

The diversity and ethnobotanical study of medicinal plants in the southern slope of Mount Merapi, Yogyakarta, Indonesia

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Abstract. Nahdi MS, Kurniawan AP. 2019. *The diversity and ethnobotanical study of medicinal plants in the southern slope of Mount Merapi, Yogyakarta, Indonesia. Biodiversitas 20: 2279-2287.* Medicinal plants have been widely used by local communities in Indonesia due to its effectiveness as medicine and its low cost. In addition, the scientific and technological development of medicinal plants has been developed rapidly. This research aims to conduct inventory of medicinal plants recorded in the ecosystem of the southern slope of Mount Merapi, Yogyakarta and to reveal the local knowledge on their uses and traditional healing method applied. We used a combination of qualitative and quantitative methods. The data of local knowledge on medicinal plants and traditional medical practices when using them were collected through in-depth and semi-structured interview with local informants selected through purposive and snowball sampling. The results showed that the abundance of medicinal plant species at the study area was very high during the rainy season, while during the dry season, some of the plant species were found in the yard and open land. A total of 82 species from 40 families were identified as medicinal plants and used by the community through various processing and for various medical treatments. The information was inherited from previous generations through counseling and training. The most favorable way to use medicinal plants was by consuming the leaf directly. Among all identified medicinal plants, betel leaves (*Piper betle* L) had the highest importance value (43.6%), followed by turmeric (*Curcuma longa* L) (38.5%), and soursop (*Annona muricata* L) (33.3%). Kelor (*Moringa pterygosperma*, Gaertn) had the most significant usage value (0,6), followed by lemongrass (*Cymbopogon citratus* (DC) Stapf) and ginger (*Curcuma xanthorrhiza* Roxb) with the same value (0.3). The medicinal plants had also co-benefits including to encourage communication as well as to building relationship among community members.

Keywords: Favorite, importance value, side effects, snowball sampling, usage value

INTRODUCTION

Traditional healing is a part of cultural system that contributes greatly to improve public health. Moreover, the custom of utilizing plants to solve various health problems is in accord with the tendency to back to nature principle (Mamahani et al. 2016). Local knowledge has been widely recognized in the world (Kunwar and Rainer 2008) and has been implemented for thousands of years (Mondal et al. 2015). In some societies, medicinal plants are also more preferable for treatment than chemical drugs (Tinitana et al. 2016), as well as beneficial for biodiversity and cultural conservation. Traditional healing can also facilitate the discovery of new element extracted from a species that potential to be developed as new medicine (Mondal et al. 2015; Abbas et al. 2017).

The usage of traditional medicine for self-care tends to increase globally (Bussmann and Douglas 2006). In India, Nepal, and Africa, 80% of people use traditional medicine as the major treatment for diseases, while Columbian residents that use traditional medicine are up to 40% of its population (Bhandary and Chandrashekar 2014; Bussmann and Douglas 2006; Mondal et al. 2015; O'Neill and Rana 2016). Similar culture can also be found in Indonesia. In Bali, for example, there is *loloh*, a traditional herbal drink for treatment and health care (Sujarwo et al. 2015). Public awareness about medicinal plants has also increased

through cultivation of crops and medicinal plants in garden, as commonly practiced by the Batak Karo community (Silalahi and Nisyawati 2018).

Medicinal herbs have been vigorously studied in Indonesia. Based on the local experiences that have been passed down for generations, traditional healing knowledge can help in determining the efficacy of medicinal plants in clinical research (Kuntorini 2005; Sujarwo et al. 2015; Abbas et al. 2017). The treatment using plants has also increasingly favored over chemical drugs due to some advantages, such as little to no side effects if it used properly, effective to cure various diseases, has affordable price, easy to find and can be used without the guidance from medical practitioners (Mondal et al. 2015; Nisyapuri et al. 2017; Suproborini et al. 2018).

Every community, ethnicity or tribe has different practices of traditional healing so that the knowledge produced varies. The knowledge of traditional healing in a community comes from the accumulation of interaction with natural environment in their living area and therefore, results in specific local wisdom (Purwanto 2017). For generations, the community living in the slopes of Mount Merapi has experienced many events of volcanic eruption of Mount Merapi hence they have a high sense of togetherness and mutual cooperation, which have still been preserved until now, as well as toughness in living life. Wonokerto is one of the villages located on the southern

part of Mount Merapi slope. Located 4 km away from Mount Merapi, this village has fertile soil. Therefore, most of the people there live from agriculture and plantations. Despite technological advances, the values and wisdom of Wonokerto's community that have been passed down from generation to generation are still maintained, including the use of medicinal plants for health care. They have lived in harmony with nature for hundreds of years ago. This long experience has established local wisdom in various fields, including the knowledge of traditional healing or ethnobotany that remains to be preserved (Gunawan 2014). There have been some changes in the knowledge of traditional healing, along with the increasing of populated area in the southern part of Merapi slope as well as the presence of several higher educational institutions. This condition most likely affects the local wisdom about medicinal plants that have been preserved by the community. In addition, the medical counseling conducted by the government and private sectors can also affect the ethnobotanical knowledge in the community of Mount Merapi slope.

Despite the increasing research on medicinal plants in Indonesia (Setyowati 2010), the local knowledge of medicinal plants and their usage for traditional healing in the Mount Merapi communities have not been fully revealed. Community is one of the foremost actors in maintaining local wisdom. Therefore, research on the abundance and ethnobotany of medicinal plants on the southern part of Mount Merapi slope is very important to

help preserving the local knowledge as well as to conserve the biodiversity in that area (Akerreta et al. 2007; Irsyad et al. 2013). This study aims to identify medicinal plants in the ecosystem of southern Mount Merapi, to reveal the information about the origin of local knowledge, and to analyze the utilization of various medicinal plants species for disease treatments.

MATERIALS AND METHODS

Research period and location

The research was conducted in February-July 2018 in the southern slope of Mount Merapi in Turi Sub-district, Sleman District, Yogyakarta Province, Indonesia, precisely at three hamlets within Wonokerto Village, namely Becici, Gondoarum, and Tunggularum hamlets. Those hamlets are located at the foot of Mount Merapi at about 4-6 km from the summit. The village has a total area of 15.58 km², and borders the Girikerto Village in the north and the east, Donokerto Village in the south, and Srumbung Village of Magelang District in the west. Located around 398-976 meters above sea level, Wonokerto Village is located at the south latitude of 07°22' 33" - 07°52' 30" and the east longitude of 110°15' 00" - 110°37' 30". The topography of the region is mostly hilly or mountainous with the rainfall of 3908 mm/year and average temperature of 24-28°C (Figure 1).

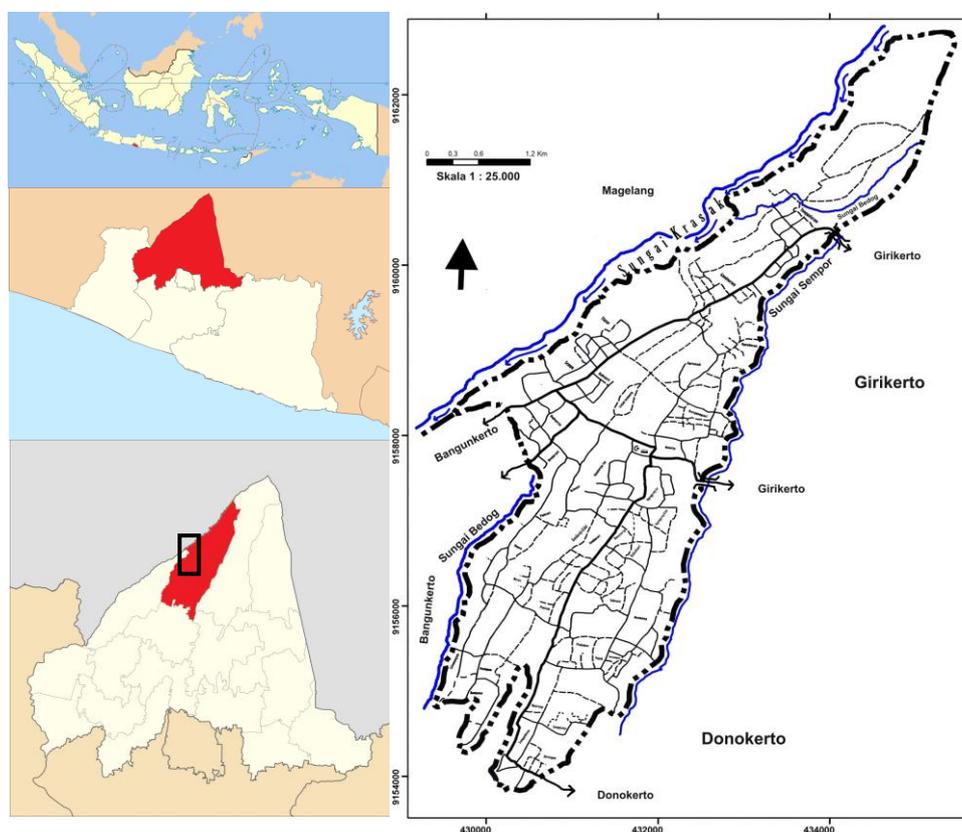


Figure 1. The study location at Wonokerto Village, Turi Sub-district, Sleman District, Yogyakarta Province, Indonesia

Data collection

The data collected was about all medicinal plant species used by the Wonokerto people, including the part of the plant used, the usage method and its benefits, and also obtained from the member of community who actively used medicinal herbs in their daily life. The information on medicinal herbs usage was obtained from 39 respondents of the native of Wonokerto, who were selected by purposive sampling through snowball sampling. The snowball sampling was used to avoid choosing inappropriate respondent (Naderifar et al. 2017; Algethami et al. 2017).

The search of information was begun from the head of hamlet as the key informant, continued to the chairman of Dasa Wisma (A group of mothers from 10 families (family heads) of neighboring houses to facilitate the running of a program) and the people who actively involved in the medicinal plant utilization. The data was collected through in-depth and structured interview for later analysis in a qualitative and quantitative description. Medicinal herbs utilized by the people were identified using the books of Steenis (1972) and Backer et al. (1973). Meanwhile, the unidentified plants were photographed, made herbarium and taken to the laboratory of Botany and Ecology, at the Faculty of Science and Technology, UIN Sunan Kalijaga to be further identified by taxonomist.

The data of plant abundance was obtained by comparing the species acquired from its habitat to the purchased plants. The important value (*IV*) was determined as the number of respondents who used a certain medicinal plant divided by the total number of respondents. The use-value (benefit value) is the particular species most widely used for treatment by respondents compared to the total use of all species of medicinal plants (Purwanto 2017; Cotton 1996).

$$IV = \frac{N_i}{\sum N} \times 100\%$$

Where:
IV: Important value
N_i: Number of respondents using Species A
N: Total number of respondents

$$UV = \frac{V_i}{\sum V}$$

Where:
UV: Use value / Benefit value
V_i: Use of species A
V: Total use of all species (Cotto 1996)

The profile of respondents

The respondents were considered as the representation of Wonokerto community who used medicinal plants (Figure 2). They were selected randomly from various profiles of gender, age, level of education, and employment. The percentage of female respondents was higher than male respondents (74% and 26%, respectively). The most active users of medicinal plants were the 45-55 years old people, and dominated by housewives and farmers (95%). Based on the level of education, senior high school graduates were the highest (49%) and followed by junior high school graduates (26%). Only 5% of respondents had undergraduate education. It showed that

women were more active in utilizing medicinal plants for family health care. The dominant users of medicinal plants were the 45 years old people, while the young respondents under 25 years old who actively used medicinal plants were only 10%. It indicated that the younger generation was less interested in using medicinal plants.

RESULTS AND DISCUSSION

The origin of knowledge on medicinal plants

The results of the interview showed that the knowledge on medicinal plants has been known by the community of Wonokerto since hundreds of years ago. In addition to the knowledge passed down from the elders, various sources of information included neighbors and friends (38%), media (11%), the medical team (11%), self-try (7%), counseling (5%), baby shaman and massage shaman (3%). Despite the low percentage, the counseling that mainly provided by LESAN from the Health Study Institute had been the most influential to motivate people to use medicinal plants (Figure 3).

The success of counseling in motivating people to be more active in utilizing medicinal plants related to the method used. It was initiated by the establishment of the Elderly Park in Tunggularum Village which engaged elderly people either male or female. The program provided counseling about the utilization, procurement of seeds and cultivation methods. The planting was conducted in the fields and the harvest was bought directly by LESAN to be processed into a ready-made herbal medicine, which afterward would be given back to the residents. The drug administration by LESAN was adjusted for the disease suffered by the residents, following a check-up every two weeks by medical personnel. Currently, LESAN is no longer active in Wonokerto Village, but the people continue to utilize and cultivate medicinal plants, either in the field or the home yard although the numbers are not as many as before. This is different from Bali, where the people are the one who plays significant role in the utilization of medicinal plants (Oktavia et al. 2017).

The source and the community's perception of medicinal plants

The medicinal plants in Wonokerto were mainly obtained from the yard (69%), followed by the market or a selling stall (12%), the fields (18%) and the surrounding forests (1%) (Figure 3). It showed that most medicinal plants were largely fulfilled from their own environment, suggesting that the abundance of medicinal plant species in Wonokerto was quite high, especially in the rainy season and decreased during the dry season. Medicinal plants were abundant because the location of Wonokerto was very close to Mount Merapi which facilitates the enrichment of nutrients from the eruption, resulting in fertile soils. This condition was also supported by the presence of many springs in Wonokerto that were well preserved.

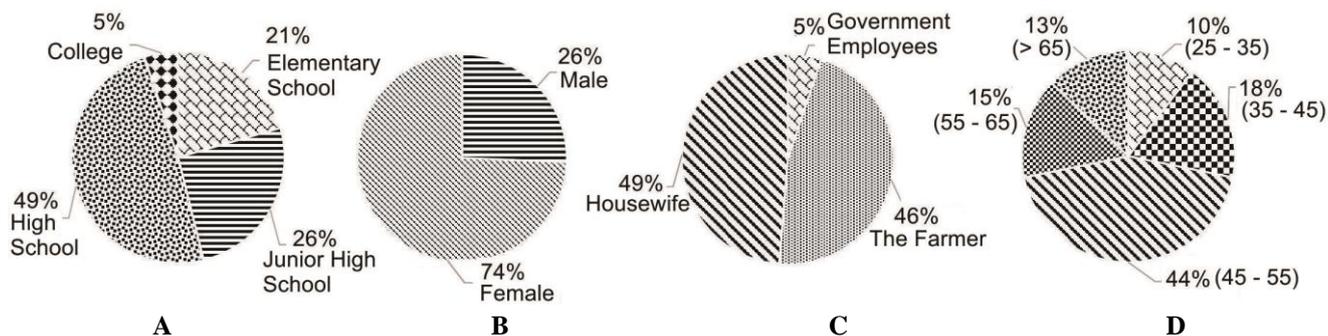


Figure 2. The profile of the respondents in the studied area based on: A. Education; B. Gender; C. Occupation; D. Age

