Journal of Applied Pharmaceutical Science Vol. 12(09), pp 178-188, September, 2022
Available online at http://www.japsonline.com
DOI: 10.7324/JAPS.2022.120921
ISSN 2231-3354

Ethnopharmacological study of medicinal plants indigenous knowledge about low back pain therapy in Sumatra, Indonesia

Ulfatun Nisa[1*], Agus Triyono[1], Danang Ardiyanto[1], Fajar Novianto[1], Ulfa Fitriani[1], Wayan D. Miftakhul Jannah[2], Peristiwan R. Widhi Astana[1], Zuraida Zulkarnain[1]

[1]Medicinal Plants and Traditional Medicine Research and Development Center, Tawangmangu, Indonesia.
[2]Institute Health Research and Development, Magelang, Indonesia.

ARTICLE INFO

Received on: 20/01/2022
Accepted on: 18/06/2022
Available Online: 04/09/2022

Key words:
Low back pain, medicinal plants, ethnopharmacology, Indonesia.

ABSTRACT

Indonesians have had a close relationship with traditional herbal medicine for ages to maintain their health. As a common disease in the community, low back pain (LBP) is always considered for traditional healers in their practice. However, there are still insufficient data regarding the use of medicinal plants for LBP treatment. An ethnopharmacological study was conducted in Sumatra, Indonesia, to gain information on the empirical use of medicinal plants for LBP therapy among traditional healers. The information on the use of medicinal plants was gathered using semistructured questionnaires and interviews with traditional healers. The collected data were analyzed using several parameters such as family use value (FUV), use value (UV), and plant part used. A total of 90 traditional healers in Sumatra cited 68 plant species in 32 families that are used in their herbal formula for LBP treatment. They prefer to use leaves, roots, and barks than other parts of a plant. The calculation result of UV reveals that *Kaempferia galanga* is the most common plant used for LBP (0.04). Zingiberaceae was categorized as having the highest FUV. *Datura metel* was a toxic plant. The phytochemical and pharmacological screening of the indicated therapeutic plants should be investigated.

INTRODUCTION

Low back pain (LBP) is a sharp or dull sensation resulting from muscular stiffness in the back. The symptom appears whether isolated in the back area or radiates to the lower limbs (ischialgia) (Al-Salameen *et al*., 2019). LBP is the second most common reason for doctor visits after headaches. LBP impacts 30%–40% of people each year, and 75%–85% of them will experience back pain at some point in their lives (Gerayeli *et al*., 2017). Accordingly, LBP is a widespread public health issue in developing countries such as Indonesia. In two decades, LBP was also linked to a 52% increase in living with disability and is responsible for adding disease burden and medical cost. Acute LBP affects nearly 80% of adults, while chronic LBP affects 23% (Cieza *et al*., 2020; Hoy *et al*., 2014; Wu *et al*., 2020).

Various methods are applied to reduce the symptoms of LBP, including the early return of regular physical activity (excluding heavy lifting), nonsteroidal anti-inflammatory drugs (NSAIDs), physical therapy, support belts, and surgery (Gerayeli *et al*., 2017; Laudahn and Walper, 2001; Stam *et al*., 2001). Physicians and patients prefer to use NSAIDs to reduce pain in LBP due to their effectiveness. However, NSAIDs also have many shortcomings reported, including limited long-term efficacy, tolerance issues, and other side effects (Sreekeesoon and Mahomoodally, 2014; Verkamp *et al*., 2013). Concerning this issue, the community, especially in Asian countries, has used natural remedies for pain management and treatment for generations (Sreekeesoon and Mahomoodally, 2014). Previous studies showed that people with LBP widely use herbal medicine (Foster *et al*., 2018). Several factors influence people to choose herbal medicine, including psychosocial considerations, ethnic and cultural aspects, accessibility to healthcare resources, and

**Corresponding Author*
Ulfatun Nisa, Medicinal Plants and Traditional Medicine Research and Development Center, Tawangmangu, Indonesia.
E-mail: redfa01 @ gmail.com

individual perceptions of physical and medical conditions (Yoon and Kim, 2013). Furthermore, the authorities have also produced guidelines that recommend several complementary and alternative medicines for LBP treatment in recent years.

Indonesia has unique flora and fauna that complete its cultural and ethnic diversity (Sreekeesoon and Mahomoodally, 2014). These ethnic groups occupy particular areas in the country. Every ethnic group has its way of life and traditions, including food, medicinal plants, and spices. It is also significantly skilled in using and conserving organic and ecological diversity (Walujo, 2008). For example, the management of LBP in each ethnic group might have different characteristics. The local community uses medicinal plants to treat diseases mainly because of the limitation of health facility access. The indigenous knowledge of using medicinal plants most likely has been passed down from generation to generation (Yaseen *et al*., 2015). This approach has managed to keep knowledge alive until now. Hence, local knowledge of medicinal plants has always been a source of research to test the effects of plants and develop new therapeutic resources (Bolson *et al*., 2015).

Ethnobotany research can reveal the indigenous knowledge of communities or ethnic groups, including their resource management and plant ecology. The research result should provide information on essential plant species, conservation potential and function, and impacts on ethnobotany and economics (Batoro and Ekowati, 2017). Another approach aims to use traditional practices in the formal health system. Hence, an ethnopharmacology study can help collect primary data on traditional remedies used by the community. There are several ethnomedicinal plants for treatment of rheumatism (LBP) that have been reported in other countries like Ezhilvalavan *et al*. (2015), Som (2021), Paudyal *et al*. (2021), and Ushashee (2021), Mandal and Mahalik (2021), but nothing has been done in Indonesia.

Ethnopharmacology assessments of medicinal plant species are essential for the conservation and protection of and are helpful in developing herbal drugs (Vitalini *et al*., 2013). The objective of this study was to assess information on the plant species that traditional healers have used to treat LBP in Sumatra, Indonesia. We collected data on preparatory procedures and the delivery of herbal remedies to document traditional healing methods of LBP. This research can help protect the medical knowledge of indigenous peoples and provide baseline data for future research.

MATERIALS AND METHODS

The area of study

Sumatra is an Indonesian island in the Malay Archipelago, the second largest (after Borneo) of the Greater Sunda Islands. It is the world's sixth-biggest and most significant island within the Indonesian territory (480,847.74 km^2) (Badan Pusat Statistik, 2021). The Strait of Malacca separates it from the Malay Peninsula in the northeast, and the Sunda Strait separates it from Java in the south. North Sumatra (Sumatera Utara), Jambi, Riau, West Sumatra (Sumatera Barat), South Sumatra (Sumatera Selatan), Bengkulu, and Lampung—along with the autonomous province of Aceh—are divided into seven propinsi (or provinsi; provinces) (Britannica, 2017).

Data collection

The ethnopharmacological field study was conducted in 2012, 2015, and 2017. Before the interview, each informant gave agreement in verbal informed consent. The key informants and respondents were interviewed in a semi-structured questionnaire. The mentioned medicinal plants were collected for herbarium specimens, and the survey approach determined habitat was done in the field. The questions in the interview were asked to understand traditional uses of medicinal plants, including information on the name of the local plant, the parts of the plant used, and the method of preparation and administration. Taxonomic identification was performed to validate the samples collected during the interviews. A herbarium was also set up to obtain dry specimens that could be used to support taxonomic identification. On the other hand, the herbarium method was only used for unknown species (Jadid *et al*., 2020). Plants species with unknown scientific names were identified at Herbarium Tawangmanguensis to discover their names.

The survey selected ethnic groups with at least 1,000 individuals living on the local community's island. The following consideration was if they still have indigenous healing knowledge and live in places with limited access to health services (Mustofa *et al*., 2021). The Ethics Commission of the Ministry of Health's National Institute of Health Research and Development approved the protocol and informed consent forms (LB.02.01/5.2/KE.318/2015 and LB.02.02/2/KE.107/2017). The informants were given full facts about the current study and its goals, and they were free to withdraw at any point.

Data analysis

In this research, several quantitative value indexes were measured to find the importance of medicinal plants. The first index is the relative frequency of citation (RFC), which is calculated by dividing a frequency of citation (FC) (the number of respondents who mention the species use) by the total number of respondents in the survey (*N*). This index ignores the variable use category. It ranges from zero to one. The value of zero indicated that no one thinks the plants are useful, while the value of one meant that everyone thinks they are useful (Mosaddegh *et al*., 2012).

$$\mathrm{RFC} = \frac{\mathrm{FC}}{N}$$

Use value (UV) was used to assess the ethnobotanical data. UV indicates the relative importance of plants that are known in the area. The following formula was used to calculate it (Phillips *et al*., 1994):

$$\mathrm{UV} = \frac{\Sigma \mathrm{U}}{N}$$

UV is the use value of a species, "*U*" is the number of use reports stated by each informant for a specific plant species, and "*N*" is the total number of informants questioned for a particular plant species. UV is used to identify the most commonly used plants (most frequently advised) in treating a disease.

Family use value (FUV) was used to determine the number of informants who used specific species from a given family. It was determined using the following equation:

$$\text{FUV} = \frac{\Sigma \text{UVs}}{Ns}$$

The FUV and UV readings above a certain threshold suggest that species were commonly utilized as medications. UVs were used to represent the UVs of all the species in a specific family. Ns denotes the total number of species in a family (Hoffman and Gallaher, 2007)

The informant citation factor (ICF) is produced using the formula below to assess the agreement amongst informants about which plants to utilize for various use categories (Mosaddegh *et al*., 2012). The ICF describes informants' understanding of medicinal plant consuming species and assesses diversity in use against ailments stated. Ailments are widely classified into distinct groups before the ICF value is calculated. The highest ICF value, close to 1, shows that most local communities employ well-known species because of their disease authenticity. However, a low ICF score near 0 indicates that the informants use the plants for random diseases (Umair *et al*., 2017). The ICF value was calculated using the following formula:

$$\text{ICF} = \frac{\text{Nur} - \text{Nt}}{\text{Nur} - 1}$$

RESULTS AND DISCUSSION

Characteristics of the traditional healer

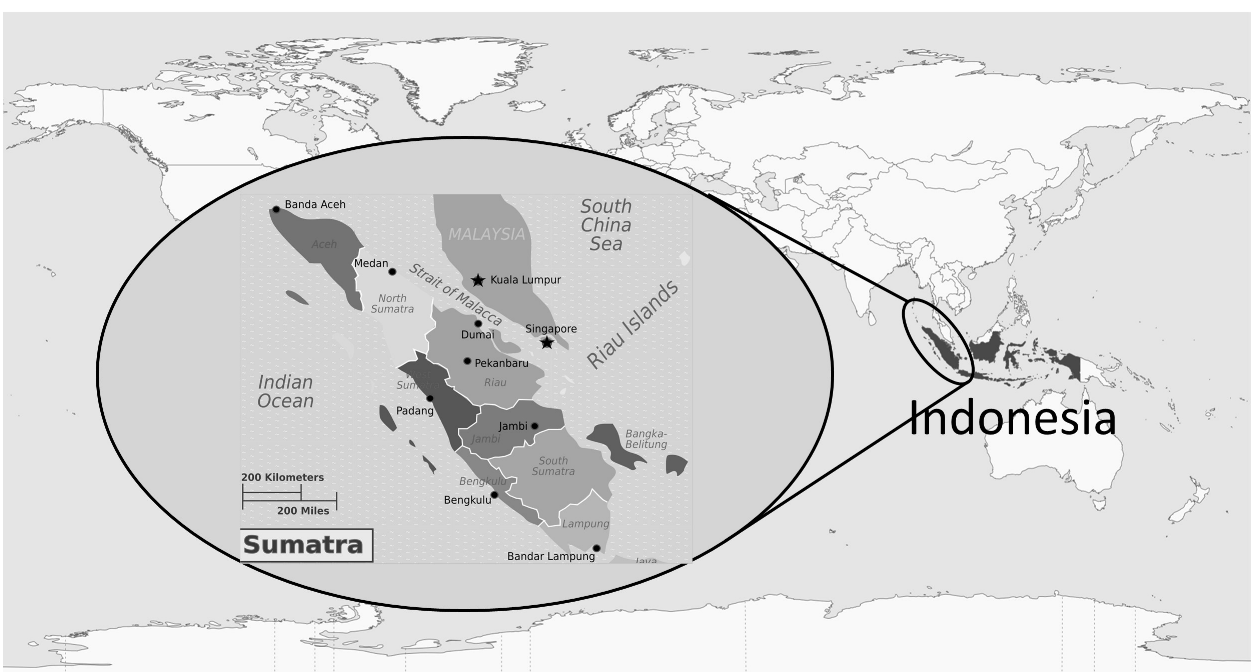
The results of the field surveys are compiled in this section. Traditional healers have an average of 28 years of experience practicing traditional medicine, and they have an average monthly patient load of approximately 87 individuals. Many traditional healers have never obtained formal schooling or completed elementary and junior high school. Half of the informants were > 60 years old (elder group). There were only 3.3% of traditional practitioners from the younger group. The previous study revealed that most informants were uneducated because of the unavailability of educational facilities in the area (Yaseen *et al*., 2015). In this study, only a few have completed some higher education, despite being literate. The majority of those who took part had completed their primary or secondary education.

The majority of informants have been practicing for at least 28 years. The amount of time a traditional healer has been practicing impacts his ability to diagnose and treat diseases. Meanwhile, many patients in a month indicate that the surrounding community believes in the traditional healer's quality and skills. The more qualified the traditional healers are, the more reliable the data used in ethnopharmacology research is (Peng *et al*., 2015).

The herbal healers in the study region used medicinal plants alone or in combination to treat various illnesses. Rural people's reliance on herbal treatments may be attributed to their lack of access to modern healthcare facilities and services. The elders chose herbal medications over allopathic drugs because they believed in the benefits of herbs. In addition, they believe in sharing their knowledge for the sake of human happiness. Even though Western medicine is available, many individuals still choose traditional herbal remedies (Somashekhara *et al*., 2015).

Pharmaceutical preparation

In this study, the preparation method of herbal medicine was categorized into oral, topical, and inhalation preparation. As seen in Figure 2, the most common preparation technique was topical preparation. Ethnomedical research in Sumatra shows that traditional healers used 68 plant species to treat LBP. Many therapeutic preparations are made by topical preparation, a common approach. The most commonly used parts of the plant were the leaves (30%), followed by roots (21%), rhizomes (17%), fruits (12%), stems (7%), seeds (6%), tubers (4%), bark (2%), and others (1%) (Fig. 3). Other



taken from https://commons.wikimedia.org/wiki/File:Indonesia_in_the_World.svg and https://commons.wikimedia.org/wiki/File:WV_Sumatra_map_PNG.png

Figure 1. The map of Sumatra Island.

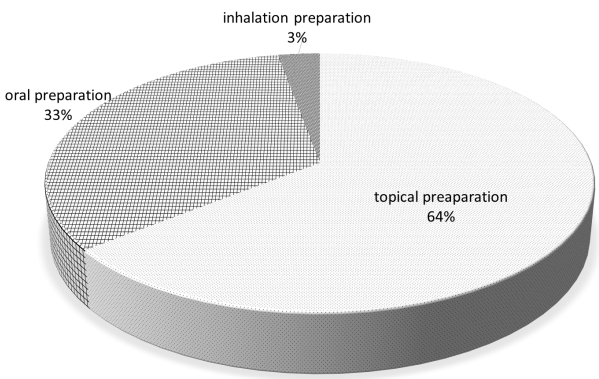


Figure 2. The proportion of oral and topical herbal medicine preparation for low back pain.

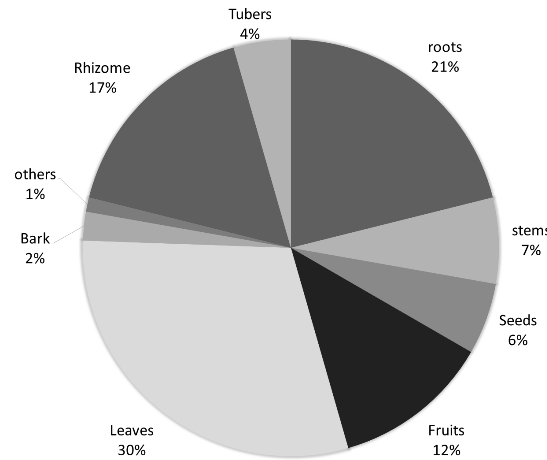


Figure 3. The proportion of plant parts used.

studies also came up with similar results. The leaves are the primary photosynthetic organs containing photosynthates with therapeutic properties. Compared to roots, and fruits, collecting leaves and then using them as medicine is relatively simple. Another rationale for employing leaves could be for plant conservation, as taking out roots could cause the plant to die, putting the species in serious trouble (Dey *et al*., 2014). Bradacs *et al*. (2011) and Leto *et al*. (2013) mentioned leaves as a standard plant part in herbal medicine used by Islanders and Italians. It has been claimed that using leaves rather than whole plants, roots, and stems might increase the survivability of medicinal plants collected by herbalists, which may pose a severe threat to local flora (Dey *et al*., 2014).

Diversity of medicinal plants and their relative importance in the treatment of LBP

Table 1 shows the information on botanical name, family, plant part used, and relative importance of plants for the treatment of LBP in Sumatra, Indonesia. Their taxonomic group and family determine medicinal plants' scientific and common names. *www.theplantlist.org* was used to double-check all of the Latin scientific and families' terms. In this study, 68 plant species were identified for LBP, which belonged to 32 families. Only the local name was recorded for 49 of the 68 species. *Kaempferia galanga* L. was the most widely used species, with four use reports from 90 informants, yielding a usage value of 0.04. *Citrus aurantiifolia* (Christm.) Swingle, *Plectranthus amboinicus* (Lour.) Spreng, and *Zingiber purpureum* Roscoe came in second with three use reports each (UV = 0.03). The next rank was occupied by *Celosia argentea* L., *Allium cepa* L., *Crinum asiaticum* L., *Fragraea fragrans* Roxb., *Tinospora crispa* (L.), *Imperata cylindrica* (L.), *Oryza sativa* L., *Nauclea* sp., *Curcuma domestica* Val., and *Zingiber zerumbet* (L.) Roscoe ex Sm. (UV = 0.02). We also listed toxic plants to discourage the public from using harmful plants, even though locals utilize them to treat various diseases from the survey. The toxic plants are *Datura metel* L. and *Solanum rudepannum*. It has been noted that plant species with powerful bioactive chemicals are frequently labeled as both toxic and therapeutic, with the outcome varying depending on the medicine production and administration (Umair *et al*., 2017). In another study, 25% of medicinal plant users knew nothing about poisonous plants (Eddouks *et al*., 2002).

In a few cases, the pharmacological effects of medicinal plants mentioned in this study have been confirmed by published data. More research about their chemical composition, pharmacological effects, and toxicity will be required to verify the plant materials' medical value. Furthermore, animal models must be used to evaluate the cellular and molecular mechanisms of the recorded plants, and thorough information on their use, duration, and dose must be explored before prescription in human healthcare (Eddouks *et al*., 2002). For example, fever, hemiplegia, rheumatism, arthritis, headaches, earache, muscle discomfort, respiratory illnesses, and digestive problems are treated using the *Justicia gendarussa* Burm's leaf in Indian and Chinese traditional medicine (Paval *et al*., 2009). Still, in this study, these plants had a low UV level.

As presented in Figure 4, we discovered that the informants use 90 medicinal plants from 32 families to treat LBP. The most used family was Zingiberaceae with FUV 0.20, followed by Lamiaceae and Poaceae with FUV 0.09 each, Amaryllidaceae (0.06), Rutaceae (0.06), Arecaceae (0.03), Menispermaceae (0.03), Solanaceae (0.03), Amaranthaceae (0.02), Compositae (0.02), Euphorbiaceae (0.02), Gentianaceae (0.02), Musaceae (0.02), Myristicaceae (0.02), Rubiaceae (0.02), and others with FUV 0.01. The Zingiberaceae family was the most well represented among the 90 plant species found, followed by Lamiaceae and Poaceae, with 10 species mentioned. Many medicinal plants are members of the Lamiaceae family, used for their rich and aromatic essential oils, primarily monoterpenes (Abe and Ohtani, 2013).

There is just one ICF for treating LBP because this study focused on a specific disease. The ICF for medicinal plants to treat LBP was 0.25. The factor represents the degree of shared knowledge among informants about using medicinal plants to treat a specific condition. When plants are chosen randomly, and little or no information is shared among informants, ICF values are low (around 0). If specific criteria have been well defined and information has been well shared, the ICF approaches one (1) (Ferrier *et al*., 2015; Jaradat *et al*., 2016; Mustofa *et al*., 2021; Yaseen *et al*., 2015). The factor discovered in this study was graded as low. The ICF was assigned low (ranges from 0.0 to 0.3), moderate (ranges from 0.31 to 0.60), and high (ranges from 0.61 to 1.0) values (Achar *et al*., 2015).

Table 1. The diversity of medicinal plants for treatment of LBP in Sumatra, Indonesia, along with quantitative values.

Scientific name	Local name	Part used	RFC	UV	FUV	Reference of the most cited plants
Acanthaceae					0.01	
Justicia gendarussa Burm. f.	Gandarusa	Leaves	1.11	0.01		
Amaranthaceae					0.01	
Celosia argentea L.	Boroco	Roots	2.22	0.02		Tang *et al*. (2016), Nidavani, *et al*. (2013), Kanu *et al*. (2017), Kharat *et al*. (2019), Adegbaju *et al*. (2020), Thirupathi et.al (2017)
Amaryllidaceae					0.06	
Allium cepa L.	Bawang merah	Tubers	2.22	0.02		Sima (2012), Teshika *et al*. (2019), Metrani *et al*. (2020), Dahariya *et al*. (2020), Dimitry *et al*. (2021)
Allium sativum L.	Bawang putih	Tubers	1.11	0.01		
Crinum asiaticum L.	Bakung	Leaves	2.22	0.02		Asmawi *et al*. (2010), Refaat *et al*. (2011), Haque *et al*. (2014), Mahomoodally *et al*. (2021)
Anacardiaceae					0.01	
Mangifera foetida Lour.	Macang	Roots	1.11	0.01		
Apocynaceae					0.01	
Hoya sp.	Steram	Leaves	1.11	0.01		
Arecaceae					0.03	
Arenga pinnata (Wurmb.) Merr.	Akar enau/bagot	Roots	1.11	0.01		
Calamus sp.	Akar rotan bolon	Roots	1.11	0.01		
Cocos nucifera L.	Kelapa	Roots	1.11	0.01		
Asparagaceae					0.01	
Sansevieria trifasciata Prain	Jadam	Leaves	1.11	0.01		
Chrysobalanaceae					0.01	
Maranthes corymbosa Blume	Kayu batu	Leaves	1.11	0.01		
Compositae					0.02	
Spilanthes acmella (L.)	Siampy	Roots	1.11	0.01		
Taraxacum sp.	Alum-alum debata	Leaves	1.11	0.01	0.01	
Dipterocarpaceae					0.01	
Dryobalanops beccarii Dyer	Kapur barus	Bark	1.11	0.01		
Equisetaceae					0.01	
Equisetum debile Roxb. ex Vaucher	Dek-dek	Leaves	1.11	0.01		
Euphorbiaceae					0.01	
Aleurites moluccanus (L.) Willd.	Kemiri	Fruits	1.11	0.01		
Claoxylon longifolium (Blume) Endl. ex Hassk.		Leaves	1.11	0.01		
Fagaceae					0.01	
Quercus infectoria G. Olivier	Manjakani	Fruits	1.11	0.01		
Gentianaceae					0.02	
Fragraea fragrans Roxb.	Kayu tembus, tembesu	Barks, leaves	2.22	0.02		Motley (2004), Zhang *et al*. (2020)
Lamiaceae					0.09	
Hyptis capitata Jacq.	Longa	Seeds	1.11	0.01		
Mentha × piperita L.	Mim	Roots	1.11	0.01		
Ocimum basilicum L.		Seeds	1.11	0.01		
Orthosiphon aristatus (Bl.) Miq.	Kumis kucing	Leaves	1.11	0.01		
Plectranthus amboinicus (Lour.) Spreng.	Bangun-bangun	Leaves	3.33	0.03		Lukhoba *et al*. (2006), Kumar *et al*. (2020)
Vitex trifolia L.	Sihala gundi	Leaves	1.11	0.01		

Scientific name	Local name	Part used	RFC	UV	FUV	Reference of the most cited plants
Leguminosae					0.04	
Butea monosperma (Lam.) Taub.	Serikan	Roots	1.11	0.01		
Indigofera suffruticosa Mill.	Telep	Leaves	1.11	0.01		
Pachyrhizus erosus (L.) Urb.	Bengkoang	Fruits	1.11	0.01		
Phaseolus sp.	Capet-capet	Leaves	1.11	0.01		
Malvaceae					0.04	
Helicteres isora L.	Lada putar	Fruits	1.11	0.01		
Hibiscus mutabilis L.	Purba jolma	Roots	1.11	0.01		
Hibiscus tiliaceus L.	Akar baru	Roots	1.11	0.01		
Sericocalyx crispus (L.) Bremek	Keji beling	Leaves	1.11	0.01		
Meliaceae					0.01	
Aglaia sp.	Balik angin	Leaves	1.11	0.01		
Menispermaceae					0.03	
Cyclea barbata Miers.	Lakkop-lakkop	Leaves	1.11	0.01		
Tinospora crispa (L.) Hook. f. & Thomson	Brotowali	Stems	2.22	0.02		Spandana *et al*. (2013), Ahmad *et al*. (2016), Warsinah *et al*. (2020), Martani and Fatmaria (2020), Rakib *et al*. (2020)
Moraceae					0.01	
Morus alba L.	Tamba tuah	Roots	1.11	0.01		
Moringaceae					0.01	
Morinda citrifolia L.	Mengkudu	Fruits	1.11	0.01		
Musaceae					0.01	
Musa × *paradisiaca* L.	Pisang	Fruits, other	1.11	0.01		
Myristicaceae					0.02	
Myristica fragrans Houtt.	Pala	Fruits, seeds	1.11	0.01		
Myrtaceae					0.01	
Syzygium aromaticum (L.) Merr. & L.M.Perry	Cengkeh	Fruits	1.11	0.01		
Orchidaceae					0.01	
Galeola nudifolia Lour.	Udut talan	Stem	1.11	0.01		
Piperaceae					0.01	
Piper nigrum L.	Lada hitam	Fruits	1.11	0.01		
Poaceae					0.09	
Chrysopogon aciculatus (Retz.) Trin.	Sitemu/sitomu dalan	Leaves	1.11	0.01		
Cymbopogon nardus (L.) Rendle	Serai	Stem	1.11	0.01		
Gigantochloa apus (Schult. & Schult. f.) Kurz	Tukkot matua	Leaves	1.11	0.01		
Imperata cylindrica (L.) Raeusch.	Lalang	Roots	2.22	0.02		Nguyen *et al*. (2004), Padma *et al*. (2013)
Oryza sativa L.	Padi	Seeds	2.22	0.02		
Saccharum officinarum L.	Tebu besi abang	Stem	1.11	0.01		Pathak (2009), Varghese and Nair, (2011), Sao *et al*. (2020)
Rubiaceae					0.02	
Nauclea sp.	Dewel	Roots, stem	2.22	0.02		Willcox *et al*. (2012), Haudecoeur *et al*. (2018), Gonzal *et al*. (2020)
Rutaceae					0.06	
Citrus × *limon* (L.) Osbeck	Unte susu	Roots	1.11	0.01		
Citrus aurantiifolia (Christm.) Swingle	Unte kapah, unte rudang	Fruits	3.33	0.03		Borokini *et al*. (2013), Weimer *et al*. (2021), Owoyele *et al*. (2018)

Scientific name	Local name	Part used	RFC	UV	FUV	Reference of the most cited plants
Zanthoxylum acanthopodium DC.	Tuba/andalaman	Fruits	1.11	0.01		
Solanaceae					0.03	
Datura metel L.	Kecubung	Leaves	1.11	0.01		
Physalis angulata L.	Ciplukan	Leaves	1.11	0.01		
Solanum rudepannum Dunal	Lancing	Leaves	1.11	0.01		
Urticaceae					0.01	
Pilea sp.	Indot	Roots	1.11	0.01		
Zingiberaceae					0.20	
Boesenbergia rotunda (L.) Mansf.	Temu kunci	Rhizome	1.11	0.01		
Curcuma domestica Val.	Kunyit	Rhizome	2.22	0.02		Chandran and Goel (2012), Grinberg (2020), Daily *et al*. (2016), Kuptniratsaikul *et al*. (2009), Fahryl and Carolia (2019), Kertia *et al*. (2012), Aszar *et al*. (2019)
Curcuma longa L.	Kunyit	Rhizome	1.11	0.01		Kumar (2010)
Curcuma sp.	Kunyit biasa	Rhizome	1.11	0.01		
Etlingera elatior (Jack) R.M.Sm.	Asam sihala	Fruits	1.11	0.01		
Kaempferia galanga L.	Kencur	Tuber, rhizome, leaves	4.44	0.04		Umar *et al*. (2012), Preetha *et al*. (2016), Andriyono (2019)
Zingiber montanum (J.Koenig) Link ex A.Dietr.	Bangle	Rhizome	1.11	0.01		
Zingiber officinale Roscoe	Jahe merah	Rhizome	2.22	0.02		Fouda and Berika (2009), Terry *et al*. (2011), Paramdeep (2013), Al-Nahain *et al*. (2014), Gupta and Sharma (2014), Kumar *et al*. (2011) Mishra *et al*. (2018), Mahboubi (2019), Borgonetti *et al*. (2020)
Zingiber purpureum Roscoe	Unik Bulnge	Rhizome	3.33	0.03		
Zingiber zerumbet (L.) Roscoe ex Sm.	Lempuyang, Temu ireng	Rhizome	2.22	0.02		Koga *et al*. (2016)

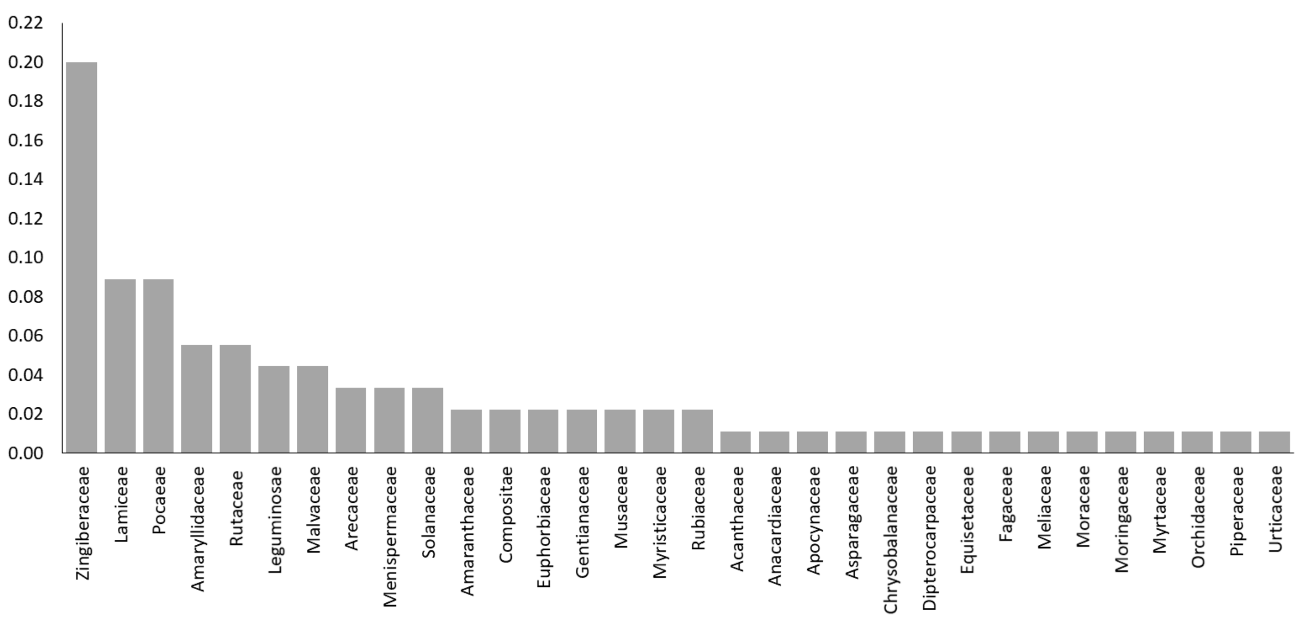


Figure 4. The Diversity of Famili Use value (FUV) of medicinal plants for treatment LBP in Sumatra.

Several properties of the most cited medicinal plants for treatment of LBP

Kaempferia galanga

Analgesic activity of *K. galanga* extract is the main activity to be applied for LBP. Based on the pain models employed in this work, its activity presumably mediated peripherally and centrally via the nervous system. In the hot plate and tail-flick tests, naloxone reversed the extract's antinociceptive effect, demonstrating that it works via opioid-mediated processes. *Kaempferia galanga* extract may bind to opioid receptors. These findings suggest the potential folk medicine usage of *K. galanga* as an antinociceptive remedy (Ridtitid *et al*., 2008). Other results reported the traditional use of *K. galanga* in treating inflammation. The anti-inflammatory activity of ethyl-*p*-methoxycinnamate from *K. galanga* is mediated by inhibition of cyclooxygenase enzymes 1 and 2 (Umar *et al*., 2012). The *in vivo* analgesic efficacy of the alcoholic *K. galanga* extract was investigated in Wistar rats using the hot plate method and the tail-flick model. According to the findings, the alcohol extract significantly increased the stress tolerance capacity of rats at doses of 1,200 and 600 mg/kg BW for 60 minutes using the hot plate method and 30 minutes via the tail-flick model (Khairullah *et al*., 2021).

Kaempferia galanga extract has the same efficacy as meloxicam administration to treat the symptoms and indications of knee OA. These findings suggest *K. galanga* extract may help with pain relief (Syahruddin *et al*., 2017).

Citrus aurantium

Citrus aurantium L. blossoms essential oil (neroli) has biologically active constituents that have significant activity against acute and especially chronic inflammation and central and peripheral antinociceptive effects, which supports the ethnomedicinal claims of the plant's use in the management of pain and inflammation (Khodabakhsh *et al*., 2015).

***Curcuma* sp.**

Curcuma roots are used to make turmeric spice. Curcumin, a polyphenol extract of turmeric, is widely known for its anti-inflammatory and antioxidant properties. *Curcuma*'s anti-inflammatory effect has various pathways. Inflammatory mediators such as interleukin-1, tumor necrosis factor-alpha, IL-8, Nitric oxide (NO), and a variety of Matrix metalloproteinases (MMPs) are strongly inhibited by *Curcuma* via reducing the activation of the Nuclear Factor-kappa B (NF-B), Akt, and mitogen-activated protein kinase (MAPK) signaling pathways.

Curcuma extracts and curcumin have recently been researched for their antiarthritic properties. Over four weeks, *C. domestica* patients had lower Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC) scores than ibuprofen patients. According to Kuptniratsaikul *et al*. (2009), curcumin had similar efficacy but more excellent safety and fewer side effects than diclofenac. A randomized, double-blind, placebo-controlled research examined highly bioavailable curcumin (Theracurmin) effects on knee OA. After eight weeks, Theracurmin reduced Visual Analog Scale (VAS) scores for knee pain and celecoxib dependence relative to placebo, but not Japanese Knee Osteoarthritis Measure (JKOM) scores. Curcuminoids (curcumin, demethoxycurcumin, and bisdemethoxycurcumin) coupled with diclofenac exhibited superior pain relief and functional capability in individuals with knee OA (Lindler *et al*., 2020).

These medicinal plants are significant in any herbal formula because approximately one-fourth of the biologically active plant-derived compounds currently in use worldwide were discovered through research of folk and ethnomedicinal services (Biswajit *et al*., 2014). In general, drug development research might be employed to extract and describe the bioactive chemicals responsible for these species' usage to treat LBP.

CONCLUSION

The properties of the most cited medicinal plant for the treatment of LBP are *K. galanga, C. aurantium*, and *Curcuma* sp. However, they are chosen randomly, and little or no information is shared among informants. Nonetheless, to acquire a better knowledge of the function of herbal medicine in the treatment of LBP in Sumatra, more research that spans a larger area and diverse population groups is needed. Pharmacological screening of medicinal plants should be evaluated, particularly those commonly referenced and used safely.

ACKNOWLEDGMENT

The authors are very much thankful to the National Institute of Health Research and Development for supporting data. Thanks are also due to the RISTOJA Team, PPI for Medicinal Plant and Traditional Medicines Research and Development Center.

CONFLICT OF INTEREST

The authors declared no potential conflicts of interest in this article's research, writing, or publishing.

AUTHOR CONTRIBUTIONS

All authors made substantial contributions to conception and design, acquisition of data, or analysis and interpretation of data; took part in drafting the article or revising it critically for important intellectual content; agreed to submit to the current journal; gave final approval of the version to be published; and agree to be accountable for all aspects of the work. All the authors are eligible to be an author as per the international committee of medical journal editors (ICMJE) requirements/guidelines.

FUNDING

There is no funding to report.

DATA AVAILABILITY

All data generated and analyzed are included within this research article.

PUBLISHER'S NOTE

This journal remains neutral with regard to jurisdictional claims in published institutional affiliation.

ETHICAL APPROVAL

The Ethics Commission approved the protocol and informed consent forms of the Ministry of Health's National Institute of Health Research and Development. The informants were given full facts about the current study and its goals, and they were free to withdraw at any point. The study's ethical approval codes were LB.02.01/5.2/KE.318/2015 and LB.02.02/2/KE.107/2017.

REFERENCES

Abe R, Ohtani K. An ethnobotanical study of medicinal plants and traditional therapies on Batan Island, the Philippines. J Ethnopharmacol, 2013; 145(2):554–65.

Achar SKG, Boosanur V, Shivanna MB. Ethno-medico-botanical knowledge of Tiptur taluk in Tumkur district of Karnataka, India. Indian. J Tradit Knowl, 2015; 14(1):147–54.

Adegbaju OD, Otunola GA, Afolayan AJ. Anti-inflammatory and cytotoxic evaluation of extracts from the flowering stage of celosia argentea. BMC Complement Med Ther, 2020; 20(1):1–7.

Ahmad W, Jantan I, Bukhari SNA. *Tinospora crispa* (L.) Hook. f. & Thomson: A review of its ethnobotanical, phytochemical, and pharmacological aspects. Front Pharmacol, 2016; 7:1–19.

Al-Nahain A, Jahan R, Rahmatullah M. *Zingiber officinale* : a potential plant against rheumatoid arthritis. Arthritis, 2014; 2014:1–8.

Al-Salameen A, Abugad H, Al-Otaibi S. Low back pain among workers in a paint factory. Saudi J Med Med Sci, 2019; 7(1):33.

Andriyono RI. *Kaempferia galanga* L. sebagai antii-Inflamasi dan analgetik. J Kesehatan, 2019; 10(3):495.

Asmawi MZ, Arafat OM, Amirin S, Eldeen IM. In vivo antinociceptive activity of leaf extract of *Crinum asiaticum* and phytochemical analysis of the bioactive fractions. Intern J Pharmacol, 2010; 7(1):125–9.

Aszar FDD, Imandiri A, Mustika A. Therapy for low back pain with acupuncture and turmeric. J Vocation Health Stud, 2019; 2(2):74.

Badan Pusat Statistik. Jakarta, Indonesia, 2021.

Batoro J, Ekowati G. An ethnobotanical tobacco (*Nicotiana tabacum* L.) in Indonesia. a review. Adv Life Sci, 2017; 7(2):26–9.

Biswajit P, Deenabandhu S, Malaya KM. Ethno-medicobotanical studies of Mohana area of Gajapati district, Odisha, India, Intern. J Herb Med, 2014; 2(4):40–5.

Bolson M, Hefler SR, Dall'Oglio Chaves EI, Gasparotto Junior A, Cardozo Junior EL. Ethno-medicinal study of plants used for treatment of human ailments, with residents of the surrounding region of forest fragments of Paraná, Brazil. J Ethnopharmacol, 2015; 161:1–10.

Borgonetti V, Governa P, Biagi M, Pellati F, Galeotti N. *Zingiber officinale* Roscoe rhizome extract alleviates neuropathic pain by inhibiting neuroinflammation in mice. Phytomed, 2020; 78:153307.

Borokini TI, Ighere DA, Clement M, Ajiboye TO, Alowonle AA. Journal of Medicinal Plants Studies Ethnobiological survey of traditional medicine practice for Women' s health in Oyo State. J Med Plants Stud, 2013;1:17–29.

Bradacs G, Heilmann J, Weckerle CS. Medicinal plant use in Vanuatu: a comparative ethnobotanical study of three islands. J Ethnopharmacol, 2011; 137(1):434–48.

Britannica. Sumatra. Encyclopedia Britannica, 2017. Available via https://www.britannica.com/place/Sumatra (Accessed 15 December 2021).

Chandran B, Goel A. A randomized, pilot study to assess the efficacy and safety of curcumin in patients with active rheumatoid arthritis. Phytother Res, 2012; 26(11):1719–25.

Cieza A, Causey K, Kamenov K, Hanson SW, Chatterji S, Vos T. Global estimates of the need for rehabilitation based on the Global Burden of Disease study 2019: a systematic analysis for the Global Burden of Disease Study 2019. Lancet, 2020; 396(10267):2006–17.

NAIR KK, Krupavaram JCB, Singh H, Solomon KA, Jaasminerjiit K, Shopana P. Evaluation of ethanolic root extract of *Allium cepa*. L for analgesic and anti-inflammatory activities in animal models. World J Curr Med Pharm Res, 2020; 2:11–3.

Daily JW, Yang M, Park S. Efficacy of turmeric extracts and curcumin for alleviating the symptoms of joint arthritis: a systematic review and meta-analysis of randomized clinical trials. J Med Food, 2016; 19(8):717–29.

Dey AK, Rashid MO, Millat S, Rashid M. Ethnobotanical survey of medicinal plants used by traditional health practitioners and indigenous people in different districts of Chittagong division, Bangladesh. Int J Pharm Sci Invent, 2014; 3(7):1–7.

Dimitry MY, Emmanuel PA, Edith DMJ, Armand AB, Nicolas NY. Antioxidant property, anti-inflammatory and analgesic effects of aqueous extracts of two onion bulbs varieties (*Allium cepa* L.). Clin Phytosci, 2021;7(1):1–8.

Eddouks M, Magharani M, Lemhadri A, Ouahidi ML, Jouad H. Ethnopharmacological survey of medicinal plants used for the treatment of diabetes mellitus, hypertension and cardiac disease in the southeast region of Morocco (Tafilalet). J Ethnopharmacol, 2002; 82(2–3):97–103.

Ezhilvalavan R, Mayilsamy M, Rajendran A. Ethnomedicinal plants used by the indigenous peoples of palani hills in southern western ghats for treating rheumatism. Intern J Sci Innov Discov Res, 2015; 5(3):23–31.

Fahryl N, Carolia N. Turmeric (Curcuma domestica Val.) as therapy of gout arthritis. Majority, 2019; 8(1):251–5.

Ferrier J, Saciragic L, Trakić S, Chen ECH, Gendron RL, Cuerrier A, Balick MJ, Redzic S, Alikadic E, Arnason JT. An ethnobotany of the Lukomir Highlanders of Bosnia & Herzegovina. J Ethnobiol Ethnomed, 2015; 11(1):1–17.

Foster NE, Anema JR, Cherkin D, Chou R, Cohen SP, Gross DP, Ferreira PH, Fritz JM, Koes BW, Peul W, Turner JA, Maher CG. Prevention and treatment of low back pain: evidence, challenges, and promising directions. Lancet, 2018; 391(10137):2368–83.

Fouda AMM, Berika MY. Evaluation of the effect of hydroalcoholic extract of zingiber officinale rhizomes in rat collagen-induced arthritis. Basic Clin Pharmacol Toxicol, 2009; 104(3):262–71.

Gerayeli MV, Abbasian A, Karimi M, Khanlarkhani N, Parvari S. 5 medicinal plants used in iranian traditional medicine for low back pain: a quick review. Eur J Exp Biol, 2017; 07(04):2–6.

Gonzal TE, Flore D, Donatien A, William N, Herve T, Vanessa M, Marius M, Gilbert A. In vitro anti-inflammatory, antioxidant and in vivo anti-arthritic properties of stem bark extracts from *Nauclea pobeguinii* (Rubiaceae) in rats. Asian Pac J Trop Biomed, 2020; 10(2):65–77.

Grinberg K. Is curcuma effective for the management of osteoarthritis knee pain ? 2020. Available via https://digitalcommons.pcom.edu/pa_systematic_reviews/542/

Gupta SK, Sharma A. Medicinal properties of *Zingiber officinale* Roscoe—a review. IOSR J Pharm Biol Scie, 2014; 9(5):124–9.

Haque M, Jahan S, Rahmatullah M. Ethnomedicinal uses of *Crinum asiaticum* : a review. World J Pharm Sci, 2014; 3(9):119–28.

Haudecoeur R, Peuchmaur M, Pérès B, Rome M, Taïwe GS, Boumendjel A, Boucherle B. Traditional uses, phytochemistry and pharmacological properties of African Nauclea species: a review. J Ethnopharmacol [Internet], 2018; 212(November):106–36.

Hoffman B, Gallaher T. Importance indices in ethnobotany. Ethno Res Appl, 2007; 5:201–18; doi: 10.17348/era.5.0.201-218

Hoy D, March L, Brooks P, Blyth F, Woolf A, Bain C, Williams G, Smith E, Vos T, Barendregt J, Murray C, Burstein R, Buchbinder R. The global burden of low back pain: estimates from the Global Burden of Disease 2010 study. Ann Rheum Dis, 2014; 73(6):968–74.

Internet citation.link Available via https://gudviral.com

Jadid N, Kurniawan E, Himayani CES, Andriyani, Prasetyowati I, Purwani KI, Muslihatin W, Hidayati D, Tjahjaningrum ITD. An ethnobotanical study of medicinal plants used by the Tengger tribe in Ngadisari village, Indonesia. PLoS One, 2020; 15:1–16.

Jaradat NA, Ayesh OI, 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, 2016; 182:57–66.

Kanu CL, Owoeye O, Imosemi IO, Malomo AO. A review of the multifaceted usefulness of celosia argentea linn. Eur J Pharm Med Res, 2017; 4(10):72–9.

Kertia N, Asdie AH, Rochmah W, Marsetyawan. Comparison of the effects of curcuminoid from Curcuma domestica Val. rhizome extract and diclofenac sodium on the liver function of patients with osteoarthritis. J Pharmacogn Phyther, 2012; 4(5):62–5.

Khairullah AR, Solikhah TI, Ansori ANM, Hanisia RH, Puspitarani GA, Fadholly A, Ramandinianto S. Medicinal importance of *Kaempferia galanga* l. (zingiberaceae): a comprehensive review. J Herb Med Pharmacol, 2021; 10(3):281–8.

Kharat A, Tarkasband Y, Kharat K. Antinociceptive, anti-inflammatory and antidepressant potential of methanolic extract of Celosia argentea Linn. J Drug Deliver. Ther, 2019; 9(2):291–5.

Khodabakhsh P, Shafaroodi H, Asgarpanah J. Analgesic and anti-inflammatory activities of Citrus aurantium L. blossoms essential oil (neroli): involvement of the nitric oxide/cyclic-guanosine monophosphate pathway. J Nat Med, 2015; 69(3):324–31.

Koga AY, Beltrame FL, Pereira AV. Several aspects of *Zingiber zerumbet*: a review. Revista Brasileira de Farmacognosia, 2016; 26(3):385–91.

Kumar A. inflammatory and analgesic agents. Ethnomed Source Compl Ther, 2010; 267–93.

Kumar G, Karthik L, Bhaskara Rao KV. A review on pharmacological and phytochemical properties of *Zingiber officinale* Roscoe (Zingiberaceae). J Pharm Res, 2011; 4(9):2963–6.

Kumar P, Singh S, Kumar N. *Plectranthus amboinicus:* a review on its pharmacological and pharmacognostical studies. Am J Physiol Biochem Pharmacol, 2020; 10(2):55.

Kuptniratsaikul V, Thanakhumtorn S, Chinswangwatanakul P, Wattanamongkonsil L, Thamlikitkul V. Efficacy and safety of *Curcuma domestica* extracts in patients with knee osteoarthritis. J Altern Complement Med, 2009; 15(8):891–7.

Laudahn D, Walper A. Efficacy and tolerance of Harpagophytum extract LI 174 in patients with chronic non-radicular back pain. Phyto Res, 2001; 15(7):621–4.

Leto C, Tuttolomondo T, La Bella S, Licata M. Ethnobotanical study in the Madonie Regional Park (Central Sicily, Italy)—Medicinal use of wild shrub and herbaceous plant species. J Ethnopharmacol, 2013; 146(1):90–112.

Lindler BN, Long KE, Taylor NA, Lei W. Use of herbal medications for treatment of osteoarthritis and rheumatoid arthritis. Medicines, 2020; 7(11):67.

Lukhoba CW, Simmonds MSJ, Paton AJ. Plectranthus: a review of ethnobotanical uses. J Ethnopharmacol, 2006; 103(1):1–24.

Mahboubi M. *Zingiber officinale* Rosc. essential oil, a review on its composition and bioactivity. Clin Phytoscie, 2019; 5(1):1–12.

Mahomoodally MF, Sadeer NB, Suroowan S, Jugreet S, Lobine D, Rengasamy KRR. Ethnomedicinal, phytochemistry, toxicity and pharmacological benefits of poison bulb—*Crinum asiaticum* L. South African J Bot, 2021; 136:16–29.

Mandal U, Mahalik G. 2021. Ethnomedicinal plants used in rheumatoid arthritis. In: Devi RS, Kumar S, ed. Medico-Biowealth of India-II. APRF 140–147.

Martani NS, Fatmaria F. Pemanfaatan penawar sampai (*Tinospora crispa* L.) sebagai tanaman obat tradisional oleh suku Dayak Ngaju'. APRF Publishers City India, J Pharmasci, 2020; 7(2):156.

Metrani R, Singh J, Archaya P, Jayaprakasha G, Patil B. Comparative metabolomics profiling of polyphenols. Plants, 2020; 9(9):1–18.

Mishra RK, Kumar A, Kumar A. Pharmacological activity of *Zingiber officinale.* Intern J Pharm Chem Scie, 2018; 1(3):1073–8.

Mosaddegh M, Naghibi F, Moazzeni H, Pirani A, Esmaeili S. Ethnobotanical survey of herbal remedies traditionally used in Kohghiluyeh va Boyer Ahmad province of Iran. J Ethnopharmacol, 2012; 141(1):80–95.

Motley TJ. The ethnobotany of *Fagraea thunb*. (Gentianaceae): the timber of malesia and the scent of polynesia. Eco Botany, 2004; 58(3):396–409.

Mustofa IF, Rahmawati N, Saryanto S. Ethnomedicine of medicinal plants used by traditional healers to facilitate bone injury healing in West Kalimantan, Indonesia. J Tumbuh Obat Indones, 2021; 14(1):29–47.

Nguyen MT, Awale S, Tezuka Y, Tran QL, Watanabe H, Kadota S. Xanthine oxidase inhibitory activity of Vietnamese medicinal plants. Biol Pharm Bull, 2004; 27(9):1414–21.

Nidavani RB, Mahalakshmi AM, Shalawadi M. Towards a better understanding of an updated ethnopharmacology of Celosia argentea L. Intern J Pharm Pharm Sci, 2013; 5(3):54–9.

Owoyele B V, Ibiyemi AV, Oyeleke MB. Anti-athritic effects of lime , maize husk extract and its co administration on wistar rats', Adv Herb Medi, 2018; 4(4):58–70.

Padma R, Parvathy NG, Renjith V, Rahate KP. Quantitative estimation of tannins, phenols and antioxidant activity of methanolic extract of Imperata cylindrica. Int J Res Pharm Sci, 2013; 4(1):73–7.

Paramdeep G. Efficacy and tolerability of ginger (Zingiber officinale) in patients of osteoarthritis of knee', Indian J Physiol Pharmacol, 2013; 57(2):177–83.

Pathak HN. An overview on ethnobotanical knowledge on *Oryza sativa* L. cultivated in Paiyunpata VDC , Baglung. Himalayan Sci J, 2009; 2:1–5.

Paudyal SP, Rai A, Das BD, Paudel N. Ethnomedicinal knowledge on Rai community of Ramprasadrai rural municipality , Bhojpur district , eastern Nepal. Eur J Biol Res, 2021; 11:367–80.

Paval J, Kaitheri SK, Potu BK, Govindan S, Kumar RS, Narayanan SN, Moorkoth S. Anti-arthritic potential of the plant Justicia gendarussa Burm F. Clinics, 2009; 64(4):357–62.

Peng W, Liu YJ, Wu N, Sun T, He XY, Gao YX, Wu CJ. *Areca catechu* L. (Arecaceae): a review of its traditional uses, botany, phytochemistry, pharmacology and toxicology. J Ethnopharmacol [Internet], 2015; 164:340–56.

Phillips O, Gentry AH, Reynel C, Wilkin P, Galvez-Durand BC. Quantitative ethnobotany and amazonian conservation. Conserv Biol, 1994; 8(1):225–48.

Preetha TS, Krishnan PN, Thankappan C, Preetha S, Suvarna Preetha T, Sudarsanan Hemanthakumar A. A comprehensive review of *Kaempferia galanga* L. (Zingiberaceae): a high sought medicinal plant in Tropical Asia. J Med Plants Stu, 2016; 4(3):270–6.

Rakib A, Ahmed S, Islam MA, Uddin MMN, Paul A, Chy MNU, Emran TB, Seidel V *et al*. Pharmacological studies on the antinociceptive, anxiolytic and antidepressant activity of Tinospora crispa. Phyther Res, 2020; 34(11):2978–84.

Refaat J, Kamel M, Ramadan M, Ali A. Analgesic, anti-inflammatory and antimicrobial activities of *Crinum augustum* Rox. and *Crinum asiaticum* L. Res J Pharmacogn Phytochem, 2011; 3(6):289–96.

Ridtitid W, Sae-wong C, Reanmongkol W, Wongnawa M. Antinociceptive activity of the methanolic extract of *Kaempferia galanga* Linn. in experimental animals. J Ethnopharmacol, 2008; 118(2):225–30.

Sao A, Panigrahi P, Kumar P, Sahu H. Molecular Distinguishness among rice (*Oryza sativa* L.) landrace of Central India using microsatellite markers. Int J Chem Stud, 2020; 8(4):1046–50.

Sima N. Evaluation of analgesic and anti-inflammatory effects of fresh onion juice in experimental animals. African J Pharm Pharmacol, 2012; 6(23):1679–84.

Somashekhara Achar KG, Boosanur V, Shivanna MB. Ethno-medico-botanical knowledge of Tiptur taluk in Tumkur district of Karnataka, India. Indian J Tradit Knowl, 2015;1(1):147–54.

Solomon, Jaasminerjiit K, Shopana P. Evaluation of ethanolic root extract of Allium cepa. L for analgesic and anti-inflammatory activities in animal models. World J Curr Med Pharm Res, 2020; 2:11–3.

Spandana U, Ali SL, Nirmala T, Santhi M, Sipai Babu SD. A review on tinospora cordifolia. Int J Curr Pharm Rev Res, 2013; 4(2):61–8.

Sreekeesoon DP, Mahomoodally MF. Ethnopharmacological analysis of medicinal plants and animals used in the treatment and management of pain in Mauritius'. J Ethnopharmacol, 2014; 157:181–200.

Stam C, Bonnet MS, Van Haselen RA. The efficacy and safety of a homeopathic gel in the treatment of acute low back pain: A multi-centre, randomized, double-blind comparative clinical trial. Br Homepath J, 2001; 90(1):21–8.

Syahruddin AN, Dahlan CK, Taslim NA. The effects of *Kaempferia galanga* L . extract on pain , stiffness and functional physic in patient with knee osteoarthritis : double blind randomized clinical trial. Intern J Sci Healthcare Res, 2017; 2(4):37–43.

Tang Y, Xin HL, Guo ML. Review on research of the phytochemistry and pharmacological activities of Celosia argentea'. Rev Brasil Farmacogn, 2016; 26(6):787–96.

Terry R, Posadzki P, Watson LK, Ernst E. The use of ginger (*Zingiber officinale*) for the treatment of pain: a systematic review of clinical trials. Pain Med, 2011; 12(12):1808–18.

Teshika JD, Zakariyyah AM, Zaynab T, Zengin G, Rengasamy KRR, Pandian SK, Fawzi MM. Traditional and modern uses of onion bulb (*Allium cepa* L.): a systematic review. Crit Rev Food Sci Nutr, 2019; 59(sup1):S39–70.

Thirupathi DAT. Analgesic activity of the ethanolic extract of flower parts of Celosia argentea Linn. W J Pharma Res, 2017; 6(5):775–80.

Umair M, Altaf M, Abbasi AM. An ethnobotanical survey of indigenous medicinal plants in Hafizabad district, Punjab-Pakistan'. PLoS ONE, 2017; 12(6):1–22.

Umar MI, Asmawi MZ, Sadikun A, Atangwho IJ, Yam MF, Altaf R, Ahmed A. Bioactivity-guided isolation of ethyl-p-methoxycinnamate, an anti-inflammatory constituent, from *Kaempferia galanga* L. extracts. Molecules, 2012; 17(7):8720–34.

Varghese S, Nair C. The rice landrace *Oryza sativa* Linn. cv. Navara in Kerala—a review. SAMAGRA, 2011; 7:8–15.

Verkamp EK, Flowers SR, Lynch-Jordan AM, Taylor J, Ting TV, Kashikar-Zuck S. A survey of conventional and complementary therapies used by youth with juvenile-onset fibromyalgia. Pain Manag Nurs, 2013; 14(4): 244–50.

Vitalini S, Iriti M, Puricelli C, Ciuchi D, Segale A, Fico G. Traditional knowledge on medicinal and food plants used in Val San Giacomo (Sondrio, Italy)—an alpine ethnobotanical study. J Ethnopharmacol, 2013; 145(2):517–29.

Walujo. Review: research tthnobotany in Indonesia and the future perspectives. Biodiversitas, 2008; 9(1):59–63

Warsinah W, Baroroh HN, Harwoko H. Phytochemical analysis and antioxidant activity of Brotowali (*Tinospora crispa* L. Mier) stem. Molekul, 2020; 15(2):73–8.

Weimer P, Lisbôa Moura JG, Mossmann V, Immig ML, de Castilhos J, Rossi RC. *Citrus aurantiifolia* (Christm) Swingle: biological potential and safety profile of essential oils from leaves and fruit peels. Food Biosci, 2021; 40:100905.

Willcox M, Siegfried N, Johnson Q. Capacity for clinical research on herbal medicines in Africa. J Altern Compl Med, 2012; 18(6):622–8.

Wu A, March L, Zheng X, Huang J, Wang X, Zhao J, Blyth FM, Smith E, Buchbinder R, Hoy D. Global low back pain prevalence and years lived with disability from 1990 to 2017: estimates from the Global Burden of Disease Study 2017. Ann Transl Med, 2020; 8(6):299.

Yaseen G, Ahmad M, Sultana S, Suleiman Alharrasi A, Hussain J, Zafar M, Shafiq-Ur-Rehman. Ethnobotany of medicinal plants in the Thar Desert (Sindh) of Pakistan. J Ethnopharmacol, 2015; 163:43–59.

Yoon SL, Kim JH. Factors contributing to the use of complementary and alternative medicine in rural older women with chronic pain in South Korea. Appl Nurs Res, 2013; 26(4):186–91.

Zhang J, Li Y, Wang Y. The complete chloroplast genome sequence of *Fagraea fragrans*. Mitochond DNA Part B, 2020; 5(1):711–2.

How to cite this article:
Nisa U, Triyono A, Ardiyanto D, Novianto F, Fitriani U, Jannah WDM, Astana PRW, Zulkarnain Z. Ethnopharmacological study of medicinal plants indigenous knowledge about low back pain therapy in Sumatra, Indonesia. J Appl Pharm Sci, 2022; 12(09):178–188.