

An Ethnomedicine Study of Traditional Healers as Joint Pain Therapy in Bantul District, Yogyakarta

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Yogyakarta, Bantul Bölgesinde Eklem Ağrısı Tedavisi Olarak Geleneksel Şifacıların Etnomedikal Bir Çalışması

SUMMARY

Joint pain is a sign of disorders of the musculoskeletal system. In joint pain, there is usually discomfort, swelling, inflammation, and stiffness that cause movement restrictions. Bantul is the district with the lowest prevalence of joint disease in Yogyakarta, Indonesia. It related to the community culture in using traditional herbs to treat the disease. This study aims to determine the types of plants, the process of making traditional herbal medicine, and ways to use herbs to treat joint pain complaints. Traditional knowledge about using local plants was collected through field surveys. The 48 healers from 3 hamlets in Bantul District were found by snowball sampling technique and 47 traditional herbal medicines were recorded as being applied for joint pain treatment. Among traditional herbal medicines are identified that they use 33 plants belonging to 18 families, and the most widely used family is Zingiberaceae. Raw materials were detected to process by washing, boiling, pounding, grinding, pulverizing, and squeezing and used orally and topically (compress). This study showed that most of people in the Bantul District still depend on medicinal plants to treat diseases. Nevertheless, there are only a few traditional healers. There is a great danger that traditional knowledge will soon be lost because the young generation is not concerned about continuing this custom.

Key Words: Traditional herbs, joint pain, Kiringan, Mangunan, Kunden

ÖZ

Eklem ağrısı, kas-iskelet sistemi bozukluklarının bir işaretidir. Eklem ağrılarında genellikle hareket kısıtlılığına neden olan rahatsızlık, şişlik, iltihaplanma ve sertlik vardır. Bantul, Yogyakarta'da eklem hastalığı prevalansının en düşük olduğu bölgedir. Eklem hastalığının düşük prevalansı, hastalığı tedavi etmek için geleneksel bitkileri kullanan toplumun kültürü ile ilgili olabilir. Bu çalışmanın amacı, eklem ağrısı şikayetlerini tedavi etmek için geleneksel bitkisel ilaç yapımında kullanılan bitki türlerini, kullanılan bitkilerin nasıl işlendiğini ve eklem ağrılarını tedavi etmek için şifalı bitkilerin nasıl kullanıldığını belirlemektir. Kullanılan yerel bitkiler hakkında geleneksel bilgiler saha araştırmaları ile toplanmıştır. Yogyakarta, Bantul Mahallesi'ndeki 3 mezradan kartopu örnekleme tekniği ile 48 şifacı bulunmuştur. Eklem ağrısı tedavisi için uygulanan 47 adet geleneksel bitkisel ilaç kaydedilmiştir. Geleneksel bitkisel ilaçlar arasında tespit edilenler 18 familyaya ait 33 bitki kullanılmaktadır ve en çok kullanılan familya Zingiberaceae'dir. Ham materyallerin yıkanarak, kaynatılarak, dövülerek, öğütülerek, toz haline getirilerek ve sıkılarak işlendiği ve dahilen ve haricen (kompres) kullanıldığı tespit edilmiştir. Bu çalışma, Bantul Mahallesi'ndeki insanların çoğunun hastalıkları tedavi etmek için hala şifalı bitkilere bağımlı olduğunu göstermektedir. Bununla birlikte, sadece birkaç geleneksel şifacı kalmıştır. Genç nesil bu geleneği sürdürmekle ilgilenmediği için geleneksel bilginin yakında kaybolma tehlikesi söz konusudur.

Anahtar Kelimeler: Geleneksel bitkiler, eklem ağrısı, Kiringan, Mangunan, Kunden

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INTRODUCTION

Joint pain is a sign of disorders of the musculoskeletal system. Joint pain is caused by immune mechanisms, metabolic factors, genetics, environment, and age (Sunaringtyas et al. 2019). In joint pain, there will usually be discomfort, swelling, inflammation, and stiffness that can cause movement restrictions. Musculoskeletal diseases that can cause joint pain include osteoarthritis, gouty arthritis, rheumatoid arthritis, and infectious arthritis (Noviyanti and Azwar, 2021). Joint pain management involves pharmacological and non-pharmacological therapies (Sunaringtyas et al. 2019). Pharmacological therapy is carried out to reduce pain by administering non-steroidal anti-inflammatory drugs (NSAIDs). Besides that, bone surgery therapy (joint replacement) is a therapy that is widely used as a treatment option (Rachmawati et al. 2018). One of the non-pharmacological therapies can be done with warm compresses. With the application of heat, the blood vessels will widen to improve blood circulation in the tissue, and the process of distributing food to cells will increase. Increased cell activity will reduce pain/pain and will support the wound-healing process and the inflammatory process (Hannan et al. 2019).

The low prevalence of joint disease can be influenced by the distinctive culture that is owned and still carried out by the people of the Special Region of Yogyakarta, who are full of noble values including the culture of using traditional herbs to prevent and treat diseases (Yogyakarta Health Office, 2021). In Indonesia, using of traditional herbs has become a culture and tradition since time immemorial. The people of Bantul Regency, Yogyakarta Province, used traditional herbs such as 'Jamu Gendong,' 'Jamu Simplicia,' and 'Jamu Instant' to maintain their health. Some examples of herbs to treat joint pain are 'Jamu Cabe Puyang' which consists of Javanese long pepper (*Piper retrofractum* Vahl.) fruit, bitter ginger (*Zingiber*

zerumbet (L.) J.E. Smith) rhizome, turmeric (*Curcuma longa* L.) rhizome, kedawung (*Parkia roxburghii* G. Don) seeds, ginger (*Zingiber officinale* Roscoe) rhizome, tamarind (*Tamarindus indica* L.) fruit, coconut (*Cocos nucifera* L.), sugar, salt, and water (Sukini, 2018). The use of traditional herbal medicine in Bantul District can be seen in several traditional herbal medicine industry centers, namely Kiringan, Mangunan, and Kunden hamlets.

Traditional products derived from plants and natural materials have the potential to develop as an alternative medicine to treat joint pain. Treatment using traditional herbs is in great demand because it is considered more affordable and has lower side effects compared to treatment methods using conventional drugs (Abat et al. 2017). An in-depth study needs to be carried out to find out the concept of the people of Kiringan, Mangunan, and Kunden hamlets, Bantul district in treating joint pain therapy.

The purpose of this study was to identify the traditional medicinal plants in traditional herbal medicine and their use in the Bantul district of Yogyakarta. This research is the first study on the local wisdom of the Bantul ethnic about osteoarthritis (OA) and its treatment methods that they have practiced from generation to generation. In particular, this study is intended to invent and document herbals applied by healers in their joint pain therapy.

MATERIAL AND METHODS

Study Area

This research was conducted in the Bantul district, Yogyakarta, as shown in Figure 1 shows is one of the districts in the special region of Yogyakarta, Indonesia. This district has an area of 508.85 km² and a population of 954,706 people. Bantul district is located between the coordinates of 07° 44' 04" – 08° 00' 27" south latitude and 110° 12' 34" – 110° 31' 08" east longitude. Bantul district has a tropical

climate, the rainy season is usually from November to April, and the dry season is usually from May to October. The type of climate influences the diversity of medicinal plants in this area. The rainfall in Bantul is 1942 mm per year with rainy days ranging from 100–130 rainy days, and the months with the highest rainfall are January and February. Temperatures are consistent throughout the year, with average temperatures ranging from 22° to 31°C. Specifically, data collection was carried out in three hamlets in Bantul District, namely Kiringan, Mangunan, and Kunden hamlets.

Demographic Profile of Healers

The demographic profiles of healers are shown in Table 1. More than 50% of healers are over 50 years old. The final education of the healer is described as follows, as much as 8% are illiterate, 40% have an

absolute education in elementary school, and the rest have the last education in junior high school, high school, and bachelor’s degree. Almost all the healers are entrepreneurs (selling herbs). In addition, most of them are natives of Bantul District, Yogyakarta.



Figure 1. Map of Yogyakarta; Bantul District

Table 1. Demographic profile of healers (N=48)

Parameters	Group	Amount of Informant	
		N	%
Domicile	Kiringan hamlets	44	92
	Mangunan hamlets	2	4
	Kunden hamlets	2	4
Gender	Male	0	0
	Female	48	100
Age	< 49 years old	23	48
	50-69 years old	22	46
	> 70 years old	3	6
Education Levels	Illiterate	4	8
	Elementary School	19	40
	Junior High School	9	19
	Senior High School	14	29
Main Profession	Diploma/Bachelor Degree	2	4
	Entrepreneur (Selling herbal medicine)	48	100

Knowledge of Healers

The knowledge of healers about traditional medicinal plants was obtained in several ways, namely: (1) learning from parents as a legacy of family knowledge, (2) observing traditional medical practices carried out

by parents or traditional healers in the hamlets, (3) experiencing illness and being treated with traditional medicine, (4) attending training and learning from books was shown in Table 2. Around 73% of the informants obtained the potions from heredity or learning from parents as a legacy of family knowledge.

Table 2. The knowledge of healers about traditional medicinal plants (N=48)

Local Concept	Group	Amount of Informant	
		N	%
Knowledge & experimental	Hereditary	35	73
	Learn from Training	6	13
	Learn from friends/neighbors	4	8
	Personal Experience	2	4
	Learn from Books, etc.	1	2
Attending of Training	Yes	5	10
	Never	43	90

Interview Methods with Healers

Before conducting the research, we obtained an ethical test license from the health research ethics committee of Universitas Airlangga with certificate number 04/LE/2022. An amount of 48 female healers involved in this study, as shown in Table 1. The informants are residents of the hamlets of Kiringan, Mangunan, and Kunden who work as an herbalists and are at least 21 years old. Informants who know about ingredients for complaints of joint pain are willing to become informants in the study. The selection of informants was made by purposive sampling and snowball sampling. Data was collected using field research, and data collection methods were conducted by interviewing informants who know joint pain treatment, observation, and documentation. This research was conducted in Bantul District, Yogyakarta. In the snowball sampling technique, the information of the second informant is received by asking the first informant, and so on.

Plant Materials

Traditional herbal medicines used by healers were collected during interviews and they were identified at the Materia Medika Institute, Batu. The traditional herbal medicines were deposited in the order of voucher specimen numbers from BY-1 to BY-47. In addition, identification of the plants used in these traditional herbal medicines was also carried out. These plants are given the number code B1-B33 based on the amount of use. All of the specimens deposited at the Natural Products Drug Discovery & Development-Research Group, Faculty of Pharmacy Universitas Airlangga.

Data Analysis

Data analysis in this study was carried out qualitatively and quantitatively. Quantitative analysis is done by calculates the relative frequency of citations (RFC) and Family Important Value (FIV). RFC is used to describe the distribution of community knowledge in using plants to overcome joint pain complaints which are calculated by the formula; $RFC = Fc/N$, where Fc is the

number of informants who mention the use of plant species and N the total number of informants participating in the survey. The RFC value is "0" if there is no use mentioned by the informant and 1 if a type is proper (Agbodeka et al. 2016). FIV distinguishes the most influential families based on the number of informants quoted and the number of plant species used for treatment. FIV is calculated using the formula $FIV = (Fc/N) \times 100$, Where Fc is the quoting frequency of the plant family, and N is the number of total informants. The FIV value indicates the local importance of medicinal plant families ranging from 0 to 100, where the most essential family has a value close to 100 (Dapar et al. 2020).

RESULTS AND DISCUSSION

Jamu is traditional herbal medicine from Indonesia and is made from natural materials, such as roots, barks, flowers, seeds, leaves, and fruits of plants. It is also acquired from animals, such as honey, royal jelly, milk, and native chicken eggs are often used as well. Jamu is one of the identities of the people in Central Java, one of which is the people in the Bantul District, because they drink it not only for healing but also for disease prevention. The discussion of herbal medicine also includes the ethnicity of healers. This ethnic group believes in the value and efficacy of jamu, so they influenced other groups involved or not in traditional medicine culture. This value and effectiveness make a group of people who believed in it consume jamu every day as human life mandatory, and providing cultural interpretation as a cognitive map (Spradley, 1997).

Ethnobotany and ethnopharmacology studies have an essential role discovering of new drugs and compounds (Yadav et al.2015). Indonesia is a country with a tropical climate and has a diversity of plants that play an essential role in the discovery of new medicinal plants. Each plant produces varying amounts of secondary metabolites, depending on its defense system against herbivores and pathogens (Rani and Jyothsna, 2010; Adenubi et al. 2016). These compounds work synergistically to increase potency, reduce side

effects, and develop resistance (Adenubi et al. 2018).

Most of the patients who went treatment at traditional healers in Bantul district come from the same area (85%), the rest are from outside (15%), and the traditional healers give the potion directly. Healers included in this study had a long experience of which there were working as herbalists for less than 10 years (33%), for 10-30 years (29%), and for more than 30 years (38%). It shows that the informant has had much practical experience regarding traditional ingredients. This experience comes from the habit of the informant to observing or even learning about compounding by using traditional herbal medicine carried out by previous generations. Healers have several ways of selling or marketing their herbal products, including selling products by walking around (79%), selling permanently in a place (15%) such as markets and herbal medicine stalls, and marketing products through online media (6%). The herbal products sold are herbal medicine according to the wishes of consumers. Usually, these herbs are served in coconut shells or "Batok" and consumed individually direct. Special herbs sold online are herbal products that can be stored for an extended of time.

From the survey data in this study, we got 47 traditional herbal medicines consisting of 33 types of plants used by traditional healers in the Bantul district to treat joint pain. Distribution knowledge of healers in utilizing plants to overcome joint pain complaints is described through the RFC. Based on the calculation of the RFC shows that the plant species that are most widely used in traditional herbal medicine for joint pain by traditional healers in the Bantul district include *Kaempferia galanga* L (0.778), *Zingiber officinale* Roescoe (0.667), *Oryza sativa* L. (0.352), *Curcuma xanthorrhiza* Roxb (0.241), and *Piper retrofractum* Vahl (0.204). Joint Pain treatment carried out by the healer consists of consuming the concoction orally (89%) and topical therapy utilizing compresses (11%) as shown in Table 3.

Table 3. Plants used in traditional herbal medicines for joint pain therapy by healers in Bantul District

Family	Plant Number	Plant name	Local name	Part(s) used	Preparations	Applications	RFC
Zingiberaceae	B-1	<i>Kaempferia galanga</i> L.	Kencur	Rhizome	Grounded and squeezed with warm water	Drink directly, 2-3 times a week	0.778
					Mixed with Oryza Seed, then mashed and applied to the part that feels painful	Compress-topical used	
Zingiberaceae	B-2	<i>Zingiber officinale</i> Roscoe	Jahe	Rhizome	Pounded and squeezed with warm water	Drink directly, 2-3 times a week	0.667
					Mashed and applied to the part that feels painful	Compress-topical used	
Poaceae	B-3	<i>Oryza sativa</i> L.	Beras	Seed	Mixed with Kaempferia Rhizome, then mashed and applied to the part that feels painful	Compress-topical used	0.352
Zingiberaceae	B-4	<i>Curcuma xanthorrhiza</i> Roxb.	Temulawak	Rhizome	Dried and pulverized. Put in hot water when consuming	Drink directly, 2-3 times a week	0.241
					Mashed and applied to the part that feels painful	Compress-topical used	
Piperaceae	B-5	<i>Piper retrofractum</i> Vahl	Cabe Jawa	Fruit	Pounded and boiled	Drink directly, 2-3 times a week	0.204
Zingiberaceae	B-6	<i>Zingiber zerumbet</i> (L.) J.E.Smith	Lempuyang	Rhizome	Dried and pulverized. Put in hot water when consuming	Drink directly, 2-3 times a week	0.185
Zingiberaceae	B-7	<i>Curcuma longa</i> L.	Kunyit	Rhizome	Grounded and squeezed with warm water	Drink directly, 2-3 times a week	0.111
Acanthaceae	B-8	<i>Andrographis paniculata</i> Nees	Sambiloto	Leaf	Washed and boiled	Drink directly, daily until the pain is gone	0.056
					Leaves and lime betel, then mashed and applied to the part that feels painful	Compress-topical used	
Myrtaceae	B-9	<i>Syzygium polyanthum</i> (Wight) Walpers	Daun salam	Leaf	Washed and boiled	Drink directly, daily until the pain is gone	0.056
Zingiberaceae	B-10	<i>Curcuma aeruginosa</i> Roxb.	Temu Ireng	Rhizome	Grounded and squeezed with warm water	Drink directly, 2-3 times a week	0.037
Poaceae	B-11	<i>Cymbopogon nardus</i> Rendle	Sereh	Leaf	Pounded and boiled	Drink directly, every day	0.037
Myrtaceae	B-12	<i>Syzygium aromaticum</i> (L.) Merrill & Perry	Cengkeh	Leaf	Pounded and boiled	Drink directly, a times a week	0.037
Zingiberaceae	B-13	<i>Amomum compactum</i> Soland.ex Maton	Kapulaga	Fruit	Pounded and boiled	Drink directly, times a week	0.037
Meliaceae	B-14	<i>Swietenia macrophylla</i> King	Mahoni	Seed	Pounded and boiled	Drink directly, 2-3 times a week	0.056

Zingiberaceae	B-15	<i>Curcuma mangga</i> Valenton & van Zijp	Temu mang-ga	Rhizome	Grounded and squeezed with warm water	Drink directly, 2-3 times a week	0.037
Apiaceae	B-16	<i>Foeniculum vulgare</i> Mill	Adas	Fruit	Pounded and boiled	Drink directly, times a week	0.037
Annonaceae	B-17	<i>Annona muricata</i> L.	Sirsak	Leaf	Washed and boiled	Drink directly, daily until the pain is gone	0.037
Poaceae	B-18	<i>Imperata cylindrica</i> (L.) Raeusch.	Alang-alang	Root	Pounded and boiled	Drink directly, daily until the pain is gone	0.037
Apocynaceae	B-19	<i>Alstonia scholaris</i> L. R. Br.	Kayu pule	Bark	Pounded and boiled	Drink directly, 2-3 times a week	0.019
Solanaceae	B-20	<i>Capsicum annuum</i> L.	Cabai	Fruit	Pounded and boiled	Drink directly, 2-3 times a week	0.019
Fabaceae	B-21	<i>Parkia roxburghii</i> G.Don.	Kedawung	Seed	Pounded and boiled	Drink directly, 2-3 times a week	0.019
Leguminose	B-22	<i>Tamarindus indica</i> L.	Asam Jawa	Fruit	Grounded and squeezed with warm water	Drink directly, daily until the pain is gone	0.019
Rutaceae	B-23	<i>Justicia gendarussa</i> Burm.f.	gandarusa	Leaf	Washed and boiled	Drink directly, daily until the pain is gone	0.019
					Leaves and Ginger Rhizome, then mashed and applied to the part that feels painful	Compress-topical used	
Lauraceae	B-24	<i>Cryptocarya massoia</i> (Oken) Kosterm	Mesoyi	Bark	Pounded and boiled	Drink directly, 2-3 times a week	0.019
Caricaceae	B-25	<i>Carica papaya</i> L.	Pepaya	Leaf	Washed and boiled	Drink directly, daily until the pain is gone	0.019
Sterculiaceae	B-26	<i>Helicteres isora</i> L.	Kayu ules	Fruit	Pounded and boiled	Drink directly, 2-3 times a week	0.019
Solanaceae	B-27	<i>Physalis angulata</i> L.	Cipluk	Fruit, Leaf	Pounded and boiled	Drink directly, 2-3 times a week	0.019
Fabaceae	B-28	<i>Caesalpinia sappan</i> L.	Secang	Bark	Pounded and boiled	Drink directly, 2-3 times a week	0.019
Lamiaceae	B-29	<i>Orthosiphon stamineus</i> (Blume) Miq.	Remujung	Leaf	Washed and boiled	Drink directly, daily until the pain is gone	0.019
Myrtaceae	B-30	<i>Eucalyptus alba</i> Reinw. Ex Blume	Ceplik	Seed	Pounded and boiled	Drink directly, 2-3 times a week	0.019
Oleaceae	B-31	<i>Jasminum sambac</i> (L.) Sol. ex Aiton	Melati	Flower	Washed and boiled	Drink directly, every day	0.019
Lauraceae	B-32	<i>Cinnamomum burmannii</i> (Nees & T.Nees)	Kayu manis	Bark	Pounded and boiled	Drink directly, 2-3 times a week	0.019
Piperaceae	B-33	<i>Piper cubeba</i> L.	Kemukus	Fruit	Pounded and boiled	Drink directly, 2-3 times a week	0.019

Several parts of the plants are used by healers, such as leaves (9 species), rhizome (7 species), fruits (8 species), seeds (4 species), bark (4 species), roots, and flowers. Leaves are the most widely used plant parts in traditional herbal medicines to treat joint pain. Processing plants into ingredients is also done simply, namely by boiling all or part of the plant. Leaves are the primary photosynthetic organs of plants and are the most commonly used plant parts because they contain helpful bioactive compounds. In this study, it was stated that the use of herbs traditionally could

be done orally 2-5 times a week or up to complaints of pain felt better. After the pain has improved, this herb is still carried out as a preventive effort for the emergence of back pain. In addition to the use of herbal medicine, to prevent joint pain complaints as well must be accompanied by a healthy lifestyle.