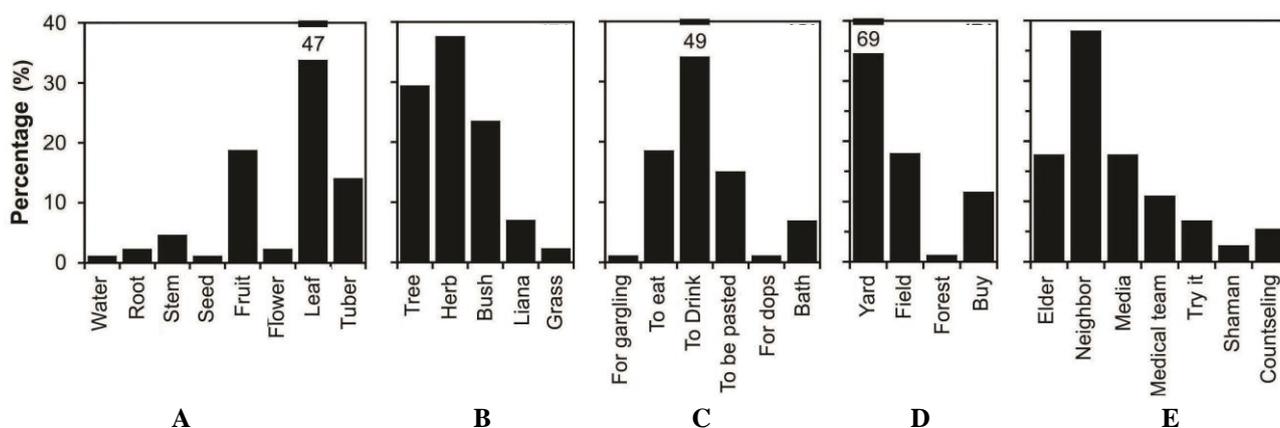


Figure 3. The summary of information on medicinal plants in Wonokerto based on: A. The part of the plant being used; B. Habitus; C. How to use; D. The location where the plants being collected; E. The source of information obtained

We found that the abundance of medicinal plant species had not been utilized as a business commodity to improve the welfare as the community rather prioritized togetherness, cooperation and sharing. The community more concerned about family system because the land available for agriculture was still sufficient so that the medicinal plants were not for trading, but were freely given to relatives, close neighbors or someone else in need. These results are similar to the research conducted by Conde (2017) in Brazil, but different to the Nepali people. In Nepal, medicinal plants are traded commodities and 50% of the people there rely on it for living (Kunwar and Rainer 2008).

The habitus, the part and the serving method of medicinal plants

The most dominant habitus used of medicinal plants in Wonokerto was herbaceous plant (38%), followed by tree (29%), shrub (24%), liana (7%) and grass (2%) (Figure 3B). This is similar to the results on the medicinal plants found in the Jakholi block, Himalayan India that comprised of 56% of herbaceous plant, 23% of tree and 37% roots (Sing 2017). On the other hand, the most widely used part of the plant was leaf (55%), followed by fruit (19%), tuber

(14%), stem (5%), and roots, water, seeds and flowers (each accounted for 1-2%) (Figure 3.A). This result is similar with the study in Sinjai District, Indonesia in which the leaf is the highest plant part used, followed by rhizome and stem, while the fruit used for medicine only a few (Sari et al. 2017). The leaves as the most used part for medicine are also revealed in the Wonoharjo Village, Pangandaran, West Java and Kampong Dukuh (Hidayat et al. 2010; Nisyapuri et al. 2017). This is because they believe that the leaves have the highest efficacy, easy to obtain, do not damage the trees and easily sprout again, as well as having soft fibers. In addition, the leaves are one of the organs that contain high carbohydrates, minerals, and vitamins, and also easily found (Abbas 2017; Setyowati and Wardah 2007; Sing 2017). However, it is different from the results obtained in Jeju Island, which reporting the roots as the most widely used part for medicinal purposes, followed by fruit, leaves, and seeds (Song et al. 2013).

The use of medicinal plant for herbal drinks was the most favorite usage serving method by the community (49%). The herbal drink was easily made and treated diseases more quickly. The other way was to eat it directly or being boiled/burned first (19%), pasted and smeared (15%), used for bathing or soaking (7%), and used for

gargling and dropping (1% each) (Figure 5). This result is similar to the results obtained in Mecca in which drinking (63%) is the most common serving method, followed with being eaten (21%), pasted (7%), pasted directly on the teeth (2%), and in small quantities used for lotion, for rubbing and washing (Algethami et al. 2017).

The diversity of medicinal plants

The people in Wonokerto recognized and utilized 84 medicinal plant species that belong to 40 families (Table 1). Those plants were used to cure various diseases including digestion, respiratory, reproductive, endocrine, muscles and joints as well as excretion, circulatory, supplements, skin, and beauty (Table 2). The number of species found in Wonokerto is higher than those found in Turgo Village that located 7 km from the summit of Merapi, which consists of 69 species from 36 families (Maizer et al. 2016), as well as higher than the medicinal plants found in Wawonii Island which has 73 species from 43 families (Rahayu et al. 2006), and in Pakistan with 64 species from 41 families (Aziz et al. 2018). However, it is fewer than medicinal plant species found in Kampong Adat Dukuh, Garut Regency, West Java, which has 150 species from 52 families (Hidayat et al. 2010) and the western Pyrenees with 91 species (Akerreta et al. 2007).

Zingiberaceae (7 species) was the most widely used family, followed by Asteraceae and Lamiaceae, each of which consisted of 5 species (Table 1). The study in Turgo Hill has also similar result, with 6 species each, belong to Zingiberaceae and Asteraceae, followed by 5 species from Euphorbiaceae (Maizer et al. 2016). In Adat Dukuh, Zingiberaceae family dominates with 16 species having used for medicinal purposes (Hidayat et al. 2010). However, different result is found by Algethami (2017) in Mecca which shows that the most family used is Apiaceae, followed by Fabaceae and Lamiaceae. Also in the Eastern Himalayas, Asteraceae is the most used family, followed by Polygonaceae, Rosaceae, and Zingiberaceae (Sing 2017).

The species from Zingiberaceae (8.33%) that were used for medicine in Wonokerto consisted of: (i) *Temu ireng* (*Curcuma aeruginosa* Roxb), a herbaceous plant that is used by boiling the tuber and then drink the water to relieve abdominal pain; (ii) *Temulawak* (*Curcuma xanthorrhiza* Roxb) is utilized for gastrointestinal pain including ulcer, typhus, and intestinal thickening; (iii) *Laos* (*Alpinia galanga* (L) Willd) is utilized to treat skin diseases, mainly tinea versicolor, by making it into puree and then smear it; (iv) White turmeric (*Kaempferia rotunda* L) is boiled to prevent and reduce lumps; (v) Turmeric (*Curcuma longa*) is used to cure digestion and painful menstrual periods; (vi) *Kencur* (*Kaempferia galanga* (Linn.) is used for respiratory disease, especially cough and the shortness of breath. Turmeric is made into puree, and the water is squeezed and then drinking with honey or egg yolks. It is also used for muscle and joint pain, i.e. sprains, by mashing and smearing turmeric paste in the pain area; (vii) Ginger (*Zingiber officinale* Roscoe) is especially used as a supplement to increase stamina and warm the body. Ginger is roasted, pounded or boiled and drink. It is also used to

treat muscular pain and rheumatic by grinding and smearing the paste on the pain area (Table 2). Ginger is used by 32 respondents from a total of 39 people (82%). The people in Mecca also use ginger to treat muscle and joints, in addition, to treat indigestion, cardiovascular and endocrine, and to increase stamina (Abbas et al. 2017). On the other hand, the people in the area of Lake Buyan use ginger in a balm mixture to warm the body, to treat scorpion sting and rheumatism (Octavia et al. 2017). Ginger is widely used in traditional healing, mostly to warm body and to cure cold, due to its flavonoid content. The flavonoid in ginger can activate multi-enzyme systems, such as cytochrome P-450 and B5 that affect the metabolism of lipids and bile acids (Hapsari and Hesti 2014), hence keeps the body warm and relieves cold.

The second most used family was Asteraceae with 5 species (6%) with species including (i) *Sambung nyawa* (*Ginura procumbent* (Blume) Miq) which is used for joints and muscles (gout and rheumatism). It is also used to treat endocrine and digestive pain, lowering blood sugar and reducing gastric acid. Five leaves are boiled with one glass of water until the water is reduced to half and being drink while still warm; (ii) *Sintrong* (*Crassocephalum crepidioides* (Benth.) S. Moore) is used to treat digestion problem, mainly to treat flatulence. This usage was a result of self-trying and it was successful; (iii) *Sumber waras/insulin* (*Tithonia diversifolia* (Hemsl) is used to lowering blood sugar (endocrine) of which insulin leaves are brewed with hot water for herbal drink; (iv) *Tapak liman* (*Elaphantopus scaber* Linn.) is used to heal muscles and joints (rheumatism) by making it into paste and smeared it to the pain area; (v). *Tempuyung* (*Sonchus arvensis*) is used to expedite urinary secretion and shed kidney stone.

Lamiaceae had also similar rank with Asteraceae with 5 species, which consisted of: (i) Teak (*Tectona grandis* L. f), is used to treat digestive pain (e.g. diarrhea). The stem is roasted and then put into a hot tea; (ii) Basil (*Ocimum citriodorum* Vis.) is used for skin and beauty care, mainly to remove body odor by consuming the raw leaves; (iii) *Kumis kucing* (*Orthosiphon stamineus* Benth.) is used for the excretion of pain by shedding kidney stones through boiling the plant and drink the water; (iv) *Leng lengan* (*Leucas lavandulifolia* Smith) is used to treat digestive diseases, especially intestinal worms. The leaves are ground and applied to the stomach; (v) *Remujung* (*Orthosiphon aristatus* (Blume) Miq.) is used to cure excretory disease through expediting urinary secretion and shedding kidney stones by boiling the leaves and drink the water.

