

Traditional uses of ginger (*Zingiber officinale* Roscoe) based on ethnomedicine study in 254 Indonesia ethnic groups

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Ginger (*Zingiber officinale* Roscoe) is the most cited plant for medicinal purposes around the globe. The rhizome of *Z. officinale* has been documented in traditional medical systems around the world, including Indonesia. The ethnomedicine study was conducted to inventory the traditional use of *Z. officinale* by ethnic groups in Indonesia. This study is one of a few stepping stones towards averting the extinction of indigenous knowledge and medical practices held by the community. The research was designed as a semi-qualitative study that involved 254 ethnic groups from 34 provinces. This study exhibited 785 traditional uses of *Z. officinale* to treat 69 ailments. *Z. officinale* was primarily utilized in a combination form of concoction rather than a single preparation. Pre- and postnatal care was recorded as the most frequent indication of *Z. officinale* practiced by traditional healers. The composition, plant parts used, and the way of administration of *Z. officinale* were different among the ethnic groups. This study demonstrated the critical role of traditional healers in treating various ailments using *Z. officinale* and the differences in the traditional utilization of *Z. officinale* in Indonesia.

Keywords: Ethnomedicine, Ginger, Traditional uses, *Zingiber officinale*

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Zingiber officinale Roscoe, known as ginger, is one of the most commonly used spices and herbs globally with medicinal benefits¹. It was one of the plants that was constantly used in early European cuisine². South-East Asia, China, Taiwan, Japan, India, Greco-Roman, Brazil, Australia, Africa, India, Bangladesh, Mexico, Jamaica, the Middle East, and areas of the United States have employed the plant's rhizome in traditional medicine³. Many products containing ginger, such as dietary supplements, drinks, and foodstuffs, are available nowadays. It appears as one top-selling herb, and the sales are growing from time to time⁴. Ginger has been documented in many traditional medicine systems, including Traditional Chinese Medicine (TCM), Indian Ayurvedic, Unani, and Iranian Traditional Medicine (ITM) manuscripts. Reputable as a panacea, *Z. officinale* plays a role in many ailments of the universal medication⁴. *Z.*

officinale has been used in folk medicine to treat and relieve a variety of ailments, including pain, vomiting, indigestion, cold symptoms, and upper respiratory tract infection. It has also been used for fever, pain, arthritis, cramps, sprains, sore throat, muscular aches, rheumatism, constipation, indigestion, vomiting, dementia, hypertension, and infectious diseases³. In Indonesia, there are three varieties of ginger based on the size and color of the rhizome, i.e., *Z. officinale* var. *amarum* (small white ginger known as 'jaheemprit'), *Z. officinale* var. *officinale* (big white ginger or giant ginger known as 'jahegajah'), and *Z. officinale* var. *rubrum* (small red ginger known as 'jahemerah')⁵. *Z. officinale* has been long used as a single ingredient or parts of remedy recipes. Indonesia is the top five *Z. officinale* producing country in the world⁶. *Z. officinale* is essential economically as an export commodity and possesses a broader aspect of life. It is a component of shaping the culture of ethnicities served or involved in a ceremonial ritual.

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This species is one of the herbs and spices found throughout the country⁷. Indonesia has 1,068 ethnic groups, representing a diversity of culture, including indigenous knowledge of medicinal plants. Ethnopharmacological studies reported the use of *Z. officinale* as an ingredient for ailing various health issues. The utilization of medicinal plants in the community cannot be separated from the knowledge possessed by traditional healers and the community regarding treatment using medicinal plants. Several studies reported that most traditional healers were elderly and lacked documentation regarding their knowledge and practice of medicine^{8,9}. This is one of the risks of the disappearance and loss of knowledge, as well as many issues concerning the community's healing abilities. Therefore, this endeavor may be regarded as one of a few stepping stones toward preventing the extinction of indigenous knowledge and medical practices held by the community. This study aimed to document traditional knowledge of utilizing *Z. officinale* for health purposes in the community of traditional healers in 34 provinces in Indonesia.

Methodology

Study area

The ethnomedicine study, known as Ristoja (Medicinal Plant and Jamu Research), involved 254 ethnic groups in Indonesia, as shown in

Figure 1. The ethnic groups were selected based on the Statistics Indonesia Database using the purposive sampling method and Ristoja's data collection method was conducted refers to the previous publication¹⁰. The requirements indicate the existence of their knowledge of using *Z. officinale* for medicinal purposes. Ethical approval was submitted to the Health Research Ethics Commission, NIHRD, Ministry of Health of the Republic of Indonesia. The ethical approval codes for this study were LB.02.01/5.2/KE.318/2015 and LB.02.02/2/KE.107/2017.

Data collection

Informants were selected from among traditional healers to get ethnomedicine knowledge regarding medicinal plant use. They were identified using a purposeful sample strategy with data from the community health center, local communities, and ethnic leaders. The informed consent was obtained from the informants prior to the data collection.

Specimen collection

Plant specimen was collected after the interview for the herbarium specimen. The herbarium specimen was deposited in Herbarium Tawangmanguensis, followed by a taxonomist to identify the specimen.

Data analysis

The gender, age group, education, and employment of the traditional healer were descriptively analyzed to

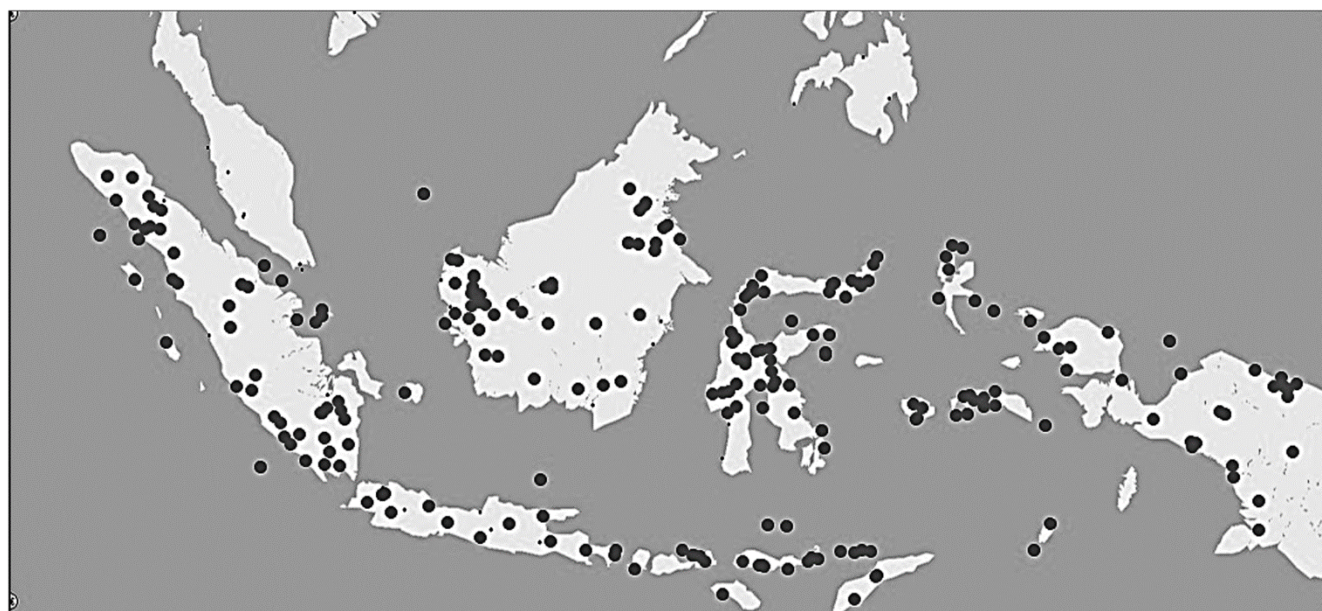


Fig. 1 — The location of the study area (RISTOJA) data is processed with MapSource® Garmin® mapping software). = ethnic groups that use *Zingiber officinale* in the concoction

derive frequency and proportions. Traditional use of *Z. officinale*: Traditional use of *Z. officinale* was analyzed descriptively to obtain diseases treated with *Z. officinale*, the source of materials, plant parts, formula composition, and administration routes involved in this study. Use Value (UV): The used value (UV) describes the relative importance of *Z. officinale*, known locally for treating certain ailments¹¹. The following equation calculates it: $UV = \sum U/n$. UV is the used value of *Z. officinale*, U is the number of *Z. officinale*'s citations, and n is the total number of informants who reported using of *Z. officinale*.

Inclusion criteria

Indigenous traditional healers of that ethnicity or who have been enculturated, practice treatment using medicinal plants, are known and recognized for their medicinal abilities by the community.

Exclusion criteria

Traditional healers who are not native to that ethnicity or who have not been enculturated and traditional healers who specifically treat one type of disease are not selected as informants.

Results

Informant characteristics

This study included 462 traditional healers from 254 ethnic groups scattered over 34 provinces in Indonesia. A brief socio-cultural profile of the informants is listed in Table 1.

Traditional uses of *Zingiber officinale*

This study revealed 785 traditional use reports of *Z. officinale* to treat 69 ailments by 462 traditional healers from 254 ethnic groups in Indonesia, as revealed in Table 2. The ethnic groups spread to 34 provinces, and following Figure 2 were the ten provinces with the most significant number of *Z. officinale*'s uses. Each province has more than 28 uses of *Z. officinale* to treat various ailments. The highest number was found in West Kalimantan (86 uses from 30 ethnic groups), and the lowest of ten was found in Lampung (29 uses from 9 ethnic groups). From a total of 69 ailments and diseases treated by healers, *Z. officinale* was the most commonly used for pre- and postpartum care, followed by rheumatoid and hyperuricemia, cough, bone injury, and other symptoms. There were four plant parts utilized by traditional healers for treatment: rhizome, leaf,

Characteristic	Number of informants (N=462)	
	Frequency	%
Gender		
Male	254	54.98
Female	208	45.02
Age group (years old)		
20-40	32	6.93
41-60	212	45.89
61-80	193	41.77
81-100	25	5.41
Education		
Uneducated	70	15.15
Elementary (not completed)	137	29.65
Elementary	132	28.57
Secondary school	43	9.31
High school	65	14.07
Undergraduate/graduate	15	3.25
Occupation		
Traditional healer	120	25.97
Governmental officer	18	3.90
Farmer	228	49.35
Fisherman	6	1.30
Seller	18	3.90
Service provider	10	2.16
Private worker	8	1.73
Others	54	11.69

Table 2 — Traditional uses of ginger (*Zingiber officinale* Roscoe) for overcoming 69 ailments

Number	Ailments/diseases	frequency	Percentage (%)
			(N=785)
1	Toothache and oral care	12	1.53
2	Liver disease	12	1.53
3	Kidney disorder	12	1.53
4	Fever	13	1.66
5	Skin disease	14	1.78
6	Asthma	14	1.78
7	Vitality disorder	17	2.17
8	Fertility disorder	16	2.04
9	Myalgia	18	2.29
10	Multiple purposes of medication	20	2.55
11	Headache	22	2.80
12	Pre- and postnatal care	92	11.72
13	Rheumatoid and hyperuricemia	52	6.62
14	Bone injury	48	6.11
15	Cough	48	6.11
16	Flu	37	4.71
17	Tumor/cancer	33	4.20
18	Stroke	31	3.95
19	Stomach ache	26	3.31
20	Other internal disease	23	2.93
21	Malaria	12	1.53
22	Tuberculosis	11	1.40
23	Gastritis	11	1.40
24	Spiritual and magical disease	10	1.27

...Contd.

Table 2 — Traditional uses of ginger (*Zingiber officinale* Roscoe) for overcoming 69 ailments (Contd.)

Number	Ailments/diseases	frequency	Percentage (%) (N=785)
25	Menstrual disorder	10	1.27
26	Wound healing	9	1.15
27	Eye care	8	1.02
28	Sexually transmitted diseases	8	1.02
29	Diarrhea	8	1.02
30	Diabetes	8	1.02
31	Muscle cramps	8	1.02
32	Hypertension	8	1.02
33	Fitness disorder	7	0.89
34	Antiinflammation	7	0.89
35	Expectant mother care	6	0.76
36	Smallpox	6	0.76
37	Heart disease	5	0.64
38	Cosmetics	5	0.64
39	Neonatal treatment (<12 months)	5	0.64
40	Diuretics	5	0.64
41	Haemorrhoid	4	0.51
42	Appendicitis	4	0.51
43	Constipation	4	0.51
44	Internal wound pain	4	0.51
45	appetite booster	4	0.51
46	Contraception	4	0.51
47	Boils	4	0.51
48	Sore throat	3	0.38
49	Antianemia	3	0.38
50	Antidot	3	0.38
51	Herpes	3	0.38
52	Anti-obesity	3	0.38
53	Typhus	2	0.25
54	Feminine care	2	0.25
55	Child health treatment	2	0.25
56	Hypercholesterolemia	2	0.25
57	Hernia	2	0.25
58	Epilepsy	2	0.25
59	Breastmilk booster	2	0.25
60	Tonsillitis	2	0.25
61	Mental disorder	1	0.13
62	Swollen lymph nodes	1	0.13
63	Burns	1	0.13
64	HIV/AIDS	1	0.13
65	Parotitis	1	0.13
66	Goitre	1	0.13
67	Kidney disorder	1	0.13
68	Hypotension	1	0.13
69	Measles	1	0.13

herbaceous parts, and stem. In comparison to leaves and other plant parts, rhizomes were found to be the most commonly used plant component by healers, followed by leaves, herbaceous parts, and stems.

Discussion

From 462 selected traditional healers with 785 *Z. officinale* use reports, the more significant proportion

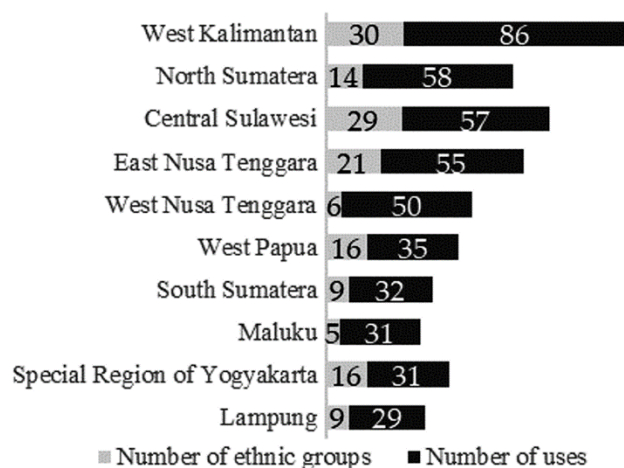


Fig. 2 — Provinces with the most significant number of *Zingiber officinale* uses

of informants were males (54.98%). The fact that males were more dominant in this field was also found in other communities^{12,13}. Based on the traditional system, men are probably responsible for meeting family needs and passing the healing knowledge to the eldest son. Furthermore, gathering plants in their natural habitat is risky for women. However, traditional female healers are equally accepted in many communities^{13,14}, especially the need for specific treatments dealing with maternity care¹⁴. The existence of women healers in Indonesia is represented mainly by traditional birth attendants. They usually possessed knowledge of traditional maternity care. A systematic review and cross-sectional survey in Africa revealed that rural African women prefer to use herbal medicine for maternity purposes provided by traditional birth attendants¹⁵.