Another way to be applied is by crushing one or a mixture of plant parts into a paste and then squeezing it into fruit juice. The following are 47 traditional herbal medicines produced by traditional healers in the Bantul district, Yogyakarta, as shown in Table 4.

Table 4. Traditional herbal medicines for joint pain and their applications

Voucher Speciment No.	Compotition of Traditional Herb	Preparation Methode	Application of Traditional Herb
BY-1	Mixed of plants B-2, B-4, B-5, B-6, and B-7	Washed, grounded, and squeezed with warm water	consumed orally
BY-2	Mixed of plants B-1, B-2, B-10, and B-15	Washed, pounded, crushed, and squeezed with warm water.	consumed orally
BY-3	Mixed of plants B-7, B-7, B-8, and B-9	Washed, pounded, crushed, and squeezed. Then the squeezed water is boiled	consumed orally
BY-4	Mixed of plants B-2 and B8	Mashed and applied to the part that feels painful	Used topically (compress)
BY-5	Mixed of plants B-1 and B-2	Washed, pounded, crushed ,and squeezed with warm water.	consumed orally
BY-6	Mixed of plants B-1, B-2, B-4, and B-22	Washed, boiled, drained, and take the boiled water	consumed orally
BY-7	Mixed of plants B-1, B-2, B-5, B7, and B-8	Washed, pounded, crushed, and squeezed with warm water.	consumed orally
BY-8	Mixed of plants B-1, B-2, B-3, and B-21	Washed, pounded, and squeezed	consumed orally
BY-9	Mixed of plants B-1, B-2, B-5, and B-6	Washed, pounded, crushed, and squeezed with warm water.	consumed orally
BY-10	Mixed of plants B-1 and B-2	Washed, pounded, crushed, and squeezed with warm water.	consumed orally
BY-11	Mixed of plants B-1 and B-3	Mashed and applied to the part that feels painful	Used topically (compress)
BY-12	Mixed of plants B-1 and B-2	Washed, pounded, crushed, and squeezed with warm water.	consumed orally
BY-13	Mixed of plants B-1, B-2, B-3, B-5, and B-6	Washed, pounded, crushed, and squeezed with warm water.	consumed orally
BY-14	Mixed of plants B-1 and B-22	Washed, pounded, and squeezed	consumed orally
BY-15	Mixed of plants B-1, B-2, and B-3	Washed, pounded, crushed, and squeezed with warm water.	consumed orally

BY-16	Mixed of plants B-1, B-3, and B-7	Washed, boiled, drained, and take the boiled water	consumed orally
BY-17	Mixed of plants B-1 and B-3	Washed, pounded, and squeezed	consumed orally
BY-18	Mixed of plants B-1 and B-2	Washed, pounded, crushed, and squeezed with warm water.	consumed orally
BY-19	Mixed of plants B-1, B-3, and B-8	Washed, pounded, crushed ,and boiled	consumed orally
BY-20	Mixed of plants B-4, B-5, B-6, B-7, B-12, and B-24	Washed, pounded, crushed, and squeezed with warm water.	consumed orally
BY-21	Mixed of plants B-1 and B-2	Mashed and applied to the part that feels painful	Used topically (compress)
BY-22	Mixed of plants B-7, B-22, and B-25	Washed, pounded, crushed, and squeezed with warm water.	consumed orally
BY-23	Mixed of plants B-1, B-2, and B-7	Washed, pounded, crushed , and squeezed with warm water.	consumed orally
BY-24	Mixed of plants B-1, B-2, B-13, and B-16	Washed, grounded, pounded, crushed, and boiled	consumed orally
BY-25	Mixed of plants B-1, B-4, B-5, B-6, and B-7	Washed, pounded, crushed, and squeezed with warm water.	consumed orally
BY-26	Mixed of plants B-1, B-3, B-7	Washed, pounded, crushed, and squeezed with warm water.	consumed orally
BY-27	Mixed of plants B-1, B-2, and B-3	Washed, pounded, crushed, and squeezed with warm water.	consumed orally
BY-28	Mixed of plants B-1 and B-2	Washed, pounded, crushed, and squeezed with warm water.	consumed orally
BY-29	Mixed of plants B-1, B-2, B-4, B-9, and B-16	Washed, grounded, pounded, crushed, and boiled	consumed orally
BY-30	Mixed of plants B-1, B-2, and B-3	Washed, pounded, crushed, and squeezed with warm water.	consumed orally
BY-31	Mixed of plants B-1, B-3, B-4, B-7 and B-22	Washed, grounded, pounded, crushed, and boiled	consumed orally
BY-32	Mixed of plants B-1 and B-2	Washed, pounded, crushed, and squeezed with warm water.	consumed orally
BY-33	Mixed of plants B-1, B-3, B-5, and B-6	Washed, pounded, drained, and boiled.	consumed orally
BY-34	Mixed of plants B-1 and B-2	Washed, pounded, crushed, and squeezed with warm water.	consumed orally
BY-35	Mixed of plants B-1 and B-3	Mashed and applied to the part that feels painful	Used topically (compress)
BY-36	Mixed of plants B-1, B-3, B-4, B-5, B-6, and B-15	Washed, grounded, pounded, crushed, and boiled	consumed orally
BY-37	Mixed of plants B-2 and B-23	Mashed and applied to the part that feels painful	Used topically (compress)
BY-38	Mixed of plants B-2, B-5, B-6, and B-18	Washed, grounded, pounded, crushed, and boiled	consumed orally
BY-39	Mixed of plants B-4, B-8, B-10, B-14, B-19, B-29, B-30, B-31, and B-32	Washed, pounded, drained, and boiled.	consumed orally