In addition to being utilized as medicine, the people in Wonokerto Village use certain plants to reduce pollution and prevent diseases. *Lidah mertua* (*Sansevieria trifasciata* Prain), for example, is used to reduce air pollution, both outdoor and indoor, especially pollution caused by carbon monoxide from cigarette smoke (Haerani et al. 2016). Lemongrass (*Cymbopogon citratus* (DC.) Stapf) is used to reduce mosquito population. The ethanol extract from lemongrass leaves and stem can be used as pesticides to control *Aedes aegypti* mosquitoes since it contains saponin, tannins, quinone and steroid (Hendrik et al. 2013).

The species with the highest importance value was betel (*Piper betle* L) which is used by 17 out of 39 respondents in total (43.6%), followed by ginger (*Zingiber officinale* Roscoe) with a value of 38.5% or used by 15 respondents, and soursop (*Annona muricata* L) with a value of 33.3% or used by a third of respondents. Meanwhile, the other species had values between 5%-20%. *Piper betle* is a medicinal plant species that has been widely used in China and India, many of which is used to cure microbial infections on the oral cavity (Pradhan et al. 2015). Betel leaf has been widely used as a chewing material and is considered beneficial for respiratory and oral hygiene. This plant has high medicinal properties because it contains tannins, chavicol, phenyl, and propane so that it is also used for treating digestion, as an expectorant, stimulant, anti-bacterial and to stimulate euphoria (Dasgupta and Bratati 2016). Another species with a highly important value, soursop, is a member of Annonaceae family that has been used by the people for a long time. It has many benefits, including as an anticancer, anticonvulsant, antiarthritic, antiparasitic, antimalarial, antidiabetic, anti-inflammatory and immune-booster (Patel and Patel 2016).

Table 1. The family and the number of species of medicinal plants in Wonokerto Village, Turi Sub-district, Sleman District, Yogyakarta, Indonesia

Family	Number of species
Acanthaceae	3
Amaryllidaceae	2
Annonaceae	1
Apiaceae	3
Apocynaceae	1
Araceae	2
Araliaceae	1
Arecaceae	3
Asteraceae	5
Lauraceae	3
Basellaceae	1
Brassicaceae	2
Bromeliaceae	1
Campanulaceae	1
Caricaceae	1
Cucurbitaceae	4
Euphorbiaceae	2
Fabaceae	3
Iridaceae	1
Lamiaceae	5
Liliaceae	2
Marantaceae	1
Menispermaceae	1
Meliaceae	1
Moraceae	1
Moringaceae	1
Musaceae	1
Myrtaceae	4
Oxalidaceae	1
Phyllanthaceae	1
Piperaceae	3
Poaceae	2
Portulacaceae	1
Rosaceae	1
Rubiaceae	3
Rutaceae	4
Sapotaceae	2
Simaroubaceae	1
Zingiberaceae	7

Table 3. The grouping of diseases regarding the uses of medicinal plants by Wonokerto community, Yogyakarta, Indonesia

Disease categories	The name of disease	
Digestive	Ulcer/stomach	
	Typhus	
	Intestinal thickening	
	Flatulence/stomachache	
	Sprue	
	Toothache	
	Intestinal worms	
	Diarrhea	
	Hemorrhoid	
	Diabetes	
Endocrine	Diabetes	
	Gout	
Muscles and joints	Sore muscles	
	Sprains	
	Arthritis	
	Waist pain	
	Pinched nerves	
	Stroke	
	Vertigo	
	Headache	
	Senses and Beauty	Sore eyes
		Wounds
Chickenpox		
Itching		
Tine versicolor		
Allergies		
Boils		
Hair loss		
Body Odor		
Cough		
Respiratory	Nosebleeds	
	Shortness of breath	
	Mumps	
Reproduction	Menstruation	
	Breast milk	
	Vaginal discharge	
	Vaginal hygiene	
	Vaginal itching	
Excretion	Urinary secretion	
	Kidney stones	
Circulatory	Hypertension	
	Anemia	
	Hypotension	
	Cholesterol	
	Heart	
	Cleanse the blood	
	Increase platelets	
	Dengue fever	
	Accelerate blood circulation	
	Warm the body/stomach	
Supplements	Boosts stamina	
	Preventing cancer	
	Antioxidant	
	Appetite	
	Child Intelligence	
Pollution & environment	Antiseptic	
	Eliminates cigarette smoke odor	
	Reduce mosquito population	

Table 2. The list of medicinal plants in Wonokerto Village, Turi Sub-district, Sleman District, Yogyakarta, including the family name, latin name, local name and their benefits.