Most informants were between 41 and 60 years old (45.89%), similar to those reported by studies in South Africa and India^{13,16}. The age group represents a productive age that must be responsible for the family's needs. Due to the limited number of the youngest age group (6.93%) discovered in this study, there was a large generation distinction. Former studies revealed a similar gap that probably indicates the lack of youth interest in this field and the unavailability of documentation for medicinal plant knowledge¹³.

As mentioned in Table 1, a significant proportion of informants' education level was elementary school, including uncompleted ones (29.65%). Less than half of them who received primary education in elementary school were completed. The informants who attended higher education in an academy or

university were only 3.25%. Education level related to literacy ability becomes important regarding conservation issues of endangered medicinal plant species. Traditional healers need to enhance their skills in managing natural resources and safely treating various ailments. Better education will contribute to their sustainability and work performance^{14,16}. Nearly half of the informants acknowledged that their primary job was farmers (49.35%). Most of them earned a living by farming since it took up most of their time. However, 25.97% of the informants in this study were full-time traditional healing practitioners. Former research in Theni District, Tamil Nadu, India, discovered that 41.25% of informants worked as healers as their primary occupation¹⁵. Some informants thought that becoming healers was not an occupation but a social responsibility to help each other. The limited revenue through healing practices caused dependence on other jobs for their livelihood¹⁵; thus, they had various ones, as given in Table 1.

The number of ethnic groups is not constantly in line with the number of uses. Each ethnic group has its own specific and systematic interaction with the surrounding nature. That interaction led to rich local knowledge regarding a particular plant's use, including medicinal uses¹⁷.

From 69 ailments and diseases treated by healers, *Z. officinale* was the most commonly used for pre- and postpartum care, followed by rheumatoid and hyperuricemia, cough, bone injury, and other symptoms. The usage of *Z. officinale* for prenatal and postnatal care of pregnant women may differ. Nausea and vomiting are complaints that often occur in the first trimester of pregnancy. If not addressed, the mother and fetus can be at risk of malnutrition due to a lack of energy intake. The administration of 500 mg/kg body weight (BW) *Z. officinale* extract for 14 consecutive days may lower systolic and diastolic blood pressure in pregnant women with gestational hypertension¹⁸.

Dissanayake *et al.*¹⁹ reported that *Z. officinale* is effectively used to increase the body's vitality. Zingerone, zerumbone, 6-shogaol, 6-paradol, and 6-gingerol are some of the active compounds in ginger that are responsible for the mechanism of increasing appetite, immunity, and enzyme activity¹⁹. Rosadi *et al.*²⁰ state that *Z. officinale* is the most effective medicinal herb employed by Sundanese for postpartum recovery to avoid infection and

inflammation, as well as reproductive organ convalescence. *Z. officinale* ethanol extract has potential for treating inflammation-related disorders²¹ (Sri Nadya, 2020). With the local knowledge, *Z. officinale* is also utilized by Acehnese for postnatal mother care for many treatments namely body massage, herbal remedies for stomach appliances, burn stones, fog treatment, herb pills, body scrub, and bathing herb²². The local people in Dayak Tomun, Central Kalimantan, considered whether postnatal mothers tend to have lower body temperature; hence, they administered *Z. officinale* to warm up the body and increase mothers' breastfeeding²³. Traditional Chinese medicine also claimed this medicinal plant's function for warming and restoring the body after losing blood, especially postnatal care²⁴. In Negeri Sembilan, Malaysia, *Z. officinale*, combined with *Citrus aurantifolia*, is traditionally applied to the abdomen to induce uterus contraction and streamline the belly²⁵. It might be linked to the discovery of the randomized control experiment done by Ebrahimzadeh *et al.* on eighty obese women, which demonstrated that 2 g/day of *Z. officinale* administration for 12 weeks dramatically reduced body mass index and insulin blood levels²⁶. Furthermore, Mahmoud and Elnour emphasized that *Z. officinale* is a strong weight loss treatment with the mechanism of lipase enzyme inhibition and dietary fat absorption of the gut without changing its bilirubin content²⁷.

Rheumatoid and hyperuricemia, which healers define as pain in part or all joints with swelling, especially on the feet and hands, is the second most prominent disease traditional healers prescribes for *Z. officinale*. Warm *Z. officinale* compress contains oleoresin proven to decrease the pain level of gout arthritis patients²⁸. Aqueous extract of *Z. officinale* combined with *Acalypha indica* exhibits activity on decreasing uric acid levels of male experimental rats²⁹. A clinical trial of the administration of standardized *Z. officinale* extracts to 261 subjects for six weeks was shown to decrease knee osteoarthritis symptoms³⁰.

The third and fourth ailments cured by traditional healers with *Z. officinale* were cough and bone injury, with the exact case percentage of 6.11%. Previous research found that 6-shogaol, the primary polyphenolic found in fresh *Z. officinale*, was more effective than 6-gingerol as an antitussive and expectorant agent in conquering cough²⁴. *Z. officinale*

demonstrated antibacterial and antiviral activities due to its mechanism of inhibiting virus internalization and the formation of biofilm of the bacteria. In comparison, Singh reported that medicinal plants could effectively reduce pain in swelling and fractures and speed up recovery³¹.

As reported in Figure 3, *Z. officinale* is also mainly used to treat cold or influenza. The common cold is a mild and self-limiting disease caused by more than 200 viruses. *Z. officinale* has been used to cure colds and influenza in several countries. Immuno-boosting ginger properties are presumably linked to *Z. officinale* in treating cold and flu³². Earlier research reported that a high concentration of fresh ginger could stimulate IFN- β secretion from mucosal cells, which is probably responsible for counteracting viral infection by inhibiting viral attachment and internalization³³.

The material source of *Z. officinale* used by traditional healers was classified into two types: cultivation and taking wild plants, and the second was bought from the market. Figure 4 revealed that most of *Z. officinale* administered by healers came from cultivation and wild plants, and the remaining source was buying from the market. Both wild harvesting and cultivation have their advantages and disadvantages. Unwell management of wild harvesting tends to accelerate the extinction of medicinal plant species and populations; moreover, the standardization of herbs' quality may not be controlled. However, it was conveyed that wild

harvesting positively impacts public awareness in protecting the habitat, population, and genetic variation of wild-type species³⁴. Meanwhile, cultivating medicinal plants in home gardens is better at continuously providing herbal medicines and income-generating, especially for households^{35,36}. On a greater scale of cultivation, the standard process of production, post-harvest, and quality assurance may be managed³⁴.

Figure 5 exhibited rhizome as the most prominent plant part used of *Z. officinale*. Rhizome has been broadly used for many beneficent purposes, both traditional and modern applications³⁷. This result corresponds to several previous studies. *Z. officinale* rhizome was reported to have more phytochemical constituents and antimicrobial agents than in leaf³⁸. Flavonoids, essential oils, curcumins, and gingerols are responsible for the pharmacological activities accumulated in oil cells and cavities of *Z. officinale* rhizome. The more mature the rhizome, the higher the essential oil possessed by *Z. officinale*³⁹. Previous studies have revealed a linear association between plant maturity, total phenol concentration, and antioxidant activity^{40,41}.

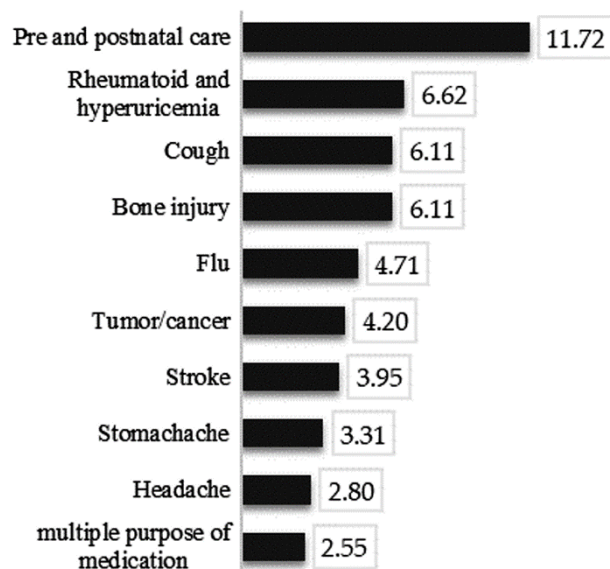


Fig. 3 — The percentage of top ten disease healing by traditional healers using *Zingiber officinale*

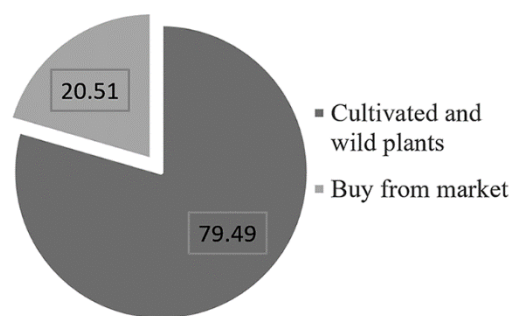


Fig. 4 — Plant sources

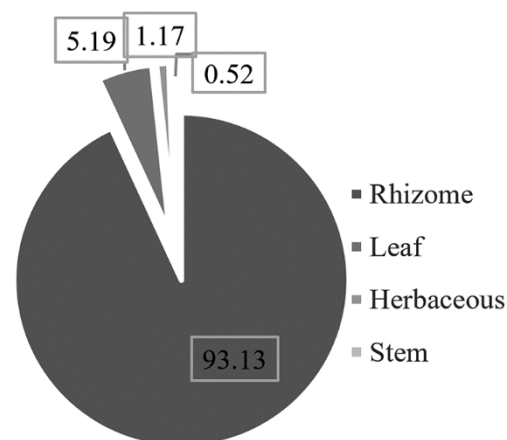


Fig. 5 — Plant part used

The study demonstrated the use of *Z. officinale* for the treatment of 69 diseases, and the dose form was generally in the form of a mixture rather than a single ingredient, as shown in Figure 6. According to Syahrir *et al.*⁴², *Z. officinale* has the strongest synergistic impact of antihyperglycemic action when combined with *Momordica charantia* or *Tinospora crispa*. In contrast to conventional medicine, which bases its activity on a chemical compound, medicinal plants that play a pivotal role in drug bio-sources exhibit their pharmacological effects through additive and even antagonism mechanisms among all compositions⁴³.

There are several ways of utilizing *Z. officinale* for health purposes. Figure 7 showed that the internal route of administration was the most common way of consuming *Z. officinale*, while inhalation was the last one; however, the use of *Z. officinale* by external use was also quite a lot. In this study, the internal route was defined as taking the mixture orally. In contrast, using more than one administration route was categorized as a combination way. This finding is met with as per the General Guidelines for Methodologies on Research and Evaluation of Traditional Medicine published by the World Health Organization;

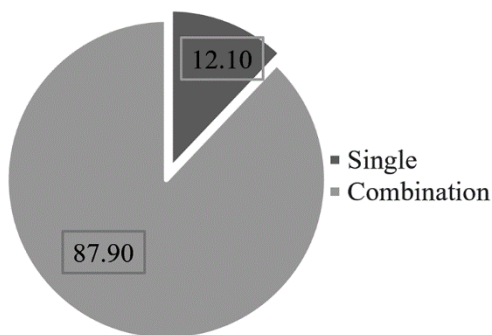


Fig. 6 — Formula composition

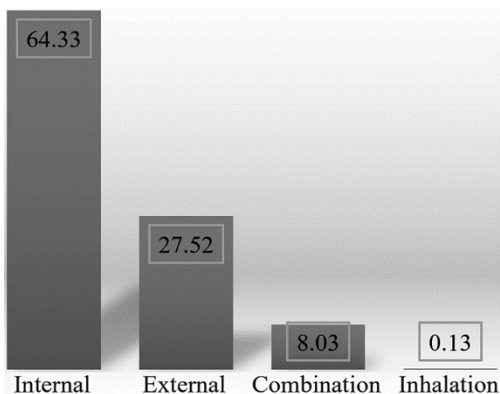


Fig. 7 — Administration route

meanwhile, the oral route is the established regular clinical administration route of herbal medicines⁴⁴.

The study revealed that the five highest UV of *Z. officinale* were for pre- and postnatal care (0.199), rheumatic (0.113), bone injury (0.104), cough (0.104), and common cold (0.080). When the UV score is close to zero (0), only a few reports are related to its use. Furthermore, the understanding of traditional healers to employ the species for specific health goals influences the high UV score⁴⁵. A high score of UV described that the relative importance of *Z. officinale* in treating particular ailments is more than others. In this study, the UV of *Z. officinale* to treat pre and postnatal cases was relatively the most important among other diseases. Use values are high when many useful reports for a plant imply the community's plant importance. Many ethnic groups in Indonesia essentially need *Z. officinale* to treat various ailments. That species was widely distributed in 34 provinces all over Indonesia and well adapted to diverse geographical types. The condition led to the different genetic diversity and phytochemical contents of *Z. officinale* that need further observation.

It is intended that the findings of this study would have a favorable impact on and benefit multiple stakeholders. Aside from being recorded as research results and nationally documented, the findings of this study, involving knowledge and skills on traditional remedy techniques and diverse traditional components employed, may be further investigated in terms of its development potential. The contribution of study results to the government, particularly to the Ministry of Health, is that research results that have been demonstrated to be efficacious and safe may be shared to the communities, increasing the effectiveness of their benefits. Along with that, the central and regional governments might urge the community to conserve plants with high potential for preservation and development. The findings of the current research may benefit the industry by providing a basis for the development of health-related products that are more cost-effective and convenient for consumers to use. Local communities can also play a significant role in maintaining traditional medical knowledge and skills, as well as medicinal plants that are used through plant cultivation.

Conclusion

The study demonstrated the crucial role of traditional healers in treating various diseases using *Z. officinale*, with 785 traditional usage reports of

Z. officinale being used to cure 69 ailments by 462 traditional healers from 254 ethnic groups in 34 provinces in Indonesia. Internal administration routes were the most prevalent method of using *Z. officinale* for health purposes. Pre- and postnatal care was recorded as the most frequent indication of *Z. officinale* practiced by traditional healers. *Z. officinale* was primarily used in concoction formulation rather than a single administration. Further study is needed to examine the chemical components and the mechanisms of action involved in each indication.

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Conflict of Interest

The authors declare that there is no conflict of interest regarding the publication of this manuscript.

Authors' Contributions

Conceptualization, NR, FIM, SH, IYMS, DS, HW, RM, AM, and YW; methodology, AM and FIM; software, DS and RM; validation, HW, NR, and DS; formal analysis, NR and IYMS; investigation, FIM; resources, YW; data curation, DS and RM; writing—original draft preparation, DS, HW, NR, FIM, SH, IYMS, RM, AM, and YW; writing, review and editing, DS, HW, NR, FIM, SH, IYMS, RM, AM, and YW; visualization, IYMS; supervision, YW, HW, and SH. All authors have read and agreed to the published version of the manuscript.

References

- Jakribettu R P, Bloor R, Bhat H P, Thaliath A, Haniadka R, *et al.*, Ginger (*Zingiber officinale* Rosc.) oils, *Essent Oils Food Preserv Flavor Saf*, (October 2017) (2016) 447-454.
- Pora S, Kuswanjono A & Hadi H, Epistemological implications of maluku spices against European minds in xiv-xvii century, *Int J Sci Technol Res*, 9 (4) (2020) 1109-1114.
- Shahrajabian M H, Sun W & Cheng Q, Pharmacological uses and health benefits of ginger (*Zingiber officinale*) in traditional Asian and ancient Chinese Medicine, and modern practice, *Not Sci Biol*, 11 (3) (2019) 309-319.
- Braga S S, Ginger: Panacea or consumer's hype? *Appl Sci*, 9 (8) (2019) 1-16.
- Setyawan A D W I, Wiryanto, Suranto & Bermawie N, Variation in the isozymic pattern of germplasm from three ginger (*Zingiber officinale*) varieties, *Nusantara Biosci*, 6 (1) (2014) 86-93.
- Dhanik J, Arya N, Nand V & Jyotsna Dhanik C, A review on *Zingiber officinale*, *J Pharmacogn Phytochem*, 6 (3) (2017) 174-184.
- Wijaya S, Indonesian food culture mapping: A starter contribution to promote Indonesian culinary tourism, *J Ethn Foods*, 6 (1) (2019) 1-10.
- Peltzer K & Pengpid S, Traditional health practitioners in Indonesia: their profile, practice and treatment characteristics, *Complement Med Res*, 26 (2) (2019) 93-100.
- Mustofa F I, Rahmawati N & Aminullah, Medicinal plants and practices of Rongkong traditional healers in South Sulawesi, Indonesia, *Biodiversitas*, 21 (2) (2020).
- Subositi D & Wahyono S, Study of the genus *Curcuma* in Indonesia used as traditional herbal medicines, *Biodiversitas*, 20 (5) (2019) 1356-1361.
- Jaradat N A, Ayesh O I & Anderson C, Ethnopharmacological survey about medicinal plants utilized by herbalists and traditional practitioner healers for treatments of diarrhea in the West Bank/Palestine, *J Ethnopharmacol*, 182 (2016) 57-66.
- Semenya S S & Potgieter M J, Bapedi traditional healers in the Limpopo Province, South Africa: Their socio-cultural profile and traditional healing practice, *J Ethnobiol Ethnomedicine*, 10 (1) (2014) 1-12.
- Heriadi M, Perandantugas dukun bayi dalam penanganan kesehatan di Desa Talang Perapat, Kecamatan Seluma Barat, Kabupaten Seluma, *J Hawa*, 2 (1) (2020) 1-10.
- Shewamene Z, Dune T & Smith C A, The use of traditional medicine in maternity care among African women in Africa and the diaspora: A systematic review, *BMC Complement Altern Med*, 17 (1) (2017) 1-16.
- Pandikumar P, Chellappandian M, Mutheeswaran S & Ignacimuthu S, Consensus of local knowledge on medicinal plants among traditional healers in Mayiladumparai block of Theni District, Tamil Nadu, India, *J Ethnopharmacol*, 134 (2) (2011) 354-362.
- Mathibela M K, Egan B A, Du Plessis H J & Potgieter M J, Socio-cultural profile of Bapedi traditional healers as indigenous knowledge custodians and conservation partners in the Blouberg area, Limpopo Province, South Africa, *J Ethnobiol Ethnomed*, 11 (1) (2015) 1-11.
- Ghimire K, Adhikari M, Uprety Y & Chaudhary R, Ethnomedicinal use of plants by the highland communities of Kailash Sacred Landscape, Far-west Nepal, *Acad J Med*, 6 (11) (2018) 365-378.
- Hutabarat N C, Supriyana & Suhartono, The effect of extract red ginger (*Zingiber officinale* Var. Rubrum) on reducing the blood pressure level among maternal with gestational hypertension, *Int J Nurs Health Serv*, 3 (4) (2020) 479-488.
- Dissanayake K G C, Waliwita A L C W & Liyanage R P, A review on medicinal uses of *Zingiber officinale* (ginger), *Int J Health Sci Res*, 10 (6) (2020) 142-148.
- Rosadi S D, Nisyawati N & Putrika A, Plants diversity on postpartum recovery medical used in sundanese community

