

# Ethnobotanical study on medicinal dietary plants used by the Yi people in southeastern Yunnan, China

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## Research

**Keywords:** Medicinal dietary plants, Ethnobotanical surveys, Mile, Yi people, Traditional medicine

**Posted Date:** April 23rd, 2020

**DOI:** <https://doi.org/10.21203/rs.3.rs-23750/v1>

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**Version of Record:** A version of this preprint was published on August 28th, 2020. See the published version at <https://doi.org/10.1186/s13002-020-00400-5>.

## Abstract

## Background

With a population of more than 5 million, Yi is the largest of the 25 ethnic groups in Yunnan Province, China. Yi people tend to live in mountainous areas, and their culture includes a unique dietary system for treating illnesses and protecting people against them. Medicinal plants occupy an essential place in the Yi diet because they play a key role in health and the prevention and treatment of diseases. The objectives of this paper were to document the medicinal dietary plants and the traditional knowledge associated with them and describes this paper adequately.

## Methods

Field investigations were carried out in six villages in Mile County, Honghe Hani and Yi Autonomous Prefecture, Yunnan, from July 2017 to May 2018. Information was collected using participatory rural appraisal (PRA), direct observation, semi-structured interviews, key informant interviews, individual discussions, focus group discussions, and questionnaires.

## Results

The study documented 124 species belonging to 62 families and 102 genera. These included: angiosperms (117 spp.), gymnosperms (3), pteridophytes (2), lichens (1), and fungi (1). The most commonly used plant parts were fruits and roots. The most frequently used edible parts were fruits, and the most frequently used medicinal parts were roots. The medicinal parts were used to treat conditions such as cough, catarrh, rheumatism, swelling, kidney deficiency, spleen deficiency, gastric disease, and others. Some of the plants required special preparation. Several had good economic potential due to their significant effects. In addition, a number of these plants are scarce and require conservation. The use-value (UV) and frequency of utilization index (FUI) of medicinal dietary plant species were analyzed. The 20 species with the highest UV were noted as particularly important to the Yi people's daily life in Mile county.

## Conclusion

A wide variety of medicinal dietary plants is used by Yi people in Mile. These plants occupy an essential position in the Yi diet and medicine. These plants are not only nutritious but also have medicinal value and, by consuming them, the Yi people maintain health and treat diseases through their daily diet. Ethnobotanical surveys of medicinal dietary plants provide a theoretical reference for the conservation and sustainable use of these plant resources and can contribute to the protection of the Yi food culture and traditional medicine in Mile. In addition, this information provides a basis for the development and utilization of Yi ethnic medicine and health products.

## Background

There are many overlaps between medicine and food, and dietary products can simultaneously be food and medicine [1]. The concept of "medicinal dietary" is based on ancient lore about food, and medicine discovery in ancient times, which reflected the edibility and medicinal function of certain plants. In fact, many plants in local food cultures have therapeutic value. The idea of "food as medicine" has existed in China since ancient times. In recent years, with the general improvement in people's living standards, knowledge about dietary hygiene and nutrition has become more widespread. In the world, People are paying more attention to health care, health preservation, and are advocating natural cures. In western countries, some people propose "kitchen instead of pharmacy" and "food instead of medicine" [2].

In the 1930s, there was a saying in China that "food and medicine have the same origin". The first mainstream herbology monograph in China, the *Holy Husbandman's Classic on Roots and Herbs* recorded many medicinal dietary plants. Since 1985, more than 10 food therapy books a year have been published in China [3]. However, the study of medicinal diets used by indigenous communities in China has been largely neglected. Yi, one of the most ancient ethnic groups in Southwest China [4], is the sixth largest ethnic minority [5], and is mainly distributed in Yunnan, Guizhou, Sichuan, and Guangxi provinces in southwest China, with a population of approximately 8.71 million. Around 61% of the Yi people live in Yunnan Province [6]. Two autonomous prefectures, Chuxiong and Honghe, and another 15 autonomous counties, including Nanjian, Luquan, and Shilin, are the primary locations for the Yi people in Yunnan Province. The rise in Yi medicine in the southwest can be traced to the Eastern Han Dynasty, 1800 years ago [4]. In the long struggle against disease and harsh environments, a specific system of diet and medicine was developed by the Yi [7]. For instance, many medicinal plants are used not only for essential components of the daily diet but also play an important role in health care and disease prevention under conditions of limited medical resources [8–13]. Xian Yao Ching of Yi ethnicity wrote during the Qing Dynasty (AC 1636) that all vegetables and plants could be used as medicinal materials. Plants such as *Amomum tsaoko*, *Zingiber officinale*, and *Piper nigrum* L. were reported to show therapeutic efficacy. Furthermore all plants, animals, livestock materials, and grains used as medicines could be administered in combination with each other to improve curative effects [14]. Previously, some records about the medicinal plants of the Yi have been documented in publications such as *Yi medicines* [14], *Yi herb medicines* [15], *Theory and application of Yi medicine* [16] and *Yi medicines of Chinese* [17].

Although ethnobotanical surveys on medicinal dietary plants in Lijiang, Xishuangbanna, Jinpo, Taibai Mountain areas in China, and the Vulture area in southern Italy, have been published [18–21], there has been no equivalent study on the food culture of the Yi people in Honghe Hani and Yi autonomous prefectures. Therefore, this study undertook ethnobotanical surveys on the medicinal dietary plants used by the Yi people in Mile. This study provides references for biodiversity protection, rational development, and the sustainable use of Yi medicinal dietary plant resources and traditional medicinal dietary knowledge.

## Methods

### Study area

Honghe Hani and Yi autonomous prefecture is located in the southeastern Yunnan Province, China, with Wenshan to the east, Kunming to the north, Yuxi to the west, and Vietnam to south [21]. Mile (103°04'–103°49'E and 23°50'–24°39'N) is a county-level city situated in the north of the Autonomous Prefecture and is composed of 12 townships (Fig. 1). Mile is known as the north gate of Honghe; it is approximately 78 km long from east to west, 50 km wide in the south-north direction, and covers a total area of 4004 km<sup>2</sup>. Mile is in a subtropical monsoon climatic zone with high elevations in the north and low elevations in the south and has a population of 527,767, consisting of approximately 200,000 Yi people. The highest area in Mile is Jinding Mountain with an altitude of approximately 2315 m, which is located east of Xinshao, and the lowest point is the exit of the Nanpan River with an altitude of approximately 862 m. The climate of Mile is mainly dominated by plateau monsoon, with a mean annual temperature of 18.8 °C and a mean annual rainfall of 835.4 mm [22].

### Data Collection

Field studies were carried out during three visits from July 2017 to May 2018. This study was carried out following the guidelines of the International Society of Ethnobiology Code of Ethics (<http://www.ethnobiology.net>) [23] and the American Anthropological Association Code of Ethics (<https://www.americananthro.org>) [24]. Thirty-six key informants, who had considerable knowledge and experience regarding the use of medicinal dietary plants were selected for interviews, including eight healers. Most of them had acquired medical treatment skills and knowledge from their parents. The investigated localities covered six villages in three townships (Xiyi, Xier, and Xisan). Ethnobotanical data were collected through participatory rural appraisal (PRA) [25], direct observation, semi-structured interviews, key informant interviews, individual discussions, focus group discussions, and questionnaires [26–28]. In the present study, the Yi names, local names, Latin names, edible parts, medicinal parts, preparation methods, and efficacy of the plants were recorded. Some information on Yi ethnic medicine and food culture was also recorded. The research focused exclusively on medicinal dietary plant use and knowledge. All interviews were conducted with the interviewee's consent. Generally, they were required to answer the following questions:

- 1) Which medicinal dietary plants do you use?
- 2) How do you consume these plants?
- 3) Do you use one part of the plant for food and another part for medicine?
- 4) Do you have any special preparation methods?
- 5) When do you collect medicinal dietary plants?
- 6) Where do medicinal plants grow around your community?
- 7) How do Yi people conserve medicinal dietary technologies, associated cultural practices, and traditional knowledge?

### Data analysis

During our survey, Yi names, local names, Latin names, edible parts, medicinal parts, preparation methods, and the efficacy of the various plants were recorded. Latin names were recorded by referring to The Plant List (<http://www.theplantlist.org/>) [29].

Most Yi people in Mile, especially official workers, students, and traders, can speak basic Mandarin. Therefore, interviews were conducted in Mandarin rather than through interpreters. Voucher specimens were examined and identified using the Flora of China (<http://www.iplant.cn/frps/>) [30], Subject Database of China Plant (<http://www.plant.csdb.cn/>) [31] and Medicinal Plants of Yunnan Province [32]. Specimens were deposited in the Herbarium of the School of Ethnomedicine & Ethnopharmacy, Yunnan Minzu University, Kunming, China.

The data collected in the Mile area were collated into an inventory listing all the medicinal dietary plants and related information. The use-value (UV) of each medicinal dietary plant was calculated to evaluate the relative importance of each plant based on the number of times cited and the number of informants [33–35]. The formula for UV is

$$UV = (\sum U_i) / N$$

$U_i$  is the number of times cited by each informant for a certain medicinal dietary plant, while  $N$  is the total number of informants [35]. The frequency of utilization index (FUI) of medicinal dietary plant species was graded according to the frequency of consumption by local people. FUI can also reflect the degree of closeness between the medicinal dietary plant species and the local community [35]. The FUI scores range from 0 to 5 and vary according to the consumption frequency (Table 1) [35].

Table 1  
The FUI value and corresponding category.

Consumption frequency	FUI
More than once a week	5
Once a week	4
Once a month	3
More than once a year, less than once a month	2
Once a year	1
No consumption in last 30 years	0.5

## Results And Discussion

### Medicinal dietary species documented

Our survey showed that medicinal dietary plants are widely used by Yi people in Mile. In total, 124 species were documented included angiosperms (117 spp.), gymnosperms (3), pteridophytes (2), lichens (1), and fungi (1) (Table 2 and Table 3). Detailed information about these plants is displayed in Table 2 (plants mentioned only by 1 informant are not documented in Table 2). The average number of species mentioned per informant was approximately 9. Plants belonging to 62 families and 102 genera were classified into different life forms, including herbs (48.8%), trees (27.6%), vines (9.8%), and shrubs (13.8%). The majority of the food plants belong to Rosaceae (18 species), Lamiaceae (6), Leguminosae (6), Compositae (5), Araliaceae (5), Amaryllidaceae (4), and Cucurbitaceae (4). The genera with the highest number of species are *Allium* (4 species), *Elsholtzia* (4), followed by *Diospyros* (3), *Fragaria* (3), *Prunus* (3), and *Rubus* (3).

Table 2  
Medicinal dietary plants used by the Yi people in Mile, Yunnan Province, China.

Scientific name, Family, Voucher number	Vernacular name	Yi name	Life form	Medicinal parts	Preparing methods	Medicinal uses	Edible part
<i>Amaranthus tricolor</i> L., Amaranthaceae, 20171037	Zilingxian	Nuosongnibaizai	Herb	Whole plant	Decoction	Removing liver fire to improving eyesight	Whole plant
<i>Dobinea delavayi</i> (Baill.) Baill., Anacardiaceae, 20171059	Yangjiaotianma	Ciwochengnongcizai	Herb	Rhizome	Stewed with chicken	Detumescence; apocenosic	Rhizome
<i>Amorphophallus konjac</i> K. Koch, Araceae, 20171093	Moyu	Mayumezai	Herb	Tuber	Decoction	Pneumonia; anti-tussive	Tuber
<i>Colocasia esculenta</i> (L.) Schott, Araceae, 20171077	Qingyu	Abupa	Herb	Tuber	Decoction	Tonifying the kidney; tonifying the spleen	Tuber, inflorescence and petiole
<i>Eleutherococcus senticosus</i> (Rupr. & Maxim.) Maxim., Araliaceae, 20171001	Ciwujia	Ziguzai	Shrub	Stem and root	Decoction	Tonifying the kidney; rheumatism	Tender shoot
<i>Aralia chinensis</i> L., Araliaceae, 20171022	Congmu	Heiahuozai	Tree	Bark and roots	Decoction	Tonifying the liver; rheumatism	Tender shoot
<i>Metapanax delavayi</i> (Franch.) J. Wen & Frodin, Araliaceae, 20171010	Liangwangcha	Laibuluoyuzai	Shrub	Leaves	Soaked in boiling water	Laryngopharyngitis	Tender Leaves
<i>Panax notoginseng</i> (Burkill) F.H.Chen, Araliaceae, 20171016	Sanqi	Shenglengzai	Herb	Rhizome and Root	Stewed with chicken	Enriching the blood; promoting blood circulation to remove blood stasis	Rhizome and Root
<i>Saruma henryi</i> Oliv., Aristolochiaceae, 201710207	Matixiang	Gongbunizai	Herb	Rhizome and Root	Stewed with chicken or pig feet	Tonifying the spleen; stomachache	Rhizome and Root
<i>Cynanchum otophyllum</i> C. K. Schneid., Apocynaceae, 201710503	Qingyangshen	Cinazai	Vine	Root	Stewed with chicken	Tranquilizing and allaying excitement; epilepsy	Fruits
<i>Marsdenia tenacissima</i> (Roxb.) Moon Apocynaceae, 20171099	Tongguangsan	Citongmiluozaizai	Vine	Root and stem	Stir-fried with eggs	Anti-tussive; lactogenesis; diuresis	Flowers and tender shoot
<i>Auricularia auricula</i> Judae, Auriculariaceae, 20171082	Muer	Rimelong	Fungus	Fruit body	Stir-fried or boiled	Deafness; reducing blood pressure	Fruit body
<i>Adenophora stricta</i> Miq., Campanulaceae, 201710455	Shashen	Yanpibuguozaizai	Herb	Root	Stewed with chicken	Tonifying the kidney; moistening lung	Root
<i>Codonopsis foetens</i> Hook. f. Thomson, Campanulaceae, 201710226	Choushen	Yanmebinengzai	Herb	Root	Stewed with chicken	Tonifying the kidney; strengthening yang-qi	Root
<i>Lonicera japonica</i> Thunb., Caprifoliaceae, 20171042	Jinyinhua	Tongshanmilongzai	Vine	Flowers, leaves and stem	Decoction	Abatement of fever; anti-tussive	Flowers
<i>Silene asclepiadea</i> Franch., Caryophyllaceae, 201710345	Wacao	Gawuwu	Herb	Root	Decoction	Acne; anti-tussive and reducing sputum	Leaves
<i>Chenopodium album</i> L., Amaranthaceae, 20171017	Huitiaocai	Nisewu	Herb	Whole plant	Decoction	Removing liver fire to improving eyesight	Leaves and stem
<i>Arctium lappa</i> L., Compositae, 201710417	Niubangzi	Nianbamezai	Herb	Root	Stewed with chicken	Gastric disorders; tinnitus	Root
<i>Cirsium japonicum</i> (Thunb.) Fisch. ex DC., Compositae, 201710523	Dajijiaoshu	Shanpaicimezai	Herb	Root	Stewed with meat	Tonifying the kidney; detumescence	Root

The order of plant species in this table is followed by the APG IV system, gymnosperms classification system (1978), and Qinrenchang fern plant classification system (1993).