BY-40	Mixed of plants B-5, B-6, B-10, B-12, B-13, and B-33	Washed, dried, pounded, and brewed with warm water.	consumed orally
BY-41	Mixed of plants B-4, B-8, B-10, B-11, B-14, B-19, B-26, B-27, and B-28	Washed, pounded, drained, and boiled.	consumed orally
BY-42	Mixed of plants B-1, B-2, B-8, B-17, and B-18	Washed, grounded, pounded, crushed, and boiled	consumed orally
BY-43	Mixed of plants B-1, B-2, B-8, and B-14	Washed, pounded, crushed, and squeezed with warm water.	consumed orally
BY-44	Mixed of plants B-1, B-3, B-5, and B-6	Washed, pounded, crushed, and squeezed with warm water.	consumed orally
BY-45	Mixed of plants B-1, B-3, B-4, B-5, B-6, and B-15	Washed, grounded, pounded, crushed, and boiled	consumed orally
BY-46	Mixed of plants B-1, B-2, B-5, B-20, and B-21	Washed, pounded, crushed, and squeezed with warm water.	consumed orally
BY-47	Mixed of plants B-1, B-2, B-3, B-5, and B-6	Washed, pounded, crushed, and squeezed with warm water.	consumed orally

Through FIV analysis, 33 plant species were grouped into 18 families, the most common being Zingiberaceae (9 species) (26.47), followed by Poaceae (4 species) (8.82). Piperaceae (2 species) (8.82) (Table 5):-

Table 5. Family Important Value (FIV)

Family	Plant name	Local name	FIV
Zingiberaceae	<i>Zingiber officinale</i> Roscoe	Jahe	26.47
	<i>Curcuma longa</i> L.	Kunyit	
	<i>Curcuma aeruginosa</i> Roxb.	Temu Ireng	
	<i>Amomum compactum</i> Soland.ex Maton	Kapulaga	
	<i>Curcuma mangga</i> Valenton & van Zijp	Kunir mangga	
	<i>Kaempferia galanga</i> L.	Kencur	
	<i>Curcuma xanthorrhiza</i> Roxb.	Temulawak	
	<i>Zingiber zerumbet</i> (L.) J.E.Smith	Lempuyang	
Poaceae	<i>Oryza sativa</i> L.	Beras	8.82
	<i>Cymbopogon nardus</i> Rendle	Sereh	
	<i>Imperata cylindrica</i> (L.) Raeusch.	Alang-alang	
Myrtaceae	<i>Syzygium polyanthum</i> (Wight) Walp.	Daun salam	8.82
	<i>Syzygium aromaticum</i> (L.) Merrill & Perry.	Cengkeh	
	<i>Eucalyptus alba</i> Reinw. Ex Blume	Ceplik	
Piperaceae	<i>Piper retrofractum</i> Vahl.	Cabe Jawa	5.88
	<i>Piper cubeba</i> L.	Kemukus	
Lauraceae	<i>Cryptocarya massoia</i> (Oken) Kosterm	Mesoyi	5.88
	<i>Cinnamomum burmannii</i> (Nees & T.Nees)	Kayu manis	

Fabaceae	<i>Parkia roxburghii</i> G.Don.	Kedawung	5.88
	<i>Caesalpinia sappan</i> L.	Secang	
Solanaceae	<i>Capsicum annuum</i> L.	Cabai	5.88
	<i>Physalis angulata</i> L.	Cipluk	
Acanthaceae	<i>Andrographis paniculata</i> Nees	Sambiloto	2.94
Apocynaceae	<i>Alstonia scholaris</i> L. R. Br.	Kayu pule	2.94
Apiaceae	<i>Foeniculum vulgare</i> Mill.	Adas	2.94
Annonaceae	<i>Annona muricata</i> L.	Sirsak	2.94
Caricaceae	<i>Carica papaya</i> L.	Pepaya	2.94
Lamiaceae	<i>Orthosiphon stamineus</i> (Blume) Miq.	Remujung	2.94
Leguminose	<i>Tamarindus indica</i> L.	Asam jawa	2.94
Meliaceae	<i>Swietenia macrophylla</i> King	Mahoni	2.94
Oleaceae	<i>Jasminum sambac</i> (L.) Sol.ex Aiton	Melati	2.94
Sterculiaceae	<i>Helicteres isora</i> L.	Kayu ules	2.94
Rutaceae	<i>Justicia gendarussa</i> Burm.f.	Gendarusa	2.94

The most widely used plant species for joint pain therapy in the Bantul regency are from the Zingiberaceae family. This family is widely used in traditional medicine in Indonesia, and about 700 species are widely distributed globally (Christenhusz & Byng, 2016). This family members usually contain essential oils and flavonoids. Flavonoids represent the best-known and widespread group of plant phenolics and their biological actions include protection against allergies, platelet aggregation, microbes, tumors, ulcers, and inflammation (Okwu & Okwu, 2004).

One of the plants belonging to Zingiberaceae and widely used in traditional herbal medicines for treatment of joint pain by healers in the Bantul district is *Kaempferia galanga* was shown in Table 3. It is known in Indonesia as “Kencur” and it is a medicinal plant used empirically and occupies 16th place as the most widely used medicinal plant in traditional medicinal herbal formulas (Subositi et al. 2020). This plant is traditionally used as a medicine because it has anti-inflammatory, analgesic, antioxidant,

and antimicrobial properties (Subositi et al. 2020). According to Indonesian Herbal Pharmacopoeia, a thick extract of *Kaempferia galanga* rhizome contains essential oil not less than 7.93% v/w and ethyl-p-methoxycinnamate not less than 4.30%. Ethyl-p-methoxycinnamate is an anti-inflammatory constituent that can inhibit inflammation by suppressing interleukin-1, tumor necrosis factor (TNF), and angiogenesis by blocking endothelial function (Shetu et al. 2018).

In recent years, several studies have been conducted on the biological activity of ginger, including antioxidant, antimicrobial, anti-inflammatory, and anticancer (Mao et al. 2019). The content of phytochemical compounds that have been identified in ginger is zingerone, gingerdiol, gingerol, zingiberene, and shogaol. In addition, the content obtained from others includes essential oils, diarylheptanoids, paradol, zerumbone, 1-dehydro-(10) gingerdione, terpenoids, and flavonoids (Nutakor et al. 2020). In particular, shogaol and gingerols exhibit therapeutic activity in bone disease by inhibiting rheumatic

inflammation and autoimmune response (Hwang et al. 2017). The 6-gingerol and 6-shogaol have a sharp odor in the rhizome (Shahrajabian et al. 2019). Several *in vivo* and *in vitro* studies have been carried out to describe the activity of 6-shogaol which is the main bioactive constituent in dry rhizomes. *In vivo* studies, 6-shogaol significantly reduced inflammatory markers such as leukocyte infiltration or edema formation and demonstrated neuroprotective effects. Whereas *in vitro* studies, 6-shogaol inhibited proinflammatory compounds such as cyclooxygenase-2 (COX-2), weakened inducible nitric oxide synthase (iNOS) levels, and resulted in reduced nitric oxide (NO) levels, weakened the release of proinflammatory cytokines such as interferon, TNF, interleukins, and chemokines (Bischoff-Kont et al. 2021).

Curcuma xanthorrhiza known as “Temulawak” is also a species of the family Zingiberaceae which has many health benefits. The active compounds reported to have activity in temulawak are curcuminoids, curcumene, tumerone, xanthorhizol (Rahmat et al. 2021). The secondary metabolite with the highest number in temulawak rhizome is xanthorhizol (Rahmat et al. 2021). Xanthorhizol is one of the anti-inflammatory agents with a mechanism of inhibiting interleukin-6 (IL-6) and TNF- α and suppressing the expression of COX-2 and iNOS through the nuclear factor kappa B (NF- κ B) pathway resulting in reduced prostaglandin E2 (PGE2) and NO (Oon et al. 2015).

In addition to these plants, other plants are used by traditional healers in Bantul for joint pain therapy, such as *Piper retrofractum*, *Zingiber zerumbet*, *Curcuma longa*, and *Andrographis paniculata*. *Piper retrofractum* from the Piperaceae family is a medicinal plant because it contains several secondary metabolites including piperine, essential oil, piperidine, benzene, sesame, palmitic acid, and acid hydropiperic (Boangmanalu et al, 2018). In a study using the model arthritis animals, piperine exhibits

anti-inflammatory activity by inhibiting IL-6, matrix metalloproteinase-13 (MMP-13), activator protein (AP-1), and reduced PGE2 by significantly reducing rheumatism in mice (Bang et al. 2009).

Zingiber zerumbet known as “Lempuyang” is also a plant that comes from the Zingiberaceae family. The main compound in lempuyang is zerumbone which is a sesquiterpene with one ring of atoms in the molecule and having a double bond. Lempuyang extract has activity as an anti-inflammatory and analgesic (Ahmadabadi et al. 2019). Zerumbone has been reported to have acted as an anti-inflammatory and analgesic because it can prevent inflammation through lambda carrageenan and dinoprostone which are comparable to non-steroidal anti-inflammatory drugs from the oxacam class (Somchit et al. 2012; Hosseinpour et al. 2014).

Curcuma longa (turmeric) is a plant that belongs to the Zingiberaceae family. There are three main compounds found in turmeric, namely curcumin, demethoxycurcumin, and bisdemethoxycurcumin. Curcuminoids are the main secondary metabolites found in turmeric rhizomes. Curcumin, demethoxycurcumin, and bisdemethoxycurcumin can inhibit the activation of TNF-induced NF- κ B (Fuloria et al. 2022).

“Sambiloto” (*Andrographis paniculata*) is a plant that belongs to the family Acanthaceae. The main compound is andrographolide which acts as an anti-inflammatory, antipyretic, antimalarial, and antidiabetic agent (Prihatini et al. 2020). In a study using a collagen-induced arthritis model in rodents, andrographolide may reduce arthritis clinical scores, joint damage, and NO and TNF- α production (Gupta et al. 2018). Based on these, andrographolide can be used as an anti-inflammatory agent naturally or in the form of more powerful derivatives (Burgos et al. 2020).

In the study that has been accomplished, mahogany seeds (*Swietenia macrophylla*) contain secondary

metabolites, including flavonoids, alkaloids, and saponins, which are often used in traditional medicine and have anticancer, neuroprotective, anti-hyperglycemic, anti-inflammatory, antioxidant, and anti-viral activities (Moghadamtousi et al. 2013). These compounds can not only inhibit NO production, but can also downregulate the production of proinflammatory compounds such as IL-1 β , TNF- α , IFN- γ , IL-6, COX-2, and NF-kB (Mak et al. 2021). In addition, bay leaves (*Syzygium polyanthum*) contain flavonoids and tannins are two compounds that were suspected to be responsible for anti-inflammatory effects (Hasan et al. 2020). In a study using the ethanol extract of secang (*Caesalpinia sappan*), brazilin compound was found that can inhibit the expression of proinflammatory cytokines IL-1 β and TNF- α in IL-1 β stimulated chondrocytes and LPS-stimulated THP-1 macrophages (Jung et al. 2015). In jasmine, anti-inflammatory activity was found in root and leaf extracts, there has been no further research on compounds that have activity as analgesic and anti-inflammatory in jasmine flower extract (Bhangale et al. 2012).

Based on this study, 47 traditional herbal medicines consisting of 33 plant species from 18 families. 42 herbal medicine were used orally and 5 of them were used topically. The most widely used herbal medicine orally consists of *Kaempferia galanga* (Kencur) and *Zingiber officinale* (Ginger). The oldest healer (79 years) treats joint pain by giving *Kaempferia galangal* rhizome, *Oryza sativa* seed, *Curcuma xanthorrhiza* rhizome, and *Zingiber officinale* rhizome. All part plants were washed, peeled, pounded, squeezed and consumed 2 to 4 times a week. She also provides additional therapy through ginger compresses by mashing and attaching ginger to the painful part. Furthermore, the longest-practice healer of 50 years uses *Kaempferia galanga* rhizome and *Zingiber officinale* rhizome. A mixture

of these plants is pounded and squeezed using warm water. She also suggests to compressing the painful part with salt warm water. So Zingiberaceae plants are always present in every traditional herbal medicine that mentioned by the healer in the Bantul district, Yogyakarta.

In addition to the use herbal medicine orally, the healers in the Bantul district also recommended using of the herbal medicine topically by means of compress. The plants or ingredients used for compress are *Kaempferia galanga*, *Zingiber officinale*, *Curcuma xanthorrhiza*, *Andrographis paniculata*, *Justicia gendarussa*, salt, warm water, and cold water. They are prepared by smoothing each or a mixture of materials, then affixed to the painful area. For example, ginger rhizome as a warm compress is placed on the painful site and has a hot and spicy taste which relieves pain, stiffness, muscle spasms, or vasodilation of blood vessels (Fatmawati and Ariyanto, 2021).

In general, each herb from a healer in Bantul District consists of more than three plants that are believed to be efficacious in the prevention and treatment of various diseases, one of which is joint pain. The traditional herbal medicine is made by washing, boiling, pounding, grinding, crushing, and squeezing. The boiling process is to boil some ingredients with water then filter and drink regularly at a particular time. The boiling process is considered an effective process for extracting plant material and maintaining its stability in microbes (Kamatensi et al. 2011). However, this method has a weakness, namely if the heating is high enough and for a long time it can damage the active compounds contained in plants. Besides boiling, another method is pounding. The pounding process damages the tissue and breaks down the cell wall making it easier to remove active compounds present in the cells (Taek et al. 2019). The practice of traditional medicine by healers in the Bantul district has existed for a long time since the

treatment was passed down from one generation to the next. This knowledge is still known by parents and gradually disappears among young people because it is slowly being abandoned by society. The main reason is that many young people think that traditional medicine is primitive while modern medicine is practiced.

CONCLUSION

A total of 47 traditional herbal medicine consisting of 33 types of plants from 18 families were documented as medicinal plants for the treatment of joint pain by healers in the Bantul district, Yogyakarta. These plants are a resource that plays an essential role in the development of new drugs in the future. Many local pearls of wisdom and traditional experiences have disappeared. Therefore, ethnomedical studies like this need to be done to document valuable knowledge before it is lost from society.

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CONFLICT OF INTEREST

The authors declare that there is no conflict of interest

AUTHOR CONTRIBUTIONS

R.W., research concepts, design, data analysis, preparation and editing manuscript; N.P., literature search, statistical analysis, and manuscript review; W.E., validated questions for informants, and definition of intellectual content; M.A., research concepts, design, guarantor and manuscript review; R.K.S., guarantor, corrected and reviewed manuscript

writing; Z.B.A., Experimental studies, literature search, data acquisition, and statistical analysis; I.S., data acquisition, preparation and editing manuscript.

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