Family	Species	Local name	Benefits
Acanthaceae	<i>Graptophyllum pictum</i> (L.) Handle	Ambien	Hemorrhoids
	<i>Justicia gendarussa</i> Burm. F.	Ganda rusa	Headache
	<i>Strobilanthes crispera</i> Blume	Keji beling	Expediting urinary secretion, sore muscles
Amaryllidaceae	<i>Allium sativum</i> L.	Bawang putih/garlic	Heart, blood circulation
	<i>Allium cepa</i> L.	Brambang/onion	Warming up the body
Annonaceae	<i>Annona muricata</i> L.	Sirsak/soursop	Hypertension
Apiaceae	<i>Foeniculum vulgare</i> Mill	Adas	Fever
	<i>Centella asiatica</i> (L.) Urban	Pegagan/regegeg	Sore muscles
	<i>Apium graveolens</i> L.	Seledri/celery	Hypertension
Apocynaceae	<i>Catharanthus roseus</i> L.	Tapak dara putih	Lowering blood sugar
Araceae	<i>Colocasia esculenta</i> (L.) Schott	Lompong	Wounds
	<i>Alocasia plumbea</i> K. Koch ex Van Houtte	Lompong ireng	Typhus
Araliaceae	<i>Polyscias scutellaria</i> (Burm.f.) Fosberg	Mangkokan	Lowering high blood pressure
Arecaceae	<i>Cocos nucifera</i> L.	Degan serat merah	Shedding kidney stone
	<i>Arenga pinnata</i> (Wurmb) Merr.	Kolang-kaling	Arthritis
	<i>Salacca zalacca</i> (Gaert) Voss	Salak pondoh	Hypertension
	<i>Gynura procumbens</i> (Lour.) Merr	Sambung nyawa	Sore muscles
Asteraceae	<i>Crassocephalum crepidioides</i> (Benth.) S. Moore	Sintrong	Flatulence
	<i>Tithonia diversifolia</i> (Hemsl) A. Gray	Sumber waras/insulin	Diabetes
	<i>Elephantopus scaber</i> L.	Tapak liman	Sore muscles
	<i>Sonchus oleraceus</i> L.	Tempuyung	Expediting urinary secretion and shedding kidney stone
Basellaceae	<i>Anredera cordifolia</i> (ten) Steenis	Binahong	Wounds and sore muscles
Brassicaceae	<i>Raphanus sativus</i> L.	Lobak/radish	Gout and sore muscles
	<i>Brassica rapa</i> L.	Sawi hijau	Sore eyes
Bromeliaceae	<i>Ananas phycas</i> (L.) Merr	Nanas/pineapple	Gout and sore muscles
Campanulaceae	<i>Laurentia longiflora</i> (L.) Peterm	Katarak	Sore eyes
Caricaceae	<i>Carica papaya</i> L.	Pepaya/papaya	Hypotension
Cucurbitaceae	<i>Sechium edule</i> (Jacq.) Sw.	Jipang putih	Fever
	<i>Cucumis melo</i> L.	Melon	Hypertension
	<i>Citrullus lanatus</i> (Thunb.) Matsum	Semangka/watermelon	Hypertension
	<i>Cucumis sativus</i> L.	Timun/cucumber	Hypertension
Euphorbiaceae	<i>Aleurites moluccana</i> (.) Willd	Kemiri	Gout and sore muscles
	<i>Euphorbia tirucalli</i> L. Rubber	Tikel balung	Sprains
Fabaceae	<i>Erythrina variegata</i> L.	Cangkring	Chickenpox
	<i>Leucaena leucocephala</i> (Lam.) de Wit	Petai Cina	Itching
	<i>Parkia speciosa</i> Hassk	Petai	Itching
Iridaceae	<i>Eleutherine bulbosa</i> (Mill.) Urb	Brambang brojol	Headache, sore muscles
Lamiaceae	<i>Tectona grandis</i> Linn. F.	Jati/teak	Diarrhea
	<i>Ocimum citriodorum</i> Vis.	Kemangi/basil	Eliminate body odor
	<i>Leucas lavandulifolia</i> Smith.	Leng lengan	Worm disease
	<i>Orthosiphon aristatus</i> (Blume) Miq.	Kumis kucing/cat whisker	Expediting urinary secretion and shedding kidney stone
Lauraceae	<i>Litsea glutinosa</i> (Lour.) C.B Rob	Adem-adem ati	Lowering blood pressure
	<i>Persea americana</i> Mill.	Alpukat/Avocado	Lowering blood pressure
	<i>Cinnamomum verum</i> J.Presl	Kayu manis/Cinnamon	Lowering high blood pressure
Liliaceae	<i>Sansevieria trifasciata</i> Prain.	Lidah mertua	Removing cigarette smoke odor
	<i>Aloe vera</i> Mill.	Lidah buaya	Wounds caused by hot oil
Marantaceae	<i>Maranta arundinacea</i> L.	Garut	Stomach ailments
Meliaceae	<i>Azadirachta indica</i> A. Juss.	Mimba	Muscle clamping
Menispermaceae	<i>Tinospora crispa</i> (L.) Miers ex. Hoff.f	Brotowali	Itching or allergies
Moraceae	<i>Morus alba</i> L.	Murbei/mulberry	Sore muscles, headache
Moringaceae	<i>Moringa oleifera</i> Lamk	Kelor	Vitamins, sore muscles, increasing breast milk production, lowering cholesterol, hypertension, improve blood flow, to cure witchcraft
Musaceae	<i>Musa acuminata</i> Colla	Pisang mas/banana	Fever
Myrtaceae	<i>Eugenia uniflora</i> L.	Dewandaru	Cough
	<i>Psidium guajava</i> L.	Jambu buji/guava	Diarrhea
	<i>Syzygium malaccense</i> (L.) Merr. & Perry	Jambu susu	Diarrhea
	<i>Syzygium polyanthum</i> (Wight) Walp.	Salam	Lowering cholesterol