Scientific name, Family, Voucher number	Vernacular name	Yi name	Life form	Medicinal parts	Preparing methods	Medicinal uses	Edible part
<i>Cirsium setosum</i> (Willd.) Besser ex M.Bieb., Compositae, 201710546	Xiaoji	Shanpaicimeazizai	Herb	Root	Stewed with meat	Tonifying the kidney; detumescence	Root
<i>Gynura bicolor</i> (Roxb. ex Willd.) DC., Compositae, 20171013	Guanyincai	Buwuzai	Herb	Whole plant	Decoction	Hepatitis; improving vision	Tender plant
<i>Taraxacum mongolicum</i> Hand.-Mazz., Compositae, 201710485	Pugongying	Wujieshandongzai	Herb	Whole plant	Stir-fried with eggs	Relieving pain; diuresis	Whole plant
<i>Merremia hungaiensis</i> (Lingelsh. & Borza) R. C. Fang, Convolvulaceae, 201710377	Shantugua	Agaizai	Herb	Root	Decoction	Tonifying the spleen; abate jaundice	Fruits and root
<i>Cornus kousa</i> subsp. <i>chinensis</i> (Osborn) Q.Y.Xiang Cornaceae, 201710216	Jisuzi	Sanzimezai	Tree	Leaves and root	Decoction	Ascaricide	Tender shoot and fruits
<i>Capsella bursa-pastoris</i> (L.) Medik., Brassicaceae, 201710134	Jicai	Mengjiewu	Herb	Whole plant	Decoction	Nephritis; hydroncus	Leaves
<i>Cucurbita moschata</i> Duchesne, Cucurbitaceae, 20171032	Nangua	Apumezai	Herb	Seeds	Decoction	Ascaricide	Fruits and seeds
<i>Sechium edule</i> (Jacq.) Sw., Cucurbitaceae, 20171084	Yangsigua	Lianbugua	Vine	Root	Decoction	Gastric disorders; colitis	Tender shoot and fruits
<i>Solena amplexicaulis</i> (Lam.) Gandhi, Cucurbitaceae, 20171002	Laoshuhuanggua	Mudengmilongzai	Herb	Root	Decoction	Pneumonia; anti-tussive	Fruits
<i>Trichosanthes Kirilowii</i> Maxim., Cucurbitaceae, 201710443	Tianhuafen	Mudengazizai	Vine	Root	Decoction	Relieving asthma; anti-tussive and reducing sputum	Fruits
<i>Dioscorea alata</i> L., Dioscoreaceae, 201710198	Maoshu	Abunibuzai	Vine	Tuber	Stewed with meat	Tonifying the spleen; help digestion	Tuber
<i>Dioscorea nipponica</i> Makino, Dioscoreaceae, 201710312	Yeshanyao	Laigeiageizai	Vine	Tuber	Stewed with meat	Tonifying the spleen; tonifying the kidney	Tuber
<i>Diospyros kaki</i> L. f., Ebenaceae, 20171044	Shizishu	Sanbaomezai	Tree	Root	Decoction	Killing parasites; emesia	Fruits
<i>Diospyros kaki</i> var. <i>silvestris</i> Makino, Ebenaceae, 201710397	Yeshizi	Laigusanbazai	Tree	Root	Decoction	Enteritis; cystitis	Fruits
<i>Diospyros lotus</i> L., Ebenaceae, 20171035	Ruanzao	Sanbaniguozai	Tree	Root	Decoction	Diuresis; expelling toxins	Fruits
<i>Rhododendron mucronatum</i> (Blume) G. Don, Ericaceae, 201710237	Baihuadujuan	Caigumiluotongzai	Shrub	Root	Decoction	Cystitis; hepatitis	Flowers
<i>Euphorbia helioscopia</i> L., Euphorbiaceae, 201710117	Naijiangcao	Anengdouzai	Herb	Whole plant	Decoction	Abatement of fever; detumescence	Leaves
<i>Phyllanthus emblica</i> L., Phyllanthaceae, 201710522	Yuganzi	Elengmezai	Tree	Fruits	Decoction	Pharyngolaryngitis; anti-tussive	Fruits
<i>Castanea mollissima</i> Blume, Fagaceae, 201710366	Banli	Ganme	Tree	Fruits and roots	Decoction	Tonifying the kidney; quenching thirst and helping to produce saliva	Fruits
<i>Lophatherum gracile</i> Brongn. Poaceae, 201710453	Zhuye	Medongzai	Tree	Leaves	Decoction	Anti-tussive; relieving asthma	Tender shoots
<i>Zea mays</i> L., Poaceae, 201710511	Yumi	Huomezai	Herb	Corn silk	Decoction	Removing urinary calculus	Fruits
<i>Juglans regia</i> L., Juglandaceae, 201710298	Hetao	Sanmaizai	Tree	Bark and root	Decoction	Killing parasites; relieving itching	Seeds and flowers

The order of plant species in this table is followed by the APG IV system, gymnosperms classification system (1978), and Qinrenchang fern plant classification system (2003).

Scientific name, Family, Voucher number	Vernacular name	Yi name	Life form	Medicinal parts	Preparing methods	Medicinal uses	Edible part
<i>Elsholtzia bodinieri</i> Vaniot, Lamiaceae, 201710132	Fengweicha	Sininongyuzai	Herb	Whole plant	Soaked in boiling water	laryngopharyngitis	Leaves and stem
<i>Elsholtzia ciliata</i> (Thunb.) Hyl., Lamiaceae, 201710400	Xiangru	Yetongbingnizai	Herb	Whole plant	Decoction	Headache; abatement of fever	Leaves
<i>Elsholtzia rugulosa</i> Hemsl., Lamiaceae, 201710358	Yebahao	Afeizai	Herb	Whole plant	Decoction	Pharyngolaryngitis chronica	Leaves and stem
<i>Mentha canadensis</i> L., Lamiaceae, 201710149	Bohe	Cihemiweizai	Herb	Whole plant	Decoction	Pneumonia; relieving asthma	Leaves and stem
<i>Elsholtzia flava</i> Benth., Lamiaceae, 201710231	Suzi	Ciwoguojieizai	Herb	Fruits	Decoction	Anti-tussive; bronchitis	Seeds
<i>Holboellia latifolia</i> Wall., Lardizabalaceae, 201710507	Maoshiguo	Mainaimezai	Vine	Root	Decoction	Cystitis	Fruits
<i>Litsea pungens</i> Hemsl., Lauraceae, 201710448	Mujiangzi	Zuomeshengshengzai	Tree	Root	Decoction	Gastric disorders	Fruits
<i>Parochetus communis</i> D. Don, Leguminosae, 201710241	Jinquehua	Yetongshanmezai	Herb	Flowers	Stir-fried with eggs	Rheumatism; gastric disorders	Flowers
<i>Pisum sativum</i> L., Leguminosae, 201710551	Qingdou	Anuwadu	Herb	Seeds	Decoction	Gastralgia	Seeds
<i>Pueraria montana</i> (Lour.) Merr., Leguminosae, 201710317	Ge	Zigaizai	Vine	Root	Decoction	Reducing phlegm; relieving alcoholism	Root
<i>Sophora davidii</i> (Franch.) Pavol., Leguminosae, 201710126	Kucihua	Luocizai	Shrub	Flowers and root	Decoction	Dysmenorrhea	Flowers
<i>Sophora japonica</i> L., Leguminosae, 201710394	Huaihua	Milongwujiezai	Tree	Fruits	Decoction	Removing liver fire to improving eyesight	Flowers
<i>Vicia faba</i> L., Leguminosae, 201710193	Candou	Anuazai	Herb	Seeds	Decoction	Tonifying the spleen; detumescence	Seeds
<i>Allium macrostemon</i> Bunge, Amaryllidaceae, 201710100	Xiaopusuan	Songpu	Herb	Whole plant	Decoction	Killing parasites; reducing phlegm	Whole plant
<i>Allium sativum</i> L., Amaryllidaceae, 201710469	Dasuan	Shutongzai	Herb	Whole plant	Decoction	Rhinitis; killing parasites	Bulb
<i>Allium scorodoprasum</i> L., Amaryllidaceae, 201710248	Xiaosuan	Shubuazeizai	Herb	Whole plant	Decoction	Killing parasites; abatement of fever	Bulb
<i>Allium wallichii</i> Kunth, Amaryllidaceae, 201710120	Shanjiuca	Caiguageizai	Herb	Whole plant	Stir-fried with eggs	Promoting lactation	Whole plant
<i>Hemerocallis citrina</i> Baroni, Asphodelaceae, 201710155	Xuancao	Miluoshanwuzai	Herb	Root and flowers	Decoction or Scrambled eggs with flowers	Gastritis	Flowers
<i>Lilium brownii</i> F.E.Br. ex Miellez, Liliaceae, 201710341	Baihe	Amezai	Herb	Fruits and bulb	Decoction	Tonifying the lung; reducing phlegm	Bulb
<i>Polygonatum odoratum</i> (Mill.) Druce, Asparagaceae, 201710531	Yuzhu	Medaoweilongzai	Herb	Tuber	Stew with eggs or meat	Tonifying the kidney	Tuber
<i>Smilax mairei</i> H. Lévl., Smilacaceae, 20171033	Wucibaqia	Megulianzhongzai	Shrub	Root	Decoction	Chronic colitis; irregular menses	Tender shoots
<i>Smilax riparia</i> A. DC., Smilacaceae, 201710387	Maweicai	Memazhuzai	Vine	Whole plant	Decoction	Abatement of fever; anti-tussive	Whole plant
<i>Linum usitatissimum</i> L., Linaceae, 20171091	Yama	Zhongzizai	Herb	Seeds	Made oil or powder	Reducing blood pressure; skin diseases	Seeds

The order of plant species in this table is followed by the APG IV system, gymnosperms classification system (1978), and Qinrenchang fern plant classification system (2004).

Scientific name, Family, Voucher number	Vernacular name	Yi name	Life form	Medicinal parts	Preparing methods	Medicinal uses	Edible part
<i>Toona sinensis</i> (Juss.) M. Roem., Meliaceae, 201710547	Xiangchun	Longbotong	Tree	Bark and root	Decoction	Gynecopathy; dysentery	Tender shoots
<i>Cannabis sativa</i> L., Cannabaceae, 201710461	Huomazi	Zime	Herb	Seeds and root	Made oil	Relaxing the bowel; moistening the lung	Seeds
<i>Ficus tikoua</i> Bureau, Moraceae, 201710116	Dibanteng	Cisanpianlian-zai	Vine	Root	Decoction	Gonorrhea	Fruits
<i>Morus alba</i> L., Moraceae, 201710184	Sangshu	Ahezai	Tree	Root	Decoction	Anti-tussive; reducing phlegm	Fruits
<i>Musa basjoo</i> Siebold & Zucc. ex Linum, Musaceae, 201710442	Bajiao	Gongguabuzai	Tree	Root	Decoction	Tonifying the spleen; diuresis	Stem and inflorescence
<i>Myrica rubra</i> (Lour.) Siebold & Zucc., Myricaceae, 201710129	Yangmei	Sangusongzai	Tree	Root	Decoction	Enteritis	Fruits
<i>Syzygium aromaticum</i> (L.) Merr. & L. M. Perry, Myrtaceae, 201710222	Dingxianghua	Lazigomezai	Tree	Root	Stewed with pig feet	Detumescence; relieving pain	Root
<i>Osmanthus fragrans</i> Lour., Oleaceae, 201710402	Guihua	Jiweilongzai	Tree	Flowers	Decoction	Moistening the lung; anti-tussive	Flowers
<i>Nervilia fordii</i> (Hance) Schltr., Orchidaceae, 201710544	Qingtiankui	Weinimesongzai	Herb	Whole plant	Stir-fried with eggs	Hepatitis; detumescence	Tender shoot
<i>Trachycarpus fortunei</i> (Hook.) H. Wendl., Arecaceae, 201710169	Zongshuhua	Situomizai	Tree	Root, stem and fruits	Decoction	Reducing blood pressure; dizziness	Inflorescence
<i>Ceratopteris thalictroides</i> (L.) Brongn., Pteridaceae, 201710218	Shuijuecai	Riabiwujiezai	Herb	Whole plant	Decoction	Diuresis	Whole plant
<i>Sesamum indicum</i> L., Pedaliaceae, 201710111	Zhima	Guogeimiweizai	Herb	Fruits	Decoction	Aperient bowel	Seeds
<i>Abies holophylla</i> Maxim., Pinaceae, 201710275	Shasong	Geizai	Tree	Bark and root	Decoction	Setting a broken bone; detumescence	Tender shoot
<i>Pinus armandii</i> Franch., Pinaceae, 201710432	Kongsong	Shumezai	Tree	Bark and root	Decoction	Reducing phlegm	Seeds
<i>Pinus yunnanensis</i> Franch., Pinaceae, 201710333	Yunnansong	Tumumezai	Tree	Pollen, leaves and Bark	Decoction	Lowering blood lipid	Pollen
<i>Plantago asiatica</i> L., Plantaginaceae, 201710201	Cheqiancao	Geniwu	Herb	Whole plant	Decoction	Cystitis	Leaves
<i>Fagopyrum tataricum</i> (L.) Gaertn., Polygonaceae, 20171028	Kuqiaomai	Guokangmezai	Herb	Whole plant	Decoction	Cholecystitis	Leaves, tender shoot and fruits
<i>Pteridium aquilinum</i> (L.) Kuhn, Dennstaedtiaceae, 201710381	Juecai	Abiwujiezai	Herb	Rhizome	Decoction	Angina pectoris	Whole plant
<i>Punica granatum</i> L., Lythraceae, 201710411	Shiliu	Sanbuzai	Tree	Root	Decoction	Killing parasites; dysentery	Flowers and fruits
<i>Ramalina fastigiata</i> (Pers.) Ach., Ramalinaceae, 201710477	Shuhuacai	Sinengbazai	Herb	Whole plant	Decoction	Tonifying the spleen; diuresis	Whole plant
<i>Aconitum hemsleyanum</i> E. Pritz., Ranunculaceae, 20171047	Caowu	Ciduzai	Herb	Root	Stewed with chicken	Treating rheumatism	Root
<i>Hovenia acerba</i> Lindl., Rhamnaceae, 201710250	Guaizao	Chenglenggalazai	Tree	Fruits	Decoction	Protective liver	Fruits
<i>Prunus davidiana</i> (Carrière) Franch., Rosaceae, 201710299	Yetao	Laigusanwuzai	Tree	Seeds	Decoction	Removing urinary calculus; relieving pain	Seeds

The order of plant species in this table is followed by the APG IV system, gymnosperms classification system (1978), and Qinrenchang fern plant classification system (2003).

Scientific name, Family, Voucher number	Vernacular name	Yi name	Life form	Medicinal parts	Preparing methods	Medicinal uses	Edible part
<i>Prunus mume</i> (Siebold) Siebold & Zucc., Rosaceae, 201710270	Meizishu	Sangazimezai	Tree	Root	Decoction	Tonifying the spleen	Fruits
<i>Prunus armeniaca</i> L., Rosaceae, 201710255	Xingshu	Sanzuinizai	Tree	Seeds	Decoction	Anti-tussive; reducing sputum	Fruits
<i>Cerasus pseudocerasus</i> (Lindl.) G. Don, Rosaceae, 201710519	Yingtao	Laiyumezai	Tree	Root	Decoction	Arthritis	Fruits
<i>Chaenomeles sinensis</i> (Dum. Cours) Koehne, Rosaceae, 201710174	Mugua	Sanbuzai	Tree	Fruits	Stewed with chicken	Numb limbs; rheumatism	Fruits
<i>Crataegus cuneata</i> Siebold & Zucc., Rosaceae, 201710324	Yeshanzha	Sanwozai	Shrub	Fruits	Decoction	Reducing blood pressure; help digestion	Fruits
<i>Docynia delavayi</i> (Franch.) C. K. Schneid., Rosaceae, 20171005	Duoyiguo	Sanbuazeizai	Tree	Root	Decoction	Rheumatic	Fruits
<i>Duchesnea indica</i> (Jacks.) Focke, Rosaceae, 201710109	Shemei	Hamezai	Herb	Whole plant	Decoction	Relieving asthma	Fruits
<i>Eriobotrya japonica</i> (Thunb.) Lindl., Rosaceae, 201710428	Pipa	Chichishandongzai	Tree	Leaves	Decoction	Anti-tussive; reducing sputum	Fruits
<i>Fragaria × ananassa</i> (Duchesne ex Weston) Duchesne ex Rozier, Rosaceae, 201710481	Hongshecao	Abosanzuinzai	Herb	Whole plant	Decoction	Detoxifying snake venom; hemorrhoids	Fruits
<i>Fragaria nilgerrensis</i> Schltld. ex J. Gay, Rosaceae, 201710284	Baishecao	Abosangantong	Herb	Whole plant	Decoction	Hepatitis	Fruits
<i>Fragaria vesca</i> L., Rosaceae, 201710379	Fanbaiyecao	Laigusanzuitong	Herb	Whole plant	Decoction	Detoxifying snake venom	Fruits
<i>Prinsepia utilis</i> Royle, Rosaceae, 201710438	Qingciguo	Babazai	Shrub	Root or leaves	Leaves Stir-fried with eggs	Cholecystitis	Leaves
<i>Pyrus calleryana</i> Decne., Rosaceae, 201710295	Douli	Sanlimesong	Tree	Fruits	Decoction	Acne	Fruits and flowers
<i>Pyrus pyrifolia</i> (Burm. f.) Nakai, Rosaceae, 201710436	Yemianli	Sanlimiansong	Tree	Fruits and root	Decoction	Tonifying the lung	Fruits and flowers
<i>Rubus coreanus</i> Miq., Rosaceae, 20171066	Maoyechatianpao	Sanhameazizai	Shrub	Root	Decoction	Rheumatic arthritis	Fruits
<i>Rubus ellipticus</i> Sm., Rosaceae, 201710101	Huangsuomei	Sanhamezai	Shrub	Root	Decoction	Apoplexy; rheumatism	Fruits
<i>Rubus niveus</i> Thunb., Rosaceae, 201710492	Heisuomei	Zinisan	Shrub	Root	Decoction	Tonifying the liver; improving vision; promoting the secretion of saliva or body fluids; rheumatism	Fruits
<i>Citrus medica</i> L., Rutaceae, 201710138	Xiangyuan	Paoguoazai	Shrub	Fruits	Decoction	Enteritidis; stomachache	Fruits
<i>Zanthoxylum bungeanum</i> Maxim., Rutaceae, 20171055	Huajiao	Zuozailongzai	Tree	Root and fruits	Decoction	Skin itch	Fruits
<i>Zanthoxylum armatum</i> DC., Rutaceae, 201710425	Yehuajiao	Laiguzuoazai	Shrub	Root, bark and fruits	Decoction	Numb limbs; rheumatism	Fruits
<i>Houttuynia cordata</i> Thunb., Saururaceae, 201710268	Yuxingcao	Awobinizai	Herb	Leaves, stem and root	Decoction	Anti-tussive; moistening lung	Leaves, stems and root

The order of plant species in this table is followed by the APG IV system, gymnosperms classification system (1978), and Qinrenchang fern plant classification system (2013).

