Ethnobotanical Survey of Local Wisdom Knowledge on Medicinal Plants Used by the Traditional Phouthai Ethnic Group in NaKeu Village, Hinboun District, Khammouan Province, Lao PDR

Khamphilavong Khambaya (khambp006@yahoo.com)
Northwest Agriculture and Forestry University

Lili Zhang
Northwest Agriculture and Forestry University College of Forestry

Yongxiang Kang
Northwest Agriculture and Forestry University College of Forestry

Hua Li
Northwest Agriculture and Forestry University College of Forestry

Liru Wang
Northwest Agriculture and Forestry University College of Forestry

Nishantha Muththanthirige
Northwest Agriculture University College of Agronomy

Channy Samontry
National University of Laos Faculty of Forestry

Awais Muhammad
Northwest Agriculture and Forestry University College of Plant Protection

Souksamone Phangthavong
Birsa Agricultural University Faculty of Forestry

Research

Keywords: Ethnobotanical, Medicinal Plants, Traditional local wisdom, Plant parts used and Treatment

DOI: https://doi.org/10.21203/rs.3.rs-54642/v1

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Abstract

Background: Plants have been a part of rural area’s people life since prehistoric time, plants is important in the traditional cultures in the worldwide where human used it from birth to end of life. Idigen

This study was carried out to explore and recorded the plants and part used of plants for treating numerous people illness and disease by the traditional healers of the Phouthai ethnic group in Nakeu village, Hinboun district, Khammouane province, middle part Lao PDR for medicinal plants purposes. The current study was conducted, first, to identify plant species used as a remedy for human illness, diseases and health improve, and secondly to determine plant parts used, the technique of preparation and religious belief on the preferred source of healthcare an around Hinboun district, Khammouane province, Lao PDR.

Methods: Ethnobotanical data for this paper were gathering from 03 traditional healers, and 69 households, therefore including the household of both gender (husband or wife), and across different level of education, age group, as well as the level of experience and knowledge of medicinal plants use. Plant specimens were collected during field survey which had been collected from natural wild plant and home gardens, information on each medicinal plant was recorded by using the data capture form.

Results: We found 79 medicinal plants species, 51 families, and can’t identifies 2 species. Among the tree 44 species, 55.70 %; shrub 20 species, 25.32 %; liana 12 species, 15.19 %; and gasses 3 species, 3.8 %, were used to treat 34 sicknesses. A designation of all recorded species including the plant family names, dialect names, part used, and process to preparation of treatment. The roots are the plant part most commonly used (36.70%), followed by the stem (25.31%), leaves (10.12%), liana (10.12%), whole plant (6.32%), fruits (6.32%), and bark (3.79%). The medicinal plants are prepared using dried plant parts while some other species are using in fresh form. Boiling, soaking with cold water or alcohol, crushing, and burning are main methods of preparation.

Conclusion: In this study, 79 medicinal plant species were documented as use in the treatment of different common sickness including stomach problem (gastrointestinal, flatulence, diarrhea, detox), kidney infections, fever, dysmenorrheal postpartum tonic, nervous system, skin disease, health tonic, lever infections, heart disease, dressing wounds, and others.

1. Introduction

Plants have been a part of rural area's people life since prehistoric time, plants is important in the traditional cultures in the worldwide where human used it from birth to end of life (De Boer and Lamxay, 2009; Lamxay et al, 2011). Medicine is the very important plant resource for people and constructions are built from different plant species (Pieroniet al., 2017). Plant derived medicine is used to treating illness and disease, health tonic and are important in primary healthcare around the world (Elking et al., 2009), especially the people who are live in rural area is far from hospital. Even though, High percentage of the population also in developed countries such as Australia, Canada, France, Belgium, America use traditional medicine (McFarland et al., 2002; Molassiotiset al., 2005). As present time used modern medicines were formerly resolved or synthesized on the basis of plant derivatives which serves as a stratagem (Fabricant and Farnsworth, 2001; Iwu, 2002; Lu et al., 2011), looking for bioactive compounds from plants consumes large amounts of time, specialists, and funding, and the look for traditional medicinal plants can, therefore, help to reduce costs for pharmacy discoveries. At the same time, traditional knowledge is being eroded by several processes related to globalization and urbanization (Ragupathy et al., 2008; Srithet et al., 2009). As people in each region of the world have different historical backgrounds, cultures, lifestyles, and since the florals of their environment are different, patterns of their used of plants for medicine also vary, for instance by using different plant species and plant parts, methods of preparations, and applications (Kichuet al., 2015; Menaleet al., 2016).

