The Importance Of Medicinal Plant And Herb Concoctions Used By The Osing Tribe In East Java, Indonesia For Treating COVID-19 Symptoms

Dwi Kusuma Wahyuni[1]*, Rizal Adistya Putra Pradana[1], Cici Tya Rahmawati[1], Arif Nur Muhammad Ansori[2], Viol Dhea Kharisma[1,3], Arli Aditya Parikesit[4], Shilfiana Rahayu[5], Junairiah[1], Hery Purnobasuki[1], Sehanat Prasongsuk[6], Listyani Suhargo[1]

[1]Department of Biology, Faculty of Science and Technology, Universitas Airlangga, Surabaya, East Java, 60115, Indonesia
[2]Professor Nidom Foundation, Surabaya, East Java, 60115, Indonesia
[3]Computational Virology Research Unit, Division of Molecular Biology and Genetics, Generasi Biologi Indonesia Foundation, Gresik, East Java, 61171, Indonesia
[4]Department of Bioinformatics, School of Life Science, Indonesia International Institute for Life Sciences, Jakarta, 13210, Indonesia
[5]Department of Biology, Faculty of Science and Technology, Universitas Islam Negeri Yogyakarta, Yogyakarta, 55281, Indonesia
[6]Plant Biomass Utilization Research Unit, Department of Botany, Faculty of Science, Chulalongkorn University, Bangkok, 10330, Thailand
* Corresponding authors: Dwi Kusuma Wahyuni (dwi-k-w@fst.unair.ac.id)

Abstract

The use of medicinal plants to treat the symptoms of COVID-19 is essential to increase immunity. Our research aimed to determine the therapeutic potential of Indonesian medicinal plants and the herb concoction used by the Osing Tribe in Kemiren and Glagah Village, Glagah District, Banyuwangi Regency, East Java, Indonesia, for treating the symptoms of anti-SARS-CoV-2. We conducted semi-structured and structured interviews. Twenty-five participants (30–50 years) used in traditional medicine to treat 44 diseases. Among the plant families recorded, the dominant families were Zingiberaceae and Caesalpiniaceae. Ten families were used

for treating SARS-Cov-2. Zingiber officinale Rosc (0.56) showed the highest SUV and FL (48%), while the Zingiberaceae family (0.8) had the highest FUV. Leaves were the most used part, and boiling was the predominant preparation method. The Osing people often use smearing to treat diseases. Celang Tea was the most popular concoction used for preventing the SARS-CoV-2 symptoms. This study highlighted the importance of various medicinal plants and herb concoctions used by the Osing Tribe for traditional health therapies and for preventing SARS-CoV-2 symptoms.

Keywords: ethnobotanical, ethnomedicine, medicinal plants, Osing Tribe, SARS-CoV-2 were interviewed. We analyzed Species Use Value (SUV), Family Use Value (FUV), Part Plant Use (PPU), and Fidelity Level (FL). The results showed that 94 species from 43 families were

Introduction

COVID-19 is a serious global health problem that can disrupt every aspect of human life. The disease was officially declared a pandemic by WHO in March 2020. The COVID-19 outbreak and its rapid transmission threaten global health and the economy [1]. COVID-19 was first detected in Wuhan, Hubei Province, China, at the end of December 2019 in a group of pneumonia cases of unknown etiology and then spread sporadically worldwide [2,3]. Prevention efforts, such as diagnosis, treatment, and vaccination, are very important. So far, efforts to deal with COVID-19 have not shown effective results, researchers have not determined a drug that can effectively treat the symptoms of COVID-19 [4,5].

The demand for medicinal plants in the market increased during the COVID-19 pandemic for treating disease symptoms [6]. Several approaches are adopted for searching for medicinal plants that have the potential to treat COVID-19, such as looking for plants with anti-inflammatory and immunomodulatory effects [7-9]. The Chinese community has previously studied the effects of using medicinal plants to treat SARS disease [10-12], and succeeded in reducing the effects of the symptoms of the disease [13].

Medicinal plants are now of particular concern because they have the potential to provide great benefits to society, especially in healthcare [14,15]. Eighty percent of the world's population uses natural products for healthcare. Indonesia has the second largest biodiversity in the world, with

approximately 40,000 endemic plant species including 6,000 medicinal plants, and is inhabited by approximately 300–700 ethnicities. As a result, Indonesia is rich in medicinal plants traditionally used for generations to cure diseases. Indonesian people have local wisdom to utilize nearby plants as traditional medicine [16,17].

Indonesia with various cultural backgrounds has a wealth of ethnomedicines, utilizing plants for treatment. Indonesian people consume traditional ingredients because of their beliefs and some of these results are considered adequate. Indonesian people are also accustomed to consuming traditional ingredients because it is a habit passed down from generation to generation, especially for residents who live or come from Java. Many traditional ingredients are consumed by ethnic communities for improving health, both as promotive, preventive, and curative agents. Traditional herbal ingredients are unique in every ethnicity, which have been proven to help solve public health problems for generations [18].

One of the tribes in East Java that actively uses plants for treatment is the Osing tribe. This tribe has preserved local wisdom, as evidenced by traditional healers, medicinal herbs, and traditional ceremonies [19]. Traditional medicine may be beneficial in the era of the COVID-19 pandemic as a means of prevention by boosting the immune system and increasing endurance [20]. Osing people were distributed in some districts of Banyuwangi City, one of them in Glagah District. Kemiren and Glagah Villages were the centre of Osing Tribe traditional activity including traditional health treatment. They were located in Glagah District, Banyuwangi City, East Java, Indonesia. Therefore, this study plays an important role in documenting the importance of traditional health treatment using medicinal plants.

Materials and methods

Study area

This research was conducted in Kemiren Village and Glagah Village, Glagah District, Banyuwangi. Banyuwangi District is divided into highlands in the form of mountainous regions that can produce plantation, plain areas that can produce food crops, and the area around the coastline that stretches from north to south, and a variety of areas for marine life [21]. The Osing tribe only spreads out in fertile agricultural villages in the central and eastern parts of Banyuwangi, including Kemiren

Village and Glagah Village which were the research sites (Figure 1). The Osing tribe is closely related to customs and has a lot of local wisdom, including the habit of using medicinal plants for treatment.

Figure 1. Location of the study area. Kemiren and Glagah Village (red dots) is located in Banyuwangi, East Java, Indonesia [22].

Data collection

In the survey, verbal informed consent was obtained from each participant before conducting the interview. Data collection was carried out using semi-structured and structured interviews with participants with knowledge of using medicinal plants. The survey included questions about the use of medicinal plants, parts used, utilization, and processing of medicine. Twenty-five participants were interviewed, with an average age of approximately 30–50 years. Participants were categorized into several types: community leaders, traditional healers, and ordinary people. We also determined the key person. The key person is a community figure with strong power in society. The instructions of the previous informant determined the next informant. We used the snowball sampling method to select informants to determine the key person.

Taxonomic identification and herbarium

Species authentication was conducted to determine the samples raised during the interviews. An herbarium was also prepared to obtain dry specimens supporting the taxonomical identification by Mr. Dwi Narko and Mr. Sugi, botanists at Purwodadi Botanical Garden, Indonesian Science Institute, Purwodadi, East Java, Indonesia. However, the herbarium method was used only for unknown species. Photo documentation and herbarium of medicinal plants were deposited in the Laboratory of Plant Systematics, Department of Biology, Faculty of Science and Technology, Universitas Airlangga, Indonesia.

Disease classification and grouping

Diseases were categorized into nine categories including Internal Medical (IM) (fatigue, fever, headache, hypercholesterolemia, sore, heart, hypertension, nerves, low back pain); Respiratory-nose, ears, eyes, oral or dental, and throat problems (RT) (cough, pharyngitis, influenza, asthma,

toothache, conjunctivitis, lungs, anosmia, cataract, and ulcer); Dermatological disease (DO) (incision wound, swollen, and snake venom); Gastrointestinal disorders (GI) (increased appetite, diarrhea, bloating, diabetes, stomachache, gastroesophageal reflux disease, facilitated defection, appendix vermiformis, and dysentery); Mental disorders (MD) (convulsions, trance, stress due to the loss of a loved one, mental disorder, and insomnia); Skeletal-muscle and nervous disorders (SD) (Gout arthritis); Urogenital and gynecological problems (UGP) (womanhood, kidney stone, HIV/AIDS, and whiteness); Baby's rhizomelic cord problems (BRP) (baby often shed tears, and umbilical cord/placenta); SARS-CoV-2 symptoms (CoV) (fever, cough, fatigue, pharyngitis, diarrhea, conjunctivitis, headache, influenza, and asthma).