Scientific name, Family, Voucher number	Vernacular name	Yi name	Life form	Medicinal parts	Preparing methods	Medicinal uses	Edible parts
<i>Brandisia hancei</i> Hook. f., Paulowniaceae, 201710274	Mitonghua	Dongmilongzai	Shrub	Root and leaves	Decoction	Osteomyelitis	Flowers
<i>Capsicum annuum</i> L., Solanaceae, 201710504	Lazi	Paizimezai	Herb	Fruits	Decoction	Induce perspiration	Fruits
<i>Cyphomandra betacea</i> (Cav.) Sendt., Solanaceae, 201710029	Shufanqie	Siazizai	Tree	Fruits	Decoction	Tonifying the spleen; stomachache	Fruits
<i>Physalis alkekengi</i> var. <i>franchetii</i> (Mast.) Makino, Solanaceae, 201710375	Denglongguo	Amaishanbuzai	Herb	Root	Decoction	Pharyngolaryngitis; anti-tussive	Fruits
<i>Camellia japonica</i> L., Theaceae, 201710290	Shancha	Laiguzuomizai	Shrub	Fruits	Decoction	Aperient bowel	Seeds
<i>Camellia sinensis</i> (L.) Kuntze, Theaceae, 201710496	Cha	Longri	Shrub	Leaves	Soaked in boiling water	Lowering blood lipid	Tender leaves
<i>Foeniculum vulgare</i> Mill., Apiaceae, 20171090	Xiaohuixiang	Mengsongmabizai	Herb	Root	Decoction	Abdominal distension	Tender plant
<i>Hydrocotyle nepalensis</i> Hook., Araliaceae, 201710264	Maticao	Maokongwuzai	Herb	Whole plant	Roots stewed with pork tripe	Hepatitis A	Leaves
<i>Ligusticum chuanxiong</i> S.H.Qiu, Y.Q.Zeng, K.Y.Pan, Y.C.Tang & J.M.Xu, Apiaceae, 201710213	Chuanxiong	Wujiegeimizai	Herb	Root	Stir-fried with eggs	Nervous headaches	Root
<i>Oenanthe javanica</i> (Blume) DC., Apiaceae, 201710513	Shuiqincai	Yuxiangqin	Herb	Whole plant	Decoction	Reducing blood pressure	Leaves and stems
<i>Debregeasia orientalis</i> C. J. Chen, Urticaceae, 20171075	Shuima	Yuzimezai	Shrub	Root and stem	Decoction	Dysentery	Fruits and flowers
<i>Urtica atrichocaulis</i> (Hand.-Mazz.) C.J. Chen, Urticaceae, 201710288	Xiaoqianma	Dengbuazizai	Herb	Whole plant	Stir-fried with eggs	Prostatitis	Tender stems
<i>Clerodendrum bungei</i> Steud., Lamiaceae, 20171069	Choumudan	Anikebazai	Shrub	Root	Stewed with chicken	Rheumatism	Root
<i>Ampelopsis delavayana</i> Planch. ex Franch., Vitaceae, 201710420	Yeputao	Runimesanzai	Vine	Root	Decoction	Setting a broken bone; relieving pain	Fruits
<i>Amomum tsao-ko</i> Crevost & Lemarié, Zingiberaceae, 20171087	Caoguo	Sibiyumezai	Herb	Fruits	Decoction	Renal colic	Fruits
<i>Zingiber officinale</i> Roscoe, Zingiberaceae, 201710371	Jiang	Chibozai	Herb	Fruits	Decoction	Headache; induce perspiration	Rhizome and stems

The order of plant species in this table is followed by the APG IV system, gymnosperms classification system (1978), and Qinrenchang fern plant classification system (2004).

Table 3  
Taxonomic distribution of medicinal dietary plants used by Yi in Mile, Yunnan Province, China.

Plant group	Number of species	Number of genera	Number of families
Angiosperms	117	96	57
Gymnosperms	3	2	1
Pteridophytes	2	2	2
Lichens	1	1	1
Fungi	1	1	1
Total	124	102	62

In the Mile area, 124 plant species were used as food and medicine, whereas the results of previous studies show that in Xishuangbanna and Jinpo, the number was lower [18, 21]. The overlap between these areas is illustrated using a Venn diagram (Fig. 2).

## Locally Important Plants

## Analyses to determine local importance

Quantitative analyses were carried out to determine the local importance of each medicinal dietary plant. The use-values (UV) and frequency of utilization indices (FUI) of each species were calculated (Table 1) [33]. The 20 medicinal dietary plants species with the highest UV are listed along with their average FUI in Table 4. *Amorphophallus konjac*, *Cucurbita moschata*, *Phyllanthus emblica*, and *Zea mays* had the highest UV and average FUI (Table 4). Their UV and FUI are 0.93 and 4.90, respectively. This demonstrated that this plant had major importance for local people.

Table 4  
Top 20 medicinal dietary plants with highest use value in Mile City.

Scientific name	Medicinal uses	FUI	UV
<i>Amorphophallus konjac</i>	Pneumonia; anti-tussive	4.90	0.93
<i>Cucurbita moschata</i>	Acaricide	4.90	0.93
<i>Phyllanthus emblica</i>	Pharyngolaryngitis; anti-tussive	4.90	0.93
<i>Zea mays</i>	Removing urinary calculus	4.90	0.93
<i>Juglans regia</i>	Killing parasites; relieving itching	4.90	0.91
<i>Litsea pungens</i>	Gastric disorders	4.90	0.90
<i>Allium sativum</i>	Rhinitis; killing parasites	4.70	0.90
<i>Houttuynia cordata</i>	Anti-tussive; moistening lung	4.60	0.90
<i>Capsicum annum</i>	Induce perspiration	4.60	0.90
<i>Auricularia auricula</i>	Deafness; reducing blood pressure	4.20	0.89
<i>Taraxacum mongolicum</i>	Relieving pain; diuresis	4.50	0.89
<i>Sechium edule</i>	Gastric disorders; colitis	4.50	0.88
<i>Mentha canadensis</i>	Pneumonia; relieving asthma	4.20	0.88
<i>Zingiber officinale</i>	Headache; induce perspiration	4.50	0.87
<i>Oenanthe javanica</i>	Reducing blood pressure	4.20	0.83
<i>Camellia sinensis</i>	Lowering blood lipid	4.30	0.82
<i>Vicia faba</i>	Tonifying the spleen; detumescence	3.80	0.71
<i>Eriobotrya japonica</i>	Anti-tussive; reducing sputum	2.80	0.67
<i>Musa basjoo</i>	Tonifying the spleen; diuresis	3.50	0.65
<i>Amomum tsaoko</i>	Renal colic	3.30	0.65

Several other plants in our study area were found to be popular as food and medicine based on their high UV and average FUI, including the following: *Juglans regia*, *Litsea pungens*, *Allium sativum*, *Houttuynia cordata*, *Capsicum annum*, *Auricularia auricular*, *Taraxacum mongolicum*, *Sechium edule*, *Mentha canadensis*, *Z. officinale*, *Oenanthe javanica*, *Camellia sinensis*, *Vicia faba*, *Eriobotrya japonica*, *Musa basjoo*, and *A. tsaoko*.

## Uses of locally important plants

*A. konjac* is a popular food in the daily life of the Yi people. It contains a pharmacologically active heteropolysaccharide, konjac glucomannan (KGM), extracted from konjac tubers. KGM has the characteristics of water absorption, gelatinization, adhesiveness and low heat edible, so it is widely used in food processing, pharmaceuticals, and health-care products [36].

*C. moschata* is a daily food for local people and is made into all kinds of dishes like pumpkin pie, pumpkin soup, pumpkin porridge, and fried pumpkin (Fig. 3). Pumpkin seeds are believed to kill parasites and are eaten after peeling and frying. Children enjoy the crispy texture and find it much more acceptable to eat fried pumpkin seeds than to take medicine.

## Preparation Of Medicinal Dietary Plants

### Medicinal preparation

The primary medicinal preparation method for plants recorded in the study was decoction, followed by stir-frying and eating fresh. However, 28 species required specific preparation methods (Table 2). For example, Yi people use the roots of *Dobinea delavayi*, stewed with chicken, to treat dizziness and alleviate fatigue and detumescence, and use the roots of *Saruma henryi* Oliv. stewed with chicken or pig's feet to tonify spleen and treat stomach-ache. This reflects the efficient combination of food and drugs in the Yi medical system, which makes it possible to achieve the objectives of health care, treatment, and prevention

of diseases via the daily diet. A Yi medicine book, *Theory and application of Yi medicine*, by Yi medicine expert Zhengkun Wang, recorded that the Yi people used specific preparation methods to protect their health [16]. For example, it is necessary to know which material should be stewed with the herbs, chicken, or pig's feet and how long the course of treatment should be. Sufficient knowledge about the herbs or materials and the preparation methods is required to achieve health protection.

## Preparation For Food

More than 13 cooking methods were documented in this survey. During their long history, the local Yi people have learned how to use the edible and medicinal parts of wild plants in the most effective ways.