The use of a plant for medicine is normally strictly related to a specific part of the plant such as roots, stems, leaves (Asowatata-Ayodeteet al., 2016, Ouelbaniet al., 2016, Agbodekeet al., 2016, Biruet al., 206), although some mode preparations can use any or all parts of a plant. The culling of plant part will often depend on which organ has the highest concentration of the bioactive substance that functions in the treatment (Abbasiet al., 2010, Abbas et al., 2016, Chekole, 2017, Dhamae et al., 2018), but since not all traditional medicine depends on physiological effects other parts may also be used. The preparation of the medicine modifies from lineage, which may use various solvents such as Boiling, soak with water or alcohol (Ramet et al., 2018, Asawata-Ayodeleteet al., 2016, Lamxayet al., 2011), to crushing without extraction, to ingestions without any preparation. And the medicine may be prepared as a drink or a pill or used without any preparation. Finally, the way of administering the medicine varies from ingestion to inhalation of smoke, to external application to affected parts of the body (Jai-aueet al., 2014, Baruahet al., 2016, Jahandidehet al., 2016). All these variations have cultural, geographic and temporal dimensions.

The rural people almost exclusive on traditional medicine for their primary healthcare, their dependence on medicine is high due to lack of modern healthcare services (Lu et al, 2011, Delang, 2007). Even though the communities have known and used a lot of medicine plants, but no one has written their knowledge for future use (Pooma and Suddee, 2014, Hidayatiet al., 2015). The most of local knowledge which are still available among traditional healers is another be lost or passed to next young generation only by the oral word (Park et al., 2018). Besides, lack of adequate referent on knowledge of ethnomedicinal plants use among often cited problems in the study site (Birhanuet al., 2015, Staubet al., 2016, Baruahet al., 2016, Tenaet al., 2013). Even though, the communities have known and used a lot of medicine plants, but no one has written their knowledge for future use (Pooma and Suddee, 2014, Hidayatiet al., 2015). The most of local knowledge which are still available among traditional healers is another be lost or passed to next young generation only by the oral word (Park et al., 2018). Besides, lack of adequate referent on knowledge of ethnomedicinal plants use among often cited problems in the study site (Birhanuet al., 2015, Stau
2015). The current study was conducted, first, to identify plant species used as a remedy for human illness, diseases and health improve, and secondly to determine plant parts used, the technique of preparation and religious belief on the preferred source of healthcare around Hinboun district, Khammouane province, Lao PDR.

2. Materials And Methods

2.1 Study area

The Khammouane province, one of a province in middle part of Lao PDR as presented in Fig. 1. The land area of 16,315 km², and is almost of forest mountain terrain. The province share bordered with Savannakhet province to the south, Bolikhampay province to the north and northwest, Thailand to the west, and Vietnam to the east. The forest area encloses of three store areas. These are the PhouHinPhoun National Biodiversity Conservation Area with an area is 150,000 ha, Nakai-Nam Them National Biodiversity Conservation Area has cover areas is 352,200 ha, and Hin Nam No National Biodiversity Conservation Area with an areas 86,229 ha.

The study was conducted in Nakeu village, Hinboun district. In this part of Khammouane province traditionally inhabited by the Phouthai people. It is located 33 km far away from the town, the geographically situated between 17°64' − 86°78' N and 140°78'–48°57' E, the total land area of 35,863 ha (Fig. 1). The mean monthly temperature is 32 °C, ranging from 15 °C to 38 °C, and total rainfall is 1200 mm, ranging from 600 to 1600 mm (Statistical Authority, 2017). The population of the study site is amounted to 960 people, female is 465 people all most of them is Phouthai people.

2.2 Ethnobotanical data collection

Looking at the traditional healer in the Hinboun district area was conducted with the first agreement of citation by community leaders of each household. Our research team started an interaction with each expected respondent by explaining the aim of the study in order to solicit their consent and co-operation before any ethnobotanical data gathering. While this group discussion the research team was emphasized the extensive value which each traditional healer's contribution can make the compilation a recorded of traditional knowledge of medicinal plants in Hinboun district area.

With the helping of a commenter, all interviews and discussions were conduction in Nakeu village. Ethnobotanical data for this paper were gathering from 03 traditional healers, and 69 households, therefore including the household of both gender (husband or wife), and across different level of education, age group, as well as the level of experience and knowledge of medicinal plants use. In every part of the field survey, semi-structured interviews and group discussions were conducted in order to collect the local wisdom information about medicinal plants. The question was designed to focus on the local names of plants, their multitudinous medicine application, the part of used, the methods of preparation, and handle treatment to patients.

2.3 Plant collection and plant identification

The field survey was undertaken with randomly selection household on a descriptive statistics was employed to analyze and summarize the data on report medicinal plants, part of used, mode of preparation, ministry, the postulate of used, habitats of medicinal plant, and influence of realization, religious beliefs and culture on the extra source of healthcare. Plant specimens were collected during field survey which had been collected from natural wild plant and home gardens, information on each medicinal plant was recorded by using the data capture form. Certain medicine plants were identified in the field and remaining ones identified through published oras and another reference. After identifying medicinal plants, a photograph and herbarium specimen of each medicinal plant was taken in the herbarium at Faculty of Forestry Science, the National University of Laos for comparison and verification of each plant's scientific name.

