropus androgynus* (L.) Merr.	
	Katuk	*Ipomoea mauritiana* Jacq.	
Sirih	Sirih	*Piper betle* L.	Controlling vaginal discharge, body smell
	Kunir putih	*Curcuma longa* L.	
	Garam		
Temulawak	Temulawak	*Curcuma xanthorrhiza* Roxb.	Stomach ulcer
	Kunir putih	*Curcuma longa* L.	
	Gula aren	*Arenga pinnata* (Wurmb) Merr.	
Ramuan			
Jambu biji	Jambu biji klutuk	*Psidium guajava* L.	Fever
	Dadap	*Erythrina variegata* L.	
	Cangkringan	*Erythrina variegata* L.	
	Jeruk nipis	*Citrus aurantifolia* (Christm.) Swingle	
	Jambu biji klutuk	*Psidium guajava* L.	Abdominal pain, diarrhea, lactating booster
	Jamu kunir asem		
Sirsak	Sirsak	*Annona muricata* L.	Uric acid, muscle pain
	Gula tebu	*Saccharum officinarum* L.	
	Sirsak	*Annona muricata* L.	Uric acid
	Garam		
Pepaya	Pepaya	*Carica papaya* (L.)	Stamina booster
	Temu ireng	*Curcuma aeruginosa* Roxb.	
	Sereh	*Cymbopogon citratus* (DC.) Stapt,	
	Gula aren	*Arenga pinnata* (Wurmb) Merr.	
	Pepaya	*Carica papaya* (L.)	Increasing apetite
	Garam		
Pisang kepok	Pisang kepok	*Musa paradisiaca* L.	Heart problem
	Gula aren	*Arenga pinnata* (Wurmb) Merr.	
Dlingo	Dlingo	*Acorus calamus* L.	Preventing cold in children
	Bawang putih	*Allium sativum L*	
Bangle	Bengle	*Zingiber cassumunar* Roxb.	Stamina booster
	Kunyit merah	*Curcuma longa* L.	
	Bengle	*Zingiber cassumunar* Roxb.	Preventing cold in children
	Bawang putih	*Allium sativum L*	
Kunir	Kunir	*Curcuma longa L.*	Diarrhea, stomach ache, stomach ulcer
	Enjit/gamping		
	Kunir	*Curcuma longa L.*	
	Kapur sirih	*Piper betle* L.	
Jahe	Jahe	*Zingiber officinale* Roscoe	Relaxant to the muscles
	Sereh	*Cymbopogon citratus* (DC.) Stapt	
	Jahe	*Zingiber officinale* Roscoe	
	Minyak goreng		Sprain, preventing cold, hypertension
	Jahe	*Zingiber officinale* Roscoe	

	Laos	*Alpinia galanga* (L.) Willd	
Temulawak	Temulawak	*Curcuma xanthorrhiza* Roxb.	Headache
	Garam		
Jeruk nipis	Jeruk nipis	*Citrus aurantifolia* (Christm.) Swingle	Cough
	Kecap	*Glycine soja* (L.) Merr.	
Jarak	Jarak	*Ricinus communis* L.	Toothache
	Garam		
Sereh	Cangkringan	*Cymbopogon citratus* (DC.) Stapt,	Hypertension, cholesterol,
	Salam	*Syzygium polyanthum* (Wight) Walpers	and muscle pain
	Garam		
Others			
	Sembukan	*Paederia foetida* L.	Bloating
	Brambang	*Allium cepa L*	Nasal congestion in children, cold and flu
	Sawo kecik	*Manilkara kauki* (L..) Dubard	Diarrhea
	Kliko pule	*Alstonia scholaris* L. R. Br.	Abdominal pain, nausea
	Kelor	*Moringa oleifera/ Moringa pterygosperma* Gaertn	Cholesterol, stomach ache, vegetables, uric acid
	Singkong	*Manihot esculenta* Crantz	Vitamin, dish, hypotension
	Jeruk bali	*Citrus grandis* Osbeck	Fever
	Kumis kucing	*Orthosiphon aristatus* (Blume) Miq.	Bloody urine
	Kejibeling	*Strobilanthes crispa* Blume	Bloody urine
	Brondot	*Blumea lacera* L.	Bloody urine
	Suji	*Dracaena angustifolia* (Medik.) Roxb.	Bleeding cough
	Brambang poyang	*Allium cepa L*	Appetite
	Kenikir	*Cosmos caudatus* Kunth	Salad
	Yodium	*Jatropha multifida* L.	Ulcer
	Kelapa	*Cocos nucifera* L.	Ulcer, antidote
	Alpukat	*Persea americana* Mill.	Hypertension
	Pace	*Morinda citrifolia* L.	Hypertension, nausea
	Mahoni	*Swietenia macrophylla* King	Itchy skin, nausea

In making the *jamu*, the respondents used various parts of plant body including leaf (48%), rhizomes (24%), stems (10%), fruits (8%), seeds (6%), all parts of plants (2%) and flowers (2%). This result is interestingly similar to the finding of similar research in Mecca Saudia Arabia with the most common parts being used are leaf (35%), followed by fruits (21%), seeds (18%), roots (9%), flowers (8%), saps and others (10%) (Alqethami 2017). But our finding is relatively different to similar study in Jeju Island, Korea in which the roots are dominant parts being used (23,7%), followed by fruits (18.7%), leaf (11%), seeds (8%), all parts (7.8%), stems (6.7%) and others (5.1%) (Mondal 2015). This is also different from the finding in Pakistan with all parts of plants are mostly being processed (42%), then flowers, fruits, and seeds (Abbas 2016).

The most widely used method of treatment by the respondents in the studied areas in Gunung Kidul is by drinking (82.9%), eating (5.67%), flavoring and sticking (each 2.43%), used for bathing and balancing each was 1.62%, sorted and applied to the affected part (1.21%), rubbed (0.81%) and watered and used for facial washing (0.81%). This information is similar to the results of Alqethami et al. (2017) study that drinking is the favorite used by the Mecca community (49%) followed by eating (19%), sticking (16%), for bathing (13%), made gargle and put on the teeth (1%). While the way of using medicinal plants by the people in Pakistan is mostly preferred in the form of herbal drinks (Rashid et al. 2018).

All species of medicinal plants consumed by the respondents can be grouped into nine types of ailments, namely digestive, respiratory, reproductive, endocrine, muscle, joint and nerve diseases, executions, blood vessels, senses and beauty and supplements in an effort to maintain body health (Table 3). This result is fewer than research on traditional medicine in the western Pyrenees which can be grouped into 12 disease groups (Akerreta et al. 2007).

In summary, this research revealed that people in two villages in Gunung Kidul have knowledge and local wisdom about medicinal plants with at least 46 species of 27 families were recorded. It showed that this knowledge was derived from older generations that have been practicing the skills of making *jamu* (herbal drink) and making money out of it. Furthermore, there are also external influences that increase the values of *jamu*. The medicinal plants were processed into six different types of *jamu*, i.e., *kunir asem*, *beras kencur*, *pahitan*, *kebyokan*, *temulawak* and *kunyit sirih*. As Gunung Kidul is located on dryland due to karst geological area, most of the plants could not be produced locally, so the local people buy raw materials of *jamu* from other villages.

For the outcomes, it is expected that this study can help to develop the local potential of medicinal plants for health improvement. Moreover, the financial benefits of medicinal plants are also expected to help improve public welfare. However, scientific research supported by modern technology is required to further study the potential of medicinal plants.

The existence of medicinal plants can also contribute to the conservation of diverse local wisdom and plant biodiversity in karst area. The data on the usage of medicinal plants can also be used to establish national database.

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