The main cooking method for the plants documented in this survey was boiling, followed by stir-frying, and eating fresh. The study noted that three species, *Pisum sativum*, *Pinus yunnanensis*, and *Esholtzia rugulosa*, required specific cooking methods. These three plants are converted into konjac tofu, cakes, and tea, respectively. Another plant requiring special preparation is *Linum usitatissimum*. Local Yi people like to eat the seed of *L. usitatissimum* as oil and seasoning, so the seed must be prepared through powdering and pressing.

## Preparation For Toxic Plants

Generally, traditional preparation methods of medicinal plants are similar to those normally used in cooking; however, some poisonous plants need special preparation. *Aconitum hemslayanum* is a highly toxic plant because it contains aconitine. The preparation process is strictly controlled to protect against the toxic effects. The specific cooking process is as follows: the water must be boiled completely, and then put into fresh aconitum root and lard, constantly boiled for at least 24 h. Keep adding boiling water to prevent the water evaporate, ensure food safety and prevent food poisoning. Besides, people should stay in a warm room for one night after eating the concoction. This processing method is different from Kang's and Zhang's reported [37, 38].

Another plant that needs careful handling is *Pteridium aquilinum*. The tender young leaves of this fern are a popular wild food in the area. However, improper handling may lead to poisoning. *P. aquilinum* contains ptaquiloside, which is harmful to humans and animals if eaten raw. Ptaquiloside has been listed as a class III carcinogen by the IARC (International Agency for Research on Cancer) [39, 40]. To avoid the harmful effects, the leaves are cooked in water for a long time, with frequent water changes, until they are very soft, and then stir-fried.

## Plant Parts Used

The most frequently used edible parts are fruits, leaves, roots, flowers, tender shoots, seeds, and the whole plant (Fig. 4). There were 44 types of edible fruits among the 124 medicinal dietary plants documented. This may be because the fruits are easily collected, and ripe fruits usually have a good taste, which is readily accepted by people as food. Meanwhile, the edible parts of many plants are flowers; for example, the flowers of both *Marsdenia tenacissima* and *Rhododendron mucronatum* can be boiled or fried, and this is a typical feature of the Yi dietary culture. In addition, certain parts of other species, such as the bark of *P. emblica*, the seed oil of *Prinsepia utilis*, and the pollen of *P. yunnanensis* are recognized as edible items.

Regarding the medicinal parts of these plants, some roots, whole plants, and fruits have been used for thousands of years and are reported to possess certain medical effects (Fig. 5). For instance, the roots from 59 (approximately 47.6%) of the 124 plants documented were used as a restorative treatment. The book *Essentials of Yi Medicine* indicated that Yi doctors are particularly good at using plant roots for medical treatment. Moreover, 82.48% of the roots used in Yi medicine are from herbs and are still not recorded in the literature on traditional Chinese or Tibetan medicine. The skill of the Yi doctors in using roots may have developed from ancient Yi medical theories, such as the concept of Qingzhuo, Bafeng of Yi, and the five elements of Yi [4].

## Medicinal Parts And Edible Parts Compared

Among the 124 plants documented in the study, 40 species had edible parts that were used for both food and medicine. In 82 species, however, the parts used for medicine and the parts used for food were different. For example, the tender shoot of *Aralia chinensis* can be eaten after frying or boiling, while a decoction of the bark and roots can tonify the liver and treat rheumatism. In *Z. mays*, the grain is eaten, while the corn silk has medicinal properties. It was observed that, through the long-term use of these plants, the Yi people had a very thorough understanding of the characteristics and effects of the various plant parts, and so made the best use of these resources. The preference for wild-collected leafy vegetables and fruits over underground plant parts for food seems to be common among diverse ethnic groups in Mile and might be due to the ease of collecting above-ground parts; see Fig. 4 and Table 2. The most frequently used medicinal parts of these plants are roots, and this may be due to the relatively high medicinal content.

## Conditions Treated By Yi Medicinal Plants

The medicinal dietary plants used by the Yi people are diverse and contribute to the treatment of a number of disorders, such as cough, catarrh, rheumatism, swelling, kidney deficiency, spleen deficiency, gastric disease, and parasites (Table 5). These diseases are widespread among ethnic groups living in the mountains. Yi people are prone to rheumatism and respiratory diseases due to the humid air, and are often injured during hunting. Urinary tract and digestive system diseases are also frequent among the Yi. Modern Yi medicine developed from years of experience of environmental hazards and disease.

Table 5  
Frequency of ailments treated with medicinal dietary plants.

Disease	Species used	Percentage(%)
Anti-tussive; reducing sputum	20	16%
Rheumatism	11	8.8%
Detumescence	10	8%
Tonifying the kidney	10	8%
Tonifying the spleen	10	8%
Gastric disease	10	8%
Killing parasites	8	6.4%
Diuresis	6	4.8%
Laryngopharyngitis	5	4%
Removing liver fire to improving eyesight	5	4%
Reducing blood pressure	5	4%
Moistening lung	5	4%
Abatement of fever	5	4%
Hepatitis	5	4%
Esoenteritis	5	4%
Relieving pain	4	3.2%
Relieving asthma	4	3.2%
Cystitis	4	3.2%
Pneumonia	3	2.4%
Gynecopathy	3	2.4%
Dysentery	3	2.4%
Aperient bowel	3	2.4%
Headache	3	2.4%
Help digestion	2	1.6%
Promoting lactation	2	1.6%
Deafness; tinnitus	2	1.6%
Acne	2	1.6%
Removing urinary calculus	2	1.6%
Relieving itching	2	1.6%
Detoxifying snake venom	2	1.6%
Quenching thirst and helping to produce saliva	2	1.6%
Setting a broken bone	2	1.6%
Lowering blood lipid	2	1.6%
Cholecystitis	2	1.6%
Induce perspiration	2	1.6%
Apocenosis	1	0.8%
Enriching the blood	1	0.8%
Promoting blood circulation to remove blood stasis	1	0.8%
Tranquilizing and allaying excitement	1	0.8%
Epilepsy	1	0.8%
Strengthening yang-qi	1	0.8%

Disease	Species used	Percentage(%)
Relieve jaundice	1	0.8%
Nephritis	1	0.8%
Emesia	1	0.8%
Expelling toxins	1	0.8%
Bronchitis	1	0.8%
Relieving alcoholism	1	0.8%
Rhinitis	1	0.8%
Gonorrhea	1	0.8%
Angina pectoris	1	0.8%
Dizziness	1	0.8%
Hemorrhoids	1	0.8%
Apoplexy	1	0.8%
Abdominal distension	1	0.8%
Prostatitis	1	0.8%
Osteomyelitis	1	0.8%
Anti-tussive; reducing sputum	1	0.8%

## Comparison With Medicinal Practices In Other Ethnic Groups

Other ethnic groups may use some medicinal plants in different ways to those employed by the Yi. Lingling Zhang et al. recorded 55 species of medicinal dietary plants used by the Naxi people in Lijiang area [1]. Among them, 11 species were recorded as being used in a different way. For example, medicinal parts, preparation methods, and efficacy of these 11 plants in Yi medicine were quite different from those recorded in Naxi medicine. For example, Yi people prefer to decoct the roots of *Foeniculum vulgare* to treat traumatic injury, abdominal distension, and stomach-ache, while Naxi people are more likely to use tender stems of *F. vulgare* steamed together with eggs to alleviate fatigue and backache. Notably, although ethnic medicine is similar to traditional Chinese medicine in medical outcomes, the various systems used by the different ethnic groups, each with their specific methods and characteristics, is likely to attract further research interest.

## Medicinal And Edible Plants Worldwide

Currently, more than 80% of the world's population relies on traditional medicine for primary health care [26]. The utilization of medicinal and edible plants is an important form of health care for minority communities in remote areas. Yi people use the properties of plants in food, health care, and medicine. In addition to providing food and nutrition, medicinal and edible plants can regulate human body functions due to the secondary metabolites they contain [18, 21, 41].

At present, people the world over are turning to healthy foods that supply good nutrition and prevent disease, and this has promoted the development of the health-food industry. While many traditional medicinal and edible plants have health functions, not all of them are suitable for everyone. Some of these plants contain toxins, and dangerous side-effects may occur if they are used inappropriately. Therefore, before eating these plants, people should understand their effects, potential side effects, and the category of individuals who can safely consume them. Only in this way can traditional medicines be used efficaciously with minimal side effects [2].

## Commercial Potential

Many of the plants documented in this study have the potential for development because of their low toxicity and significant medicinal efficacy. For example, the roots of *O. javanica* can be used to treat hypertension. The roots of *Cirsium japonicum* and *Cirsium setosum* are highly effective in tonifying the kidney. The fruits of *Dendrobenthamia japonica* belong to an active class of acaricide, which is poisonous to mites and ticks. The oil and powder from the seeds of *L. usitatissimum* can treat various skin diseases. The roots of *Myrica rubra* are a good source of medicine to cure diarrhea. The roots of *P. utilis* showed good anti-inflammatory activity in cholecystitis. Its seeds are rich in oil, edible and contain various nutrients. The oil is a high-grade natural edible oil with uses in food and medicine. It can protect the gastric mucosa and is a good treatment for dry skin. Thus *P. utilis* has great potential for development as a raw material for natural skin-care and health-care products [42].

Another medicinal dietary plant with economic potential is *A. konjac*. This is one of the materials used to make konjac tofu, which can be stir-fried with Chinese sauerkraut, or chicken, or used in a cold dish. The stem of *A. konjac* is used for detoxification and can treat detumescence, phlegm, bronchitis, and

cough [43].

A popular local Mile plant with commercial potential is *P. emblica*. The flavor of the fruit is unique, with an initial sour taste and then a sweet taste. Yi people like to eat the bark. They remove the bark from the fresh trunk and scrape the endothelium with a ceramic implement or knife to obtain ribbon-thin slices, which can be used in a cold dish or stir-fried with meat [33].

Apart from their use in food and medicine, many of the species in the study were put to multiple other uses. For example, many of them are used as ornamental plants or made into teas. Wild food plant species are abundant and diverse in Mile city, they provide food for the local people, and is also a source of income. People are paying more attention to food safety and preservation of health. Medicinal dietary plants, because of their excellent beneficial effects in disease prevention and treatment, should be developed as health products or drugs [44].

## Pharmacological Properties

Drugs derived from plants or their extracts have certain therapeutic properties. If antibiotics are replaced by suitable therapeutic agents, plants can play an important role in combating bacterial pathogens. In this section, we will analyze the pharmacological properties of the most utilized medicinal plant species to check their therapeutic efficacy. This is important because antibiotic resistance is an emerging global concern and research hotspot with respect to veterinary and human medicine.

The bulb of *A. konjac* is used to remove toxicity, to treat detumescence, to invigorate the stomach and to stop pain; in addition, it can treat bronchitis and persistent cough [45]. The bulb of this herb has glucomannan, flying powder, starch, proteins, amino acids, and impurities. Glucomannan is an ideal dietary fiber and contains 7 essential amino acids. Four kinds of serotonin compounds, which had the ability to inhibit inflammatory cytokines, were isolated from the flying powder. On the other hand, the bulb of *Colocasia esculenta* has 31 alkanes, pea sterol, palmitic acid, carotenoids, and other components. It contains 19 mineral elements, 17 free amino acids, 7 essential amino acids, water-soluble polysaccharides, aromatic alcohols, and oxalates. The fruit of *P. emblica* has been used as a medicine in China for at least 2000 years. Roots and leaves of the tree can be used for medicinal purposes, such as relieving heat and detoxification and treating dermatitis and rheumatism. Pharmacological studies have shown that it has anti-microbial and anti-oxidation effects and lowers blood lipids and blood glucose. The fruits are rich in vitamin C and carotene, and the seeds are rich in fatty acids, phospholipids, and essential oils. The fruit, bark, and leaves contain tannins and can be used for treating diarrhea. Six polyphenolic compounds are obtained from *P. emblica* fruit juice.

The flowers of *Camellia japonica* can be used as medicine and have an astringent action, and the leaves can be used as a substitute for tea. The oil from the seeds contains 5 kinds of fatty acids and has an unsaturated fatty acid content of more than 80%. It also contains 8 kinds of mineral elements, such as iron, sodium, and magnesium, and can be used as a tonic. In addition, the plant contains flavonoids, polyphenols, and tea glycosides. Another plant with multiple medicinal uses is *Pinus armandii*. Local people use the shoots of *P. armandii* to treat rheumatic joint pain and traumatic injury. The seed kernels are used to treat the cough caused by lung heat (a syndrome in Chinese medicine) and habitual constipation, while the pollen is used to treat stomach and duodenal ulcers. *P. armandii* seeds have an oil content of 56.5%, which includes linoleic acid, oleic acid, palmitic acid, and arachidonic acid. In one study, the unsaturated fatty acids of *P. armandii* seeds had a significant inhibitory effect on hyperlipidemia and arteriosclerosis in mice [46].

## Conservation Issues

With the rapid development of the economy and an accelerating loss of biological and cultural diversity, a large amount of traditional knowledge in minority nationalities is in danger of disappearing. Therefore, the documentation and evaluation of traditional knowledge related to plant diversity and the use and effects of medicinal food plants are crucial [47, 48]. For example, plants such as *D. delavayi*, *S. henryi*, *Adenophora stricta*, and *Codonopsis foetens* are scarce wild resources. Many precious plant resources that have the potential for future sustainable development are vanishing before they have even been discovered. The development of plant resources is necessary to maintain biological diversity and for the potential development of drugs and health-care products. Meanwhile, the loss of traditional knowledge has been recognized as a development that has important negative effects on biological diversity conservation [49]. A reduction in plant diversity also leads to the extinction of the associated indigenous knowledge. The conservation and sustainable utilization of species with multiple uses must be taken into consideration. Over-harvesting may have serious consequences both for plant survival and the environment.

## Conclusion

This is the first ethnobotanical research study on the medicinal dietary plants used by the Yi ethnic group in Mile, Yunnan. Yunnan is rich in biodiversity thanks to its favorable geographical conditions, which endow the Yi medicinal dietary plants with distinct characteristics. In the study, 124 medicinal dietary plant species in 62 families were recorded in Mile County, and the plants were more abundant and available than in other areas, such as Jinpo and Chongqing. In the species included in this study, fruits were the most frequently used edible parts, and roots were the most frequently used medicinal parts. The main diseases treated with these plants included cough, catarrh, rheumatism, swelling, kidney deficiency, spleen deficiency, gastric disease, and parasitic infestations.

In 2002, the Ministry of Health of the People's Republic of China published a "Notice on further standardizing the management of health food raw materials". In this notice, specific provisions were made for 87 species of medicinal and edible plants, the items that can be used as health foods, and the articles prohibited for use as health food. Although this provision has a guiding role in the development and utilization of medicinal and edible plants and plants to boost health, it still needs to be supplemented. The Yi people's traditional knowledge about the medicinal and edible plants of their area is the accumulation of generations of wisdom and experience. Although many of the medicinal and edible plants documented in this study are not included in the notice, they are efficacious in

the prevention and treatment of diseases. Therefore, it is of great importance to carry out research on medicinal and edible plants in minority areas, to understand relevant traditional knowledge, study the nutritional value and efficacy of the plants, and to rationally develop these plant resources, so as to better serve human health [50].

With the rapid development of the economy and the increased adoption of mainstream culture, the transfer of traditional knowledge between generations is disrupted. In addition, due to the excessive exploitation of wild plants, some of these resources have been exhausted. For example, it was very difficult to find *A. hemsleyanum* in the wild. Admittedly, over-exploitation of these resources has led to some degree of protection through cultivation. Artificial cultivation of *Acanthopanax senticosus* and *P. utilis* already exists and provides a model for the sustainable use of plant resources.

Medicinal dietary plants can not only prevent and treat diseases but are important food sources for the local Yi people. This study provide some examples about the impact of rapid economic development in subtropical China on the use of medicinal dietary plants in ethnic communities and the associated traditional knowledge. Meanwhile, ethnic groups worldwide are facing the reality that their languages and cultures are gradually disappearing. The collection of ethnobotanical information is beneficial for protecting an important part of the Yi people's culture and traditional knowledge.

There remain some limitations in our study. For example, relatively few studies have been performed on the pharmacology, toxicology, and adverse effects of edible medicinal plants in the Yi people. Furthermore, this study was primarily conducted in the Yi settlements of Mile City; no horizontal comparative analyses of medicinal and edible plants were conducted in the other Yi settlements of Yunnan or in the country as a whole. In the future, we will conduct the relevant studies needed to obtain more comprehensive information. In future work, we will carry out relevant researches in order to obtain more comprehensive information. We will do more similar studies some years apart.

## Declarations

### Acknowledgements

We are thankful to the local people for their assistance in the field investigations and for sharing their valuable knowledge.

### Authors' contributions

XZH and SGL designed and conceived the study. XZH, JXS, YX, QSY, YJC, MYJ, YHL, YKL, HRL, ZZB and SGL performed the field survey. JXS and YX prepared the manuscript. XZH revised and finalized the manuscript. All authors read and approved the final manuscript.

### Funding

This work was financially supported by the National Natural Science Foundation of China (NSFC No. 81960783), project supported by the Biodiversity Investigation, Observation and Assessment Program of Ministry of Ecology and Environment of China (2019-2023) and program for Innovative Research Team (in Science and Technology) in University of Yunnan Province.

### Availability of data and materials

All data generated or analyzed during this study are included in this published article (and its supplementary information files).