3. Result And Discussion

3.1 Medicinal plants species

From this research it was found that among the 33 respondents who were interviewed, the majority was falling within the villagers (30 people) and healers (3 people). The total of 79 species, and 51 families, and can't identifies 2 species. Among the tree 44 species, 55.70 percentage; shrub 20 species, 25.32 percentage; liana 12 species, 15.19 percentage; and grasses 3 species, 3.8 percentage (Table 1) were used to treat 34 sicknesses. A designation of all recorded species including the plant family names, dialect names, part used, and process to preparation of treatment show in Table 1.

The study indicated 32 species (40.50%) that are used for medicinal purposes by traditional healers, 13 species (16.45%) are used by villagers, and 34 species (43.03%) used by both (healers and villagers) (Fig. 2).
Plants are most frequently used for the treatment of the sickness such as stomach problems, nervous system, kidney infection, liver tonic, menstrual cycle, and postpartum tonic (55.69%) which shown in Fig. 3 and Table 1. These results are followed by the pattern found in medicinal plant studies around the world, such as in Brazil (Bolson et al., 2015), India (Kichu et al., 2015), Italy (Fortini, 2016). The roots are the plant part most commonly used in this community (36.70%), followed by the stem (25.31%), leaves (10.12%). Leaves are commonly used like medicine in many parts in developing countries (Yemele et al., 2015; Mungu et al., 2016; Fortini et al., 2016), and using leaves for medicine is a sustainable way of using plants (Mungu et al., 2016). From this research it is concluded that the liana (10.12%), whole plant (6.32%), fruits (6.32%), and bark (3.79%) were used for treatments which shown in Fig. 4, the most used part of the plant are roots (35%), because of their availability throughout the year, traditionally considered to be strong medicine, have a good smell and easy to drink. The roots are being used in different medicine manufacturing more frequently, because sometime it's difficult to use other plant parts due to presence of phytochemical compounds (Singh et al., 2016).

The medicinal plants listed in Table 1 are used for the treatment of 34 sicknesses. Most of the villagers and traditional healers make medicine by boiling and distilling medicinal plants, that methods were also used by (Gadisa et al., 2018, Methew et al., 2018, Mahwase et al., 2013). Medicine preparation methods of dominate treatments vary from drying and burning the plants for treating warts with the smoke and crushing. (Alemayehuet al., 2015, Chekole et al., 2017, Girmay and Teshome 2017) in their study also mention the mode of remedy preparation to the charred remains are used as a dressing on wounds.

The villagers and traditional healers usually collected the medicinal plants from different fields, plants parts were dry and crushed before storing in bag or bottles. This method is also similar with (Gadisa et al., 2018). It is very difficult for patients to recognize plants species that are used for their treatment, which sometimes seem ordinary plants that growing in gardens or in field. Some villagers prefer to store plants material in dry or powdered form inside bottles or plastic bags to reduce the field collection trips and make sure the availability of plants part possible throughout the year.
Table 1
Ethnobotanical information of medicinal plants uses by villagers and healers to treat sickness in Nakeu village, Hinboundistric, Khammouane province, Laos.

| No | Dialect names      | **Scientific name**           | Family name | References        | vg/hl** | Plant form | Part used | Method of prepare                                                                 |
|----|-------------------|--------------------------------|-------------|-------------------|---------|------------|----------|-----------------------------------------------------------------------------------|
| 1  | NaoNarm           | *Artabotrys spinosus* Craib    | Annonaceae  | Onvilay et al. 2016 | hl      | tree       | t        | The stem is boiled and mixture drank to treating kidney infection.                  |
| 2  | Theangseang       | *Cananga latifolia*           |             | Southavong et al. 2014 | both    | tree       | r        | Roots are soaked in cold water for 2–3 day drank to bring down fever              |
| 3  | Som Lom           | *Aganonerion polymorphum* P.  | Apocynaceae | Onvilay et al. 2016 | hl      | liana      | r        | Roots are boiled and mixture drank to treating kidney stone.                       |
| 4  | Chum Pha          | *Plumeri alba*                |             | Onvilay et al. 2016 | vl      | tree       | r        | The roots are boiled and drank for nervous pain.                                  |
| 5  | Teen Phet         | *Alstonia scholaris* L.       |             | Newman et al. 2007  | vl      | tree       | t        | The stem is boiled and mixture drank to treating paralysis.                        |
| 6  | Puk Nork          | *Centella asiatica* (L) Urbon | Apiaceae    | Lamxay et al. 2011 | vl      | shrub      | wh       | The whole plant boiled and mixture drank for alleviating numbness, aches and pains in the body. |
| 7  | Pha Rai           | *Schefflera elliptica* (Blume) Harms | Araliaceae | Southavong et al. 2014 | hl      | tree       | r        | The roots are boiled and drank for stomach problems.                              |
| 8  | Kok Tang Kai      | *Scheffera octophylla* (Loureiro) Harms |             | Southavong et al. 2013, 2014 | both    | tree       | t        | Stem cut is small piece are soaked with alcohol and drank for nervous system.     |
| 9  | Ya Far Rang       | *Chromolaena odorata* (L.) R. King & H. Robinson | Asteraceae | Lamxay et al. 2011 | vl      | shrub      | t        | The stem is boiled and mixture drank for stomach detox                            |
| 10 | Warn Hang         | *Aloe vera* L.                | Asphodelaceae | Southavong et al. 2013 | both    | tree       | r        | Roots are soaked with alcohol and mixture drank for sexual performance.           |
| 11 | Mai Khea Laow     | *Haplophrama adenophyllum*    | Bignonaceae | Southavong et al. 2013 | both    | tree       | r        | Roots are boiled and mixture drank for stomach problems.                          |

Remake: vg* villagers, hl* healers; t, stem; l, leaves; r, roots; wh, whole plant; f, fruit; b, bark; ln, liana.
| No | Dialect names   | Scientific name                          | Family name         | References          | vg*/hl** | Plant form | Part used | Method of prepare                                                                 |
|----|----------------|------------------------------------------|---------------------|---------------------|----------|------------|----------|----------------------------------------------------------------------------------|
| 12 | Lin Mai        | *Oroxylum indicum* (L.) Kurz             | Newman et al. 2007  | vl                  | tree     | t          |          | The stem is boiled and mixture drank to treating emaciation.                       |
| 13 | Nard Narm      | *Buddleja asiatica* Lour.                | Southavong et al. 2013 | both                | shrub    | rt         |          | Roots are boiled and mixture drank for aweary, post-partum tonic, cough and bruises. |
| 14 | Sakharm        | *Peltophorum dasyrachis*                  | Southavong et al. 2013 | both                | tree     | r          |          | Roots are boiled/soaked with alcohol drank for infertility, dysmenorrhoea and to improved sexual performance |
| 15 | Mai Tew        | *Cratoxylonformorsum* (jacq) Dyer        | Southavong et al. 2013 | hl                  | tree     | t          |          | The stem is boiled or soaked with alcohol and drank for nourish the body.         |
| 16 | Mark KharmKheu | *Cnestismiflora* Griff                    | Southavong et al. 2013 | both                | liana    | ln         |          | Liana are boiled or soaked with alcohol and drank for health tonic.               |
| 17 | HuoaEung       | *Costusspeiosus* (Koecnig)               | Onvilay et al. 2016  | hl                  | shrub    | t          |          | The stem is boiled and mixture drank to treating kidney infection.                |
| 18 | Mark Keae      | *Combretum quagrangulare* Kurz           | Southavong et al. 2014 | both                | tree     | t,l        |          | Stem and leaves crushed rubbed on body or used fruits and leaves are boiled as bath to treating rash on body/anti-allergy. |
| 19 | Han Drang      | *Artocarpus* ssp.                        | Newman et al. 2007  | hl                  | tree     | f          |          | The dry's fruits are boiled and mixture drank to alleviating jaundice             |
| 20 | KraDeang       | *calycoperis floribunda* (Roxn.) lamk.   | Southavong et al. 2014 | hl                  | liana    | ln         |          | The liana is boiled and drank for bring down fever.                              |
| 21 | Ya Khum Pao    | *Carexbaccans* Nees.                     | Onvilay et al. 2016  | hl                  | gasses   | r          |          | Roots are boiled and mixture drank to treating kidney problems.                  |