Data analysis

Fidelity Level (FL)

The relative frequency of citations was calculated using the FL formula derived by Friedman et al. [23] and Ouedraogo et al. [24]. FL is described as the percentage of informants using certain types of plants to treat certain diseases. This reflects the tendency of society toward certain plant species, especially in the field of medicine. FL was derived using the following equation:

$$\mathrm{FL}\ (\%) = \frac{\mathrm{Np}}{\mathrm{N}} \times 100$$

Np is the number of informants who provide information on the use of plant species for treatment measures. N is the number of informants who reported the types of plants for various treatments.

Species Use Value (SUV)

The SUV shows the value of medicinal plants used by the Osing people in Banyuwangi. This is calculated as the sum of the species use values (Uvis) for a particular drug species and dividing it by the total number of informants (Ni). SUV was calculated using the formula described by Hoffman and Gallaher [25] as follows:

$$\mathrm{SUV} = \frac{\sum \mathrm{UVis}}{(\mathrm{n_i})}$$

Family Use Value (FUV)

FUV was calculated as described by Phillips and Gentry [26] and represents the beneficial value of the plant family used as

medicine by the Osing people in Banyuwangi. The calculation uses the following equation:

$$\mathrm{FUV} = \frac{\sum \mathrm{UVs}}{(\mathrm{n_i})}$$

Where Σ Uvs represents the sum of the use values for all species belonging to a particular family divided by the total number of species in the same family.

Plant Part Value (PPV)

The value of plant parts is expressed as a percentage of plant parts such as stems, leaves, roots, fruits, and flowers used as medicine. PPV was calculated according to Gomez-Beloz [27] as follows:

$$\mathrm{PPV} = \frac{\sum \mathrm{RU}_{(\mathrm{plant\ part})}}{\sum \mathrm{RU}} \times 100$$

Where is $\Sigma \mathrm{RU}_{(\mathrm{plant\ part})}$ and Σ RU represent the stated number of plant parts and the total stated amount of use for a particular plant, respectively.

Results and discussion

Utilization of plant species as traditional medicine by the Osing tribe in Banyuwangi

The people of Banyuwangi, especially the Osing tribe, use plants as traditional medicine. Therefore, knowledge about using plants for medicinal purposes needs to be preserved and documented from generation to generation. The results reveal that the Osing tribe uses 94 species as traditional medicine. The Internal Medical (IM) category is the one that most often uses plants for treatment, which contains 48 species and another 46 species are used to treat diseases in the "Respiratory-nose, ears, eyes, oral/dental, throat problems" (RT) category. Ginger (Zingiber officinale Rosc) is the type of plant most widely used by the public for treatment. This shows that the useful value (USV) of ginger is much higher when compared to the others.

Species and family use values (SUV and FUV, respectively)

We successfully recorded 94 species of plants belonging to 43 families. The total number of species in a given family was calculated to determine the FUV value. We found that Zingiberaceae had the highest FUV value of 0.8 followed by Caesalpiniaceae with a value of 0.52 (Table 1). This confirms that the Osing people often use species in the Zingiberaceae and Caesalpiniaceae families for traditional medicine [28].

Table 1. Disease categories, health-related problems, medicinal plants, FUV, and fidelity level used in Osing Tribe, Banyuwangi, Indonesia.

Research on the content of compounds in the Zingiberaceae family has revealed their potential to treat COVID-19 owing to the content of essential oils (gingerol and zingerol) present in them that can boost the immune system and inhibit the growth of the COVID-19 virus [29]. Furthermore, the Caesalpiniaceae family contains phenolic compounds, triterpenoids, protosappanins, and naftoquinones, many of which have anti-ulcer, anti-cancer, antidiabetic, anti-inflammatory, antirheumatic, antimicrobial, antibacterial, antiviral, antioxidant, and antitumoral activity [30]. Zingiberaceae has also received attention in Morocco, the eighth out of 57 families cited by people in Morocco [31]. In addition, the Caesalpiniaceae family became the most commonly used representative in Sudan [32].