Oxalidaceae	<i>Averrhoa bilimbi</i> L.	Belimbing wuluh	Cough
Phyllanthaceae	<i>Sauropus androgynus</i> (L) Merr	Katuk	Increasing breast milk production
Piperaceae	<i>Piper betle</i> L.	Sirih/betel	Relieves cough
	<i>Peperomia pellucida</i> L.	Sirih Cina	Gout
	<i>Piper ornatum</i> L.	Sirih merah	Toothache
Poaceae	<i>Imperata cylindrica</i> Raeusch	Alang-alang	Waist pain
	<i>Cymbopogon citratus</i> (DC.) Stapf	Sereh/lemongrass	Increasing stamina, anti-cancer, and reducing mosquito populations
Portulacaceae	<i>Portulaca oleracea</i> L.	Krokot	Vertigo
Rosaceae	<i>Rosa</i> sp. L.	Mawar/rose	Cough
Rubiaceae	<i>Uncaria gambir</i> (Hunt.) Roxb.	Gambir	Stomach, typhus
	<i>Coffea arabica</i> Lind.	Kopi/coffee	Gout
	<i>Morinda citrifolia</i> L.	Pace	Hypertension and cough
Rutaceae	<i>Citrus limon</i> (L.) Osbeck	Jeruk lemon/lemon	Antioxidant
	<i>Citrus aurantifolia</i> (Christm.) Swingle	Jeruk nipis/lime	Sprue
	<i>Citrus hystrix</i> DC.	Jeruk purut	Fever
	<i>Citrus amblycarpa</i> (Hassk.) Ochse	Jeruk uwik	Fever
Sapotaceae	<i>Manilkara zapota</i> (L.) P. Vikraman	Sawo	Diarrhea
	<i>Manilkara kauki</i> (L.) Dubard	Sawo kecil	Diarrhea
Simaroubaceae	<i>Brucea javanica</i> (L.) Mess	Mekasar	Diarrhea
Zingiberaceae	<i>Zingiber officinale</i> Roscoe	Jahe/ginger	Warming the body
	<i>Kaempferia galanga</i> L.	Kencur	Relieves cough
	<i>Curcuma longa</i> L.	Kunir/turmeric	Stamina enhancer
	<i>Curcuma alba</i> L.	Kunir putih/white turmeric	Prevents lumps
	<i>Alpinia galanga</i> (L.) SW.	Laos	Lord
	<i>Curcuma aeruginosa</i> Roxb	Temu ireng	Abdominal pain
	<i>Curcuma xanthorrhiza</i> Roxb	Temulawak	Ulcer, typhus, intestinal thickening

Kelor (*Moringa pterygosperma* Gaertn) was revealed as a species with the highest usage value (0.6). It was used as a vitamin or supplement, and to treat sore muscle, to increase the production of breast milk, to reduce cholesterol and high blood pressure, to improve blood flow, to eliminate witchcraft, and to remove tingling sensation by using boiled or cooked leaves. High nutritional content in all organs of *kelor*, especially in the leaves, makes *kelor* has high medicinal properties for health care and can also be used to overcome nutritional deficiencies. Therefore, *kelor* is called the *Miracle Tree* and *Mother's Best Friend* (Aminah et al. 2015). The species with the next highest value was lemongrass (*Cymbopogon citratus* (DC.) Stapf) and *temulawak* (*Curcuma xanthorrhiza* Roxb) with the same value of 0.3. Whereas, the other species had a relatively small value, ranged between 0.1-0.2.

Mostly, the use of medicinal plants for healing has not been empirically proven so that the dosage and composition still need to be studied and developed further. In addition to health care, medicinal plants have high potential to be utilized as alternative sources of income for the people (Kunwar and Rainer 2008). Eventually, the existence of local wisdom can contribute to biodiversity conservation (Adnan and Othman 2010).

In summary, the people of Wonokerto possess knowledge on the utilization of medicinal plants which has been passed down from generation to generation. They have known and used 84 medicinal plant species from 40 families. Zingiberaceae was the family consisting of the most used species (7 species), while betel (*Piper betle* L) was the most important species, followed by ginger

(*Zingiber officinale* Roscoe) and soursop (*Annona moricata* L). *Kelor* (*Moringa pterygosperma* Gaertn) was species with the most benefits followed by lemongrass (*Cymbopogon citratus* (DC.) Stapf) and *temulawak* (*Curcuma xanthorrhiza* roxb). The leaf was the most used plant part, specifically for making herbal drinks (oral). The habitus of plants used for medicinal purposes were mostly herbaceous plants, and the plants were largely obtained from the house yard. The utilization of medicinal plants facilitates to strengthen the social relationship, sharing, and mutual cooperation in society. The processing of medicinal plants was still conventional, hence requiring further research, especially in pharmacological aspects, so that the composition and dosage can be measured accurately. However, the community needs to be continuously motivated to improve and develop the local knowledge in line with technological developments.

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