Remake: vg* villagers, hl* healers; t, stem; l, leaves; r, roots; wh, whole plant; f, fruit; b, bark; ln, liana.
| No | Dialect names   | Scientific name               | Family name        | References                      | vg*/hl** | Plant form | Part used | Method of prepare                                                                 |
|----|----------------|------------------------------|-------------------|---------------------------------|---------|------------|----------|----------------------------------------------------------------------------------|
| 22 | Hark Kha Jai   | *Cyperus elatus* L.         | Cyperaceae        | Southavong et al. 2013, 2014    | both    | shrub      | t        | Stem are boiled and mixture drank to stop diarrhea.                              |
| 23 | Khean Hin      | *Hopea ferreapierre*       | Dipterocarpaceae  | Hua & Tzen-Yuh 2017             | hl      | tree       | b        | Bark are soaked with cold water or boiled and drank for alleviating diarrhea.    |
| 24 | Thonpheang     | *Dillenia baillonii*       | Dilleniaceae      | Southavong et al. 2014          | both    | tree       | r        | Roots are soaked in cold water for 2–3 day drank to bring down fever.           |
| 25 | Mai Mark San   | *Dillenia Sp.*             |                   | Southavong et al. 2014          | hl      | tree       | r        | Roots are boiled and mixture drank to treating liver disease.                    |
| 26 | KeauKra        | *Diospyros mollis*         | Ebenaceae         | Southavong et al. 2013          | hl      | tree       | r        | The roots boiled or soaked with alcohol and drank for nourish the body or health tonic. |
| 27 | Mai Moun       | *Elaeocarpus siamensis*    | Elaeocarpaceae    | Hua & Tzen-Yuh 2017             | both    | tree       | r        | Roots are boiled and mixture drank for regulating menstrual cycle.               |
| 28 | Hoo Shang      | *Macaranga denticulate*    | Euphorbiaceae     | Lamxay et al. 2011              | both    | shrub      | l        | The leaves are boiled and drank for stomach problem.                             |
| 29 | Mark Yao       | *Vernicia montana* LOUR.   |                   | Southavong et al. 2013          | vl      | tree       | tl       | Deduct stem or leaves and used resin rubbed on the papilla.                     |
| 30 | Kang Pha       | *Phyllanthus reticulates*  | Euphorbiaceae     | Southavong et al. 2013          | hl      | tree       | l        | The leaves are soaked with cold water and drank for bring down fever.           |
| 31 | Mai deang      | *Xyliakemii*               | Fabaceae          | Southavong et al. 2013          | both    | tree       | r        | Roots are soaked with cold water and the mixture drank for the postpartum tonic. |
| 32 | None Nai       | -                           |                   | Southavong et al. 2013          | hl      | shrub      | r        | Roots are boiled and mixture drank to treating liver disease, and nervous system. |

Remake: vg* villagers, hl* healers; t, stem; l, leaves; r, roots; wh, whole plant; f, fruit; b, bark; ln, liana.
| No | Dialect names | Scientific name | Family name | References | vg*/hl** | Plant form | Part used | Method of prepare |
|----|--------------|----------------|-------------|------------|---------|------------|----------|------------------|
| 33 | Pao Thong    | *Leptostachya* sp. |            | Onvilay et al. 2016 | both    | tree       | r        | Roots are boiled and mixture drank to treating kidney problems. |
| 34 | HomsarmMeuang | *Moghanialatifolia* |            | Onvilay et al. 2016 | hl      | liana      | r        | The roots are soaked with alcohol, and drank for improved sexual performance, postpartum tonic. |
| 35 | PukKood Buang | *Gleichenia linearis* | Gleicheniaceae | Southavong et al. 2013 | both    | shrub      | r        | Roots are boiled and mixture drank for treating flatulence. |
| 36 | KokTha Kai   | *Salacia viminia wallich* ex lawon | Hippocrataceae | Onvilay et al. 2016 | hl      | shrub      | t,l      | The stem and leaves crushed and rubbed on body which has papilla. |
| 37 | Mai Ka Sao   | *Holoptelea intergrifolia* | Holoptelea | Sydara et al. 2014 | hl      | tree       | r        | Roots are boiled and mixture drank to treating liver disease. |
| 38 | Sean Meuang  | *Gonocaryum subrostratum* P. | Icacinaceae | Sydara et al. 2014 | hl      | shrub      | t        | The stem is soaked with cold water drank for jaundice. |
| 39 | PukieTou     | *Ocimum* spp. | Labiaceae | Southavong et al. 2013 | vl      | shrub      | t        | The stem is boiled and mixture drank for stomach detox |
| 40 | Ya Nouad Meo | *Orthosiphon aristatus* | Labiatae | Onvilay et al. 2016 | hl      | gasses     | wh       | Whole plant is boiled and mixture drank to treating kidney problems. |
| 41 | Mai Mark Sang | *Litsea cubeba* (Lour.) Pers. | Lauraceae | Southavong et al. 2013 | hl      | tree       | wh       | Whole plants are boiled and mixture drank for purgative, tonic blood, malaria, and dizzy. |
| 42 | Zhouangnoy   | *Cinnamomuminers* |            | Lamxay et al. 2011 | both    | tree       | t        | The stem cut is a small piece and boiled drank for easier to get pregnancy. |
| 43 | Pha Dong Mod lin | *Dalbergia* | Leguminocoeae | Southavong et al. 2013 | hl      | tree       | t        | Stem are boiled and drank to treating papilla on the body. |

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| No | Dialect names | Scientific name               | Family name     | References         | vg*/hl** | Plant form | Part used | Method of prepare                                                                 |
|----|--------------|--------------------------------|-----------------|--------------------|----------|------------|-----------|-----------------------------------------------------------------------------------|
| 44 | Sarm Hang    | *Moghania macrophylla* (Willdenow) O. Kuntze | Leguminosae     | Southavong et al. 2013 | hl       | shrub      | t         | Stem are soaked with cold water 2–3 day, drank for detox stomach.                  |
| 45 | Keua Charn   | *Spatholobu sroxburghri* Benth     |                 | Southavong et al. 2013 | hl       | liana      | ln        | The liana is boiled and drank for alleviating sore throat.                         |
| 46 | Kra Teo      | *Pterolobium platypterum* Gagnepain |                 | Onvilay et al. 2016  | hl       | liana      | ln        | The liana is boiled and mixture drank for stomach problem.                       |
| 47 | Mark Kharm   | *Tamarindus indicus* Linn.         |                 | Southavong et al. 2014 | vl       | tree       | b         | The bark is burned and made it as the powder used as a dressing on wounds to dry. |
| 48 | Khii Leck    | *Cassia timoriensis* Dc.          |                 | Hua &Tzen-Yuh 2017    | vl       | tree       | t,l       | The stem is boiled and drank or leaves cooked dish for sleep well.                |
| 49 | Kok Peuay    | *Lagerstroemia floribunda*         | Lythraceae      | Newman et al. 2007    | hl       | tree       | b         | Bark soaked with cold water 15–20 minute and drank or leaves are chewed and swallowed for diarrhea. |
| 50 | Fai Lang     | *Eriolaena candollei* Wallich     | Malvaceae       | Southavong et al. 2013 | vl       | tree       | r         | The roots are boiled and drank for stomach problems.                             |
| 51 | Keu Haem     | *Coscinium fenestrum*             | Menispermaceae  | Southavong et al. 2013 | both     | liana      | r         | Roots made is dry and boiled drank for gastrointestinal.                         |
| 52 | Keu Khaohor  | *Tinospora crispa*                |                 | Southavong et al. 2013 | both     | liana      | ln        | Liana’s fresh or dry are boiled and drank for Scabies, ringworm.                  |
| 53 | Hum Vang/Hum Hork | *Ficushisuta* Vahl               | Moraceae        | Newman et al. 2007    | hl       | shrub      | r         | Roots are boiled and drank for health tonic, nervous system.                      |
| 54 | Som Phor     | *Streblus asper* LOUR             |                 | Hua &Tzen-Yuh 2017    | both     | tree       | f         | The fresh fruit are soaked with warm water and drank to treating cough or common cold. |
| 55 | Deau Pong    | *Ficus hispida* L.f.              |                 | Lamxay et al. 2011    | both     | tree       | t         | Stem is boiled and mixture drank for bring down fever.                           |

Remake: vg* villagers, hl* healers; t, stem; l, leaves; r, roots; wh, whole plant; f, fruit; b, bark; ln, liana.
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|----|---------------------|----------------------------------|-------------|-------------------------------------|----------|------------|-----------|-------------------|
| 56 | Hang Kuang          | Gomphia serrata (Gaertn) Kanis    | Ochanaceae  | MoNRE-IUCN, 2016                    | both     | shrub      | t         | The stem is boiled and mixture drank for stomach problems. |
| 57 | Mai Mark Feung      | Averhoa yarlambora L.            | Oxalidaceae | Southavong et al. 2014              | vl       | tree       | r         | Roots are boiled and mixture drank to treating kidney problems. |
| 58 | Tong Teeb           | Pandanus amaryllifilius          | Pandanaceae | Southavong et al. 2014              | vl       | shrub      | l         | Used 3–5 leaves are boiled and drank to treating nerve pain/nervous system. |
| 59 | Trang Teep          | Glochidion brunneum Hook. f.     | Phyllanthaceae | Southavong et al. 2014             | hl       | Shrub      | wh        | The whole plant is boiled and mixture drank for stomach problems. |
| 60 | KharmPom            | Phyllanthusemblica L.            |             | Hua &Tzen-Yuh 2017                 | vl       | tree       | r,f       | The stem and leaves are boiled and drank or fresh fruit eta directly for stomach problems. |
| 61 | Deuy Hin            | Coix aquatic                     | Poaceae     | Onvilay et al. 2016                | hl       | shrub      | f         | Fruits are boiled and mixture drank to treating kidney problems. |
| 62 | Mai KhoneTha        | Harrisonia perforate             | Rataceae    | Southavong et al. 2013             | both     | shrub      | r         | Roots are boiled and mixture drank for stomach problems. |
| 63 | Seuakhong           | Ziziphus funiculosa Ham.         | Rhamnaceae  | Southavong et al. 2014             | both     | liana      | ln        | The liana cut is a small piece and soaked in alcohol/boiled drank for infertility, dysmenorrhoea or syncope |
| 64 | Mai Pork            | Parinarium annamense HANCE       | Rocaceae    | Newman et al. 2007                 | both     | tree       | r         | Roots are boiled and mixture drank for stomach problems. |
| 65 | Kok Khao            | Haldina cordifolia Roxb.         | Rubiaceae   | Onvilay et al 2016                 | both     | tree       | t         | The stem cut is a small piece and boiled drank for stomach problems. |
| 66 | Ya Ngoo Noy         | Hedyotidisfusa Wild.             |             | Southavong et al. 2014             | both     | gasses     | wh        | Whole plant is boiled drank for health tonic. |

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| No | Dialect names   | Scientific name                                | Family name | References                | vg*/hl** | Plant form | Part used | Method of prepare                                                                 |
|----|-----------------|------------------------------------------------|-------------|---------------------------|----------|------------|----------|----------------------------------------------------------------------------------|
| 67 | Khat Koa        | *Randia simensis*                               | Southavong  | Southavong et al. 2014    | both     | tree       | l        | Juice from the crushed leaves is used as a dressing on wounds.                     |
| 68 | Som Kop         | *Hymenodictyon excelsum WALL*                    | Southavong  | Southavong et al. 2014    | both     | tree       | r        | The roots are soaked with cold water and drank to treating fever.                 |
| 69 | Som Sheun       | *Glycosmis parvifolia*                           | Rutaceae    | Onvilay et al. 2016       | both     | liana      | ln       | The liana is boiled and mixture, drank for treating fever.                       |
| 70 | Kok Ken         | *Flacourtia rukam*                               | Salicaceae  | Southavong et al. 2013    | both     | tree       | r        | Roots are boiled and mixture drank to treating stomach problems or diarrhea.     |
| 71 | Nom Ngoua       | *Scleropyrum pentandrum*                         | Santalaceae | Onvilay et al. 2016       | both     | tree       | r        | Roots are soaked with cold water drank for the postpartum tonic.                 |
| 72 | Wran Sa Noy     | *Scoparia dulcis*                                | Scrophulariaceae | Southavong et al. 2013    | both     | liana      | ln       | The liana of climber cut is a small piece mixture and boiled drank for alleviating easy labour or weary |
| 73 | Koun Tha        | *Harrisonia perforate*                           | Simaroubaceae | Southavong et al. 2014    | hl       | tree       | t        | Stem are boiled and mixture drank to alleviating jaundice.                       |
| 74 | Bii Khon        | *Brucea sumatran*                                | Simaroubaceae | Southavong et al. 2014    | hl       | shrub      | f        | Dry fruit are boiled and drank treating cholecystitis.                            |
| 75 | Ya Huoa         | *Smilax glabra*                                  | Smilacaceae | Southavong et al. 2013,   | both     | liana      | r        | Roots are boiled/soaked with alcohol drank to improved sexual performance        |
|    |                 |                                                 |             | 2014                      |          |            |          |                                                                                  |
| 76 | Kok Khai Doun   | *Turpinia pomifera*                              | Staphyleaceae | Southavong et al. 2013    | hl       | tree       | l, f    | Juice leaves crushed and rubbed on the body for skin disease, and fruit is crushed as a powder mixed with warm water and drank for heart disease. |

Remake: vg* villagers, hl* healers; t, stem; l, leaves; r, roots; wh, whole plant; f, fruit; b, bark; ln, liana.
This research found that, the medicinal plant most usually used for the treatment of stomach problem (55.88%), followed by kidney infection (23.53%), fever (20.59%), Dysmenorrheal/Postpartum tonic (17.65), skin disease and nervous system (14.71%) each, health tonic and sexual performance (11.76%) each, Liver disease and Jaundice (8.82%), a weary and dressing wounds (5.88%), and while the following complains, namely pain, cough and bruises, purgative, tonic blood, malaria, dizzy, emaciation, heart disease and sore throat (2.94%) each (Fig. 5).

The main objective of this research was to keep the medicinal Plant knowledge in document form that used for treating different sickness since from ancient time and transfer orally from generation to the next generation. And the recording and maintaining of that knowledge in written form is also very useful for pharmaceutical purpose to developing advance medicine to treating these illnesses.

### 3.2 Traditional Medicine Formulae

#### Use for nervous system

| Species name | Part use | Dosage |
|--------------|----------|--------|
| Local name   | Scientific name | Family |
| SomLom       | *Aganonerionbpolymorphum* | Apocynaceae |
| Nga None Nai | Not identified | Fabaceae, Roots |
| NgaKhuoak    | *Desmodiumtriquetrum* | Poaceae, Roots |

**Method of preparation:** Take dried raw material and decoct in 1.5 liters of water. Drank as needed.

#### Use for kidney inflammation

| Species name | Part use | Dosage |
|--------------|----------|--------|
| Local name   | Scientific name | Family |
| Huoa-Eung    | *Costusspeiosus*(Koecnig) | Costus, Stem |
| NaoNarm      | *Artabotrysspinosus*Craib | Annonaceae, Stem |
| Pao Thong    | *Leptostachyas* | Fabaceae, Roots |
| YaKhumPao    | *Carexbaccans*Nees | Cyperaceae, Roots |
| DeuayHin     | *Cox aquatic* | Poaceae, Fruit |
| Sa Ly        | *Zea mays* | Poaceae, Hair |
| SomLom       | *Aganonerionbpolymorphum* | Apocynaceae, Roots |

**Method of preparation:** Take dried raw material and decoct in 2 liters of water, and drank as needed.

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Remake: vg* villagers, hl* healers; t, stem; l, leaves; r, roots; wh, whole plant; f, fruit; b, bark; ln, liana.
| Species name               | Scientific name                  | Part use | Dosage |
|---------------------------|----------------------------------|----------|--------|
| KokKhao                   | *Haldinacordifolia* Roxb.        | Roots    | 1 root |
| Nom Ngoua                 | *Scleropyrumpentandra* (Dennst.) Mabb. | Stem/Roots | 2 root |
| YaHuoa                    | *Smilax glabra* Roxb             | Roots    | 1 root |
| Sa Ly                     | *Zea mays*                       | Hair     | 1 g    |
| HomSarmMeuang             | *Moghanialatifolia*              | Root     | 1 root |
| Sa Math                   | *Euodialepla*                    | Root     | 1 root |

**Method of preparation**: Take dried raw material and decoct in 2 liters of water, and drank as need.

4. Conclusion
It was found that the total 79 plant species that were used in traditional medicine in Hinboun district, Khammuane province, Lao PDR. Of these a few species had high use values, suggesting that they may produce bioactive compounds with strong physiological effects. In this study, 79 medicinal plant species were documented as use in the treatment of different common sickness including stomach problem (gastrointestinal, flatulence, diarrhea, detox), kidney infections, fever, dysmenorrheal postpartum tonic, nervous system, skin disease, health tonic, liver infections, heart disease, dressing wounds, and others. The majority of these traditional medicinal plants are trees, shrubs, liana, and gasses that are mainly sourced from wild. Among the plant parts used, roots and stems are the most frequent used. The medicinal plants are prepared using dried plant parts while some other species are using in fresh form. Boiling, soaking with cold water or alcohol, crushing, and burning are main steps of preparation of medicine.

The current study also highlighted that realization and cultural beliefs have a significant influence on the unique source of healthcare, whereas religion was found to have no association with health-seeking behavior. Beyond, the immediate researchers believe that the therapeutic use of the identified and documented plants will provide basic data for further researches focus on pharmacological studies and the conservation of the most important medicinal plants in the study area.

**Declarations**

- **Ethics approval and consent to participate**
  
  This paper our research teams from Faculty of Forestry Science National University of Laos. Plan worked was follow the role of Faculty and Province; by submitted the letter form Faculty to Province of Agriculture and Forestry Office, then province office will contract to District and from district to villages step by step. (supporting document on attract files or if need more detail contract to author by email)

- **Consent for publication**
  
  Not applicable

- **Availability of data and materials**
  
  Please contact author for data requests

- **Funding**
  
  The program was financially supported by the Forestry Research Foundation for the Public Service from The State Forestry Administration of China,” Research on Plant Diversity in Qinling Mountains’(2015,04320)

- **Competing interests**
  
  The authors declare that they have no competing interests.

- **Authors’ contributions**
  
  Kang Yongxiang participated in the design of the study. Zhang Lily and Awais participated in the sequence alignment and drafted the manuscript. Souksamone and Channy conceived of the study and coordination and helped to data correction. Nishantha and Li Hua carried out the checking and ensure scientific name. All authors read and approved the final manuscript.
Acknowledgments

We would like very grateful to teachers of Department of Forest Community and Rural Development at Faculty of Forestry Science, National University of Laos for providing us field materials, and their students to helping us in collection data. We would also like to express our gratitude to the Province of Forestry Office. Thankfully to villagers and healers for their invaluable contribution to the study, and also thanks to all the staff in department of forestry at Hinboun district for graciously granting us permission to conduct our study.

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Figures

Figure 1

Map showing Hinboun district, Nakeu village study area
Figure 1

Map showing Hinboun district, Nakeu village study area

Figure 2

Number of plant species that knew by healers and villagers in Hinboun district, Khammouane province.
Figure 2

Number of plant species that knew by healers and villagers in Hinboun district, Khammouane province.
Figure 3

Plant form representation of medicinal plant in Hinboun district, Khammouane province.
Figure 3

Plant form representation of medicinal plant in Hinboun district, Khammouane province.

Figure 4

Plant parts used
Percentage use of plant part use in Hinboun district, Khammouane province.

![Chart showing plant parts used](image)

**Plant parts used**

Figure 4

Percentage use of plant part use in Hinboun district, Khammouane province.

![Chart showing disease condition](image)

**Disease condition**

Figure 5

The frequency by percentage of the type's medicine conditions treating by the medicinal plants used in Hinboun district, Khammouane province.
Figure 5

The frequency by percentage of the type’s medicine conditions treating by the medicinal plants used in Hinboun district, Khammouane province.

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