The SUV indicates the value of medicinal plant. The SUV results obtained from the people in Kemiren Village and Glagah Village range from 0.04 to 0.56. The five species that had the highest scores were Z. officinale, key lime (Citrus aurantifolia Christm), curcumin (Curcuma longa L), sand ginger (Kaempferia galanga L), java ginger (Curcuma xanthorrhiza Roxb) with an SUV value of 0.56; 0.4; 0.32; 0.32; 0.32, respectively (Figure 2).

Figure 2. Species Use Value (SUV) of medicinal plants used by the Osing Tribe, Banyuwangi, Indonesia.

The plant most commonly used in Indonesia is Z. officinale. A preclinical study (In Vitro and In Vivo) revealed that ginger can relieve musculoskeletal pain and inhibit the effects of the COX-2 and COX-1 enzymes/enzymatic activity on thromboxane synthesis [33,34]. Moreover, active components in ginger can suppress NF-$_K$B activation in anti-inflammatory activity tests [35].

C. aurantifolia, C. longa, K. galanga, and C. xanthorrhiza have been used in various countries, such as India, China, Mauritius, Philippines, Bangladesh, Malaysia, and Thailand. In India, C. aurantifolia is used to treat skin diseases [36] and C. longa is used to treat ringworm infection [37]. Additionally, people in Southwest Guizhou, China use C. longa for improving livestock health [38], whereas people in Mauritius use it for leg pain, body aches and stomachaches [39]. Furthermore, the

medicinal properties of K. galanga have been documented in the southern Philippines for colds, flatulence, coughs, and fever [40]. K. galanga is also used in Bangladesh as a flavor enhancer and to treat fever, gallbladder disorders, bloating, leprosy, and cough [41]. C. xanthorrhiza is used by people in Kedah, Malaysia for its anti-aging property [42]. In Thailand, C. xanthorrhiza is used by healers to treat menopause [43].

Fidelity Level (FL)

FL is a method to determine which species is frequently used for certain diseases [44]. FL shows the percentage of respondents who said a plant species can treat certain diseases. FL results in this study showed that three species had the highest levels; Z. officinale, Psidium guajava L., and C. xanthorrhiza (Table 1). Z. officinale is used by 48% of the Osing people to treat fever. Ginger has also been widely used in the Phu Thai ethnicity, Thailand (FL 87.23%) [45] and Morocco [46]. Ginger is used to treat flatulence and pathologies of the respiratory system, cold, and pathologies of the digestive system.

P. guajava is used to treat diarrhea by 44% of the Osing tribe. It is used to treat dysentery in the Atlantic Tropical Forest of Brazil [47] and colic in Mauritius [39]. Z. officinale is used to treat coughs and P. guajava to treat diarrhea in Tanzania [48]. C. xanthorrhiza is used by 44% of the Osing tribe for the prevention of COVID-19. C. xanthorrhiza is most widely used by people in several districts in Vientiane Prefecture, Laos with a percentage of 9.4%. C. xanthorrhiza is used in Vientiane Prefecture as a health tonic, to nourish the body, and to treat asthma [49].

Plant part use, mode of preparation, and mode of use

Calculation of the use of plant parts is important to determine the main plant parts used in traditional medicine [24]. The results obtained in this study showed that the most used plant part was leaves (34%), followed by rhizomes (29%) and fruits (10%) (Figure 3). Leaves were the most widely used part, contributing to the conservation of plants rather than harvesting the root part and/or the whole plant [50]. Several reports also show that leaves are the main part of traditional medicine [51-53]. The frequency of utilization of leaf parts is higher than that of other parts because they have many classes of bioactive compounds that are pharmacologically active against many diseases [54].

Figure 3. Pie chart depicting the percentage of plant part used for herbal preparations in Osing Tribe, Banyuwangi, Indonesia.

The most frequently used preparation method used by the Osing people was boiling (47.3%), followed by pounding (22.3%). Additionally, methods such as pressing, grating, and burning are also used to prepare herbal medicines (Figure 4). In addition to the Osing Tribe in Indonesia that use the decoction as a preparation method for herbal medicines, many people in other countries, such as the Lesser Western Himalayas, Pakistan, also use this method [55].

Figure 4. Mode of preparation of the medicinal plants used by the people of Osing Tribe in Banyuwangi, Indonesia.

The study results show that the smearing (60%) method was the most commonly used method by the Osing Tribe whereas drinking is only used by 4% (Figure 5). Smearing is also used by people in Karnataka, India. They apply the rhizome of Acorus calamus L to the gums for improving oral health [56]. Furthermore, people in the Tahitay Adiyabo district, northwest of Tigray, Northern Ethiopia also use these methods for wound healing. The treatment involves pounding the dry leaves of Maerua subcordata, then combining the paste with water and rubbing it on the wound [57].

Figure 5. Mode of use of the medicinal plants by the people of Osing Tribe in Banyuwangi, Indonesia.

Concoction of the medicinal plants

Traditional medicine using plants can achieved by consuming medicinal plants alone (monotherapy) or in combination with two, three, four, five, or more medicinal plants. Additionally, a combination of several parts of one plant can be used for traditional medicine. For example, a study conducted in the Eastern Cape Province of South Africa used a mixture of decoction of the leaves, stems, and roots of Leonotis leonurus (L.) R.Br. to treat cough, sore throat, cold, influenza, fever, and headache [58]. The Osing tribe also uses a combination of plants for traditional medicine.

We discovered that the Osing tribe uses 137 concoctions, which were divided into nine categories (Table 2). The most common concoction in the Osing tribe was for treating respiratory problems-nose, ears, eyes, mouth/teeth, throat (44 concoctions) and internal medical diseases (38 concoctions). The most commonly treated disease symptoms were fever (15 concoctions), cough, and asthma (nine

concoctions). These concoctions can overcome the symptoms of COVID-19. The Osing Tribe in Glagah village, has a special concoction called “Celang Tea” to prevent COVID-19. The plant materials used in this concoction were Balinese long pepper (Piper retrofractum Vahl), black turmeric (Curcuma aeruginosa Roxb), nam-nam fruit (Cynometra cauliflora L), pinecone ginger (Zingiber zerumbet L), and cogongrass (Imperata cylindrica L. Beauv). The concoction was boiled and sugar was added for taste before consumption. Each medicinal plant has a different possible mechanism for preventing COVID-19. Therefore, carrying out further studies to determine the mechanism of action of the individual compounds in the combination of these medicinal plants is necessary. Medicinal plant combinations are also used in several countries such as Nigeria, Pakistan, and Bangladesh [59-61].

Table 2. Concoction of the medicinal plants used by the Osing Tribe, Banyuwangi, Indonesia.

Diversity of medicinal plants used by the Osing Tribe

The Glagah Village and Kemiren Village in Banyuwangi are located in fertile plantation and agricultural areas. Therefore, many of the plants used by the community are derived from their gardens or agricultural land. Only two plants were taken from outside the city of Banyuwangi, temulawak (Curcuma xanthorrhiza Roxb.) from Yogyakarta and black coriander (Coriandrum sativum L.) from Surabaya.

Conclusion

Our study revealed that the Osing people in Glagah Village and Kemiren Village, Banyuwangi used 94 species of plants for traditional medicine. The 94 species belong to 43 different families and used to treat 44 types of diseases, of which 10 families were used for treating SARS-CoV-2 symptoms. The most commonly used families were Zingiberaceae and Caesalpiniaceae. Apart from consuming medicinal plants alone (monotherapy), the Osing people combined two, three, four, or more plants to make concoctions. We found 137 concoctions in the Osing tribe and divided them into nine categories. The people in Glagah Village and Kemiren Village use a special herb called “Celang Tea” to protect themselves from the spread of SARS-CoV-2 symptoms. The results of this study emphasize the importance of future clinical studies to evaluate the bioactive substances in these ingredients, especially ingredients used to inhibit the spread of COVID-19.

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Author contributions

D.K.W., A.T.W., L.S., R.A.P.P., S.R., S.P., and H.P conceived and designed the experiments; D.K.W., A.T.W., L.S., R.A.P.P., S.R., J., A.N.M.A., V.D.K. C.T.R. and A.P. prepared the questionnaire, performed the interview, identified the sample, analyzed the data, and wrote main manuscript. All authors have read, revised, and provided approval for final manuscript.

Competing interests

The authors declare there is no competing interest.

Data availability statement

The data supporting the findings of the study are available within the article and the additional data that support the findings of this study are available from the corresponding author upon reasonable request.