- forecourts in Cibural village, Banten, In: *AIP Conference Proceedings*, Volume 2023, (2018) 020117-1-020117-4.
- 21 Saanin S N, Wahyudianingsih R, Afni M, Afifah E, Maesaroh M, *et al.*, Suppression of pro-inflammatory cytokines and mediators production by ginger (*Zingiber officinale* Roscoe) ethanolic extract and gingerol in lipopolysaccharide induced RAW 264.7 murine macrophage cells, *Indian J Nat Prod Res*, 11 (4) (2020) 260-266.
 - 22 Zumaidar, Saudah, Rasnovi S & Harnelly E, Indigenous knowledge of postnatal mother care using plants by acehnese, In: *IOP Conference Series: Earth and Environmental Science*, Volume 364, 2019.
 - 23 Santoso E A, Jumari J & Utami S, Inventory of medicinal plants for pregnant and postpartum women in Dayak Tomun of The Lopus Village Lamandau Regency of Central Kalimantan, *Biosaintifika, J Biol Biol Edu*, 11 (1) (2019) 25-31.
 - 24 Mishra R K, Kumar A & Kumar A, Pharmacological activity of *Zingiber officinale*, *Int J Pharm Chem Sci*, 1 (3) (2012) 1073-1078.
 - 25 Jamal J A, Ghafar Z A & Husain K, Medicinal plants used for postnatal care in Malay traditional medicine in the Peninsular Malaysia, *Pharmacogn J*, 3 (24) (2011) 15-24.
 - 26 Ebrahimzadeh Attari V, Ostadrahimi A, Asghari Jafarabadi M, Mehrizadeh S & Mahluji S, Changes of serum adipocytokines and body weight following *Zingiber officinale* supplementation in obese women: A RCT, *Eur J Nutr*, 55 (6) (2016) 2129-2136.
 - 27 Mahmoud R H & Elnour W A, Comparative evaluation of the efficacy of ginger and orlistat on obesity management, pancreatic lipase and liver peroxisomal catalase enzyme in male albino rats, *Eur Rev Med Pharmacol Sci*, 17 (1) (2013) 75-83.
 - 28 Pertiwi E M E, Awaludin S & Sumeru A, The effect of combination therapy of a warm ginger stew compress and Ki. 3 point acupressure on the pain level of gout arthritis patients in Indonesia, *J Ners*, 14 (2) (2019) 151.
 - 29 Saputri A A D A, Amin J & Azizahwati, Pengaruh pemberian kombinasi ekstrak air akar kucing (*Acalypha indica* Linn.) dengan ekstrak etanol 70% rimpang jahe merah (*Zingiber officinale* Rosc.) terhadap penurunan kadar asam urat tikus putih, *Majalah Ilmu Kefarmasian*, 8 (3) (2011) 141-153.
 - 30 Imtiyaz S, Rahman K, Sultana A, Tariq M & Chaudhary S S, (*Zingiber officinale* Rosc.): A traditional herb with medicinal properties, *Tang [Human Tradit Med]*, 3 (4) (2013) 26.1-26.7.
 - 31 Singh V, Medicinal plants and bone healing, *Natl J Maxillofac Surg*, 8 (1) (2017) 4.
 - 32 Semwal R B, Semwal D K, Combrinck S & Viljoen A M, Gingerols and shogaols: Important nutraceutical principles from ginger, *Phytochem*, 117 (2015) 554-568.
 - 33 Chang J S, Wang K C, Yeh C F, Shieh D E & Chiang L C, Fresh ginger (*Zingiber officinale*) has anti-viral activity against human respiratory syncytial virus in human respiratory tract cell lines, *J Ethnopharmacol*, 145 (1) (2013) 146-151.
 - 34 Schippmann U, Leaman D J & Cunningham A, Impact of cultivation and gathering of medicinal plants on biodiversity: Global trends and issues, In: *Biodiversity and the ecosystem approach in agriculture, forestry, and fisheries*, edited by FAO, (FAO, Rome), (2002) 142-167.
 - 35 Singh K K, Singh S, Kumari B, Paliwal A, Chauhan J, *et al.*, Income generation of farmers via medicinal plants cultivation: A review, *Int J Pure Appl Biosci*, 7 (4) (2019) 174-177.
 - 36 Oktaviani A D, Ulayyah N N P, Yuliani T S, Rahayu M S, Lubis I, *et al.*, Use of yard land to meet family needs in Cintalaksana Village, Tegalwaru District, Karawang Regency, *J Pusat Inovasi Masyarakat*, 2 (4) (2020) 535-539.
 - 37 Ujang Z, Nordin N I & Subramaniam T, Ginger species and their traditional uses in modern applications, *J Ind Technol*, 23 (1) (2015) 59-70.
 - 38 Saad R, Wai L, Hanif N, Yusuf E & Asmani F, Comparative studies of *Zingiber officinale* leaves and rhizomes on the antibacterial effect, *Int J Pharm Anal Res*, 3 (3) (2014) 262-268.
 - 39 Liu H, Specht C D, Zhao T & Liao J, Morphological anatomy of leaf and rhizome in *Zingiber officinale* Roscoe, with emphasis on secretory structures, *Hort Sci*, 55 (2) (2020) 204-207.
 - 40 Vedashree M & Madhava N M, Influence of ginger cultivars and maturity stages on oleoresin, 6-gingerol, polyphenol contents and antioxidant property, *Indian J Exp Biol*, 61 (2023) 373-378.
 - 41 Tebboub I & Kechrid Z, Effect of ginger on zinc, lipid profile and antioxidants levels in blood and liver of streptozotocin induced diabetic rats fed on zinc deficiency diet, *Indian J Exp Biol*, 59 (2021) 168-176.
 - 42 Syahrir N H A, Afendi F M & Susetyo B, Efek sinergis bahan aktif tanaman obat berbasiskan jejaring dengan protein target, *J Jamu Indonesia*, 1 (1) (2016) 35-46.
 - 43 Jyoti P, Prasad D, Mohammad S & Dhruv D, Herbs as traditional medicines: A review, *J Drug Delivery Ther*, 8 (5) (2018) 146-150.
 - 44 Anonim, General Guidelines for Methodologies on Research and Evaluation of Traditional Medicine, *World Health Organization*, (2000) 1-74.
 - 45 Ullah S, Khan M R, Shah A, Shah S A, Majid M, *et al.*, Ethnomedicinal plant use value in the Lakki Marwat District of Pakistan, *J Ethnopharmacol*, 158 (Part A) (2014) 412-422.