### Ethics approval and consent to participate

Not applicable.

### Consent for publication

Not applicable.

### Competing interests

All the authors declare that there is no conflict of interest.

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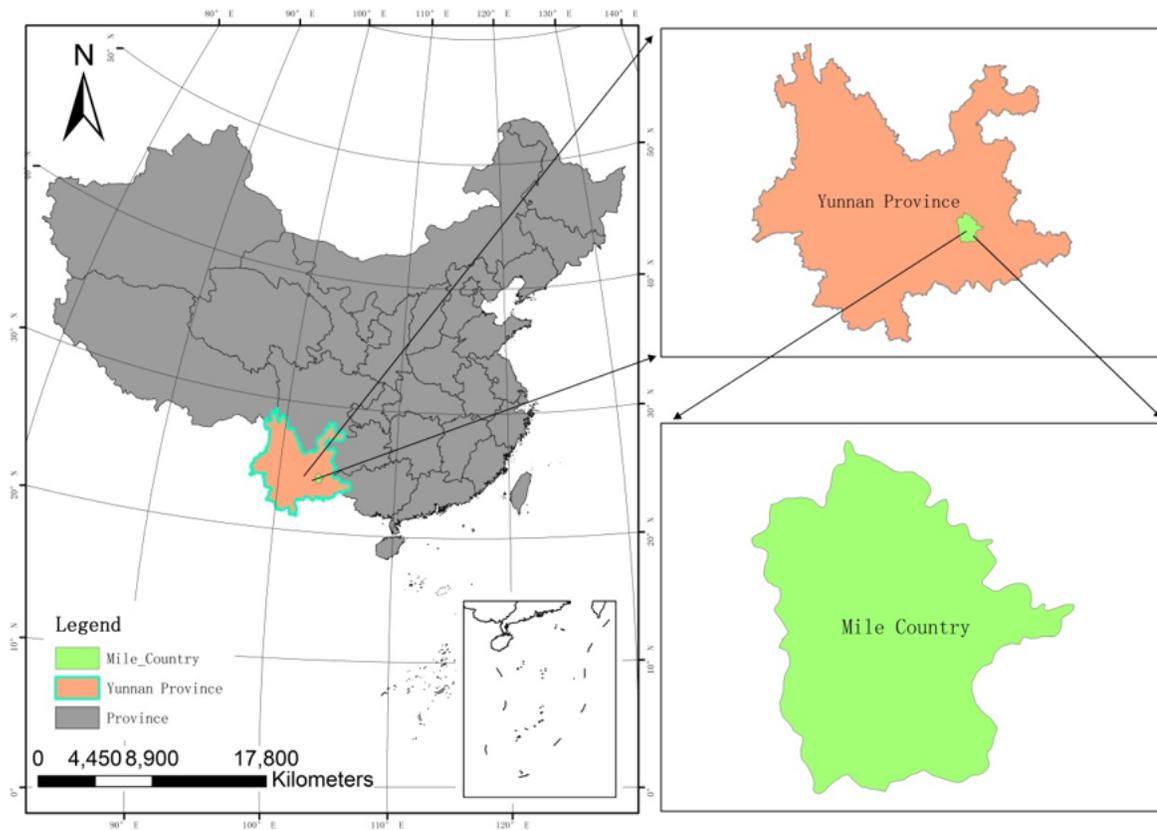
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## Figures



**Figure 1**

Location of the area covered in the investigation into medicinal dietary plants used by Yi in Mile, Yunnan, China. Note: The designations employed and the presentation of the material on this map do not imply the expression of any opinion whatsoever on the part of Research Square concerning the legal status of any country, territory, city or area or of its authorities, or concerning the delimitation of its frontiers or boundaries. This map has been provided by the authors.

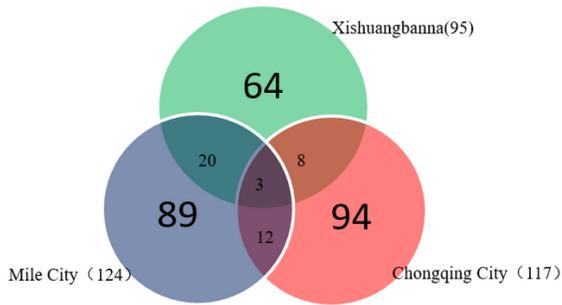
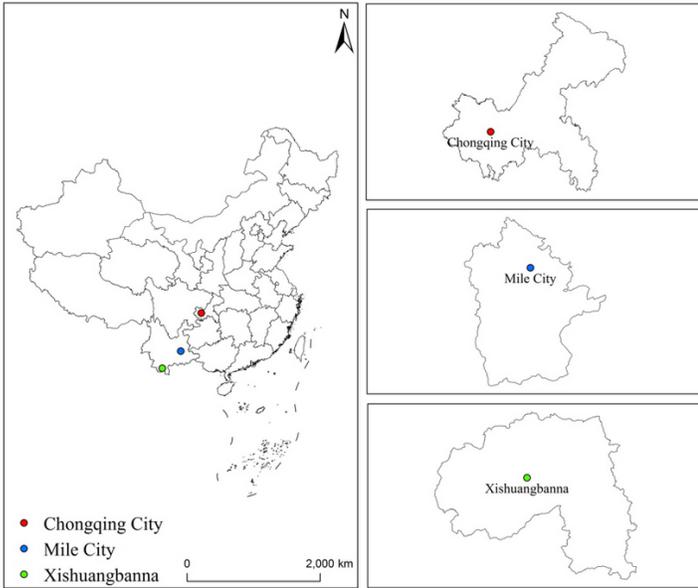


Figure 2

Venn diagram comparing plant species used for food and medicine in this research to those found in similar studies conducted in Xishuangbanna and Chongqing. Note: The designations employed and the presentation of the material on this map do not imply the expression of any opinion whatsoever on the part of Research Square concerning the legal status of any country, territory, city or area or of its authorities, or concerning the delimitation of its frontiers or boundaries. This map has been provided by the authors.



Figure 3

Difference kinds of Pumpkin food.

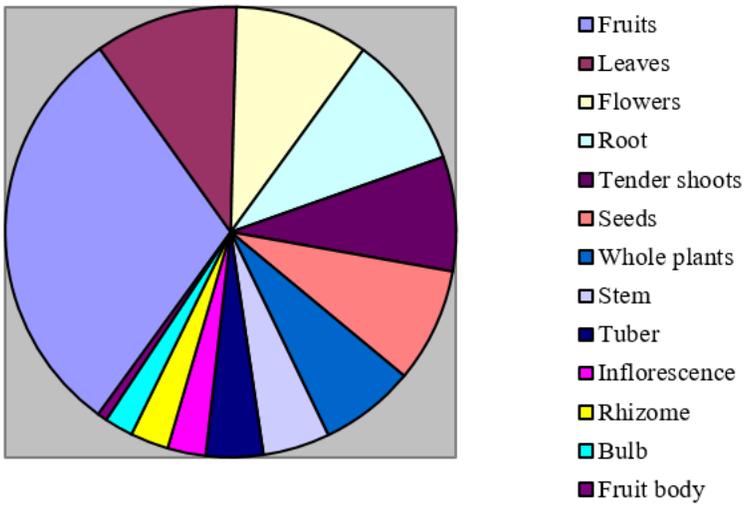


Figure 4

Frequency of use of the edible parts of medicinal dietary plants by Yi in Mile, Yunnan, China.

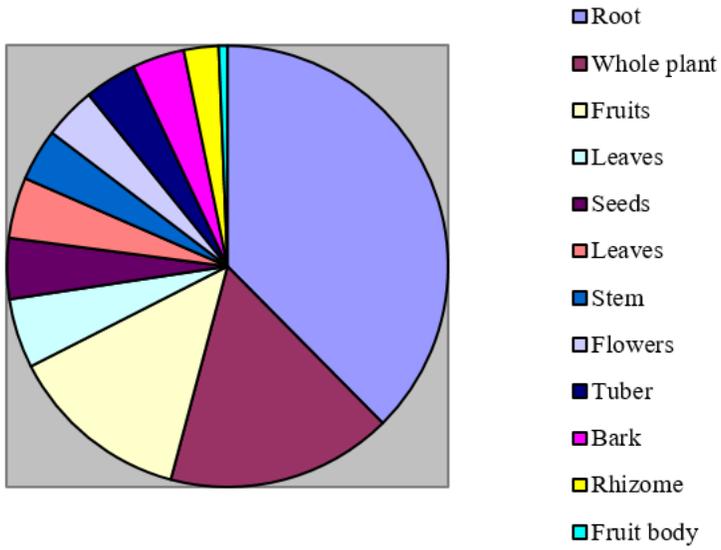


Figure 5

Frequency of use of the medicine parts of dietary plants by Yi in Mile, Yunnan, Chin