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

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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.
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, Jinfo, 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 km². 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].
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

\[ UV = \frac{\sum Ui}{N} \]

\( Ui \) 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].

| 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).

| Scientific name, Family, Voucher number | Vernacular name | Yi name | Life form | Medicinal parts | Preparing methods | Medicinal uses | Edible parts | Cooking methods | FUI | UV |
|----------------------------------------|-----------------|---------|-----------|-----------------|------------------|----------------|--------------|-----------------|-----|----|
| *Amaranthus tricolor* L., Amaranthaceae, 20171037 | Zilingxian Nuosongngibaizai | Herb | Whole plant | Decoction | Removing liver fire to improving eyesight | Whole plant | Stir-fried or boiled | 2.1 | 0.42 |
| *Dobinea delavayi* (Baill.) Baill., Anacardiaceae, 20171059 | Yangjiaotianma Ciwochenganmgongcizai | Herb | Rhizome | Stewed with chicken | Detumescence; apocenosis | Rhizome | Stewed with chicken | 1.9 | 0.45 |
| *Amorphophallus konjac* K. Koch, Araceae, 20171093 | Moyu Mayumezai | Herb | Tuber | Decoction | Pneumonia; antitussive | Tuber | Konjak tofu or boiled | 4.9 | 0.93 |
| *Colocasia esculenta* (L.) Schott, Araceae, 20171077 | Qingyu Abupa | Herb | Tuber | Decoction | Tonifying the kidney; tonifying the spleen | Tuber, inflorescence, and petioles | Boiled, stir-fried or pickled | 2.3 | 0.39 |
| *Eleutherococcus senticosus* (Rupr. & Maxim.) Maxim., Araliaceae, 20171001 | Ciwujia Ziguzai | Shrub | Stem and root | Decoction | Tonifying the kidney; rheumatism | Tender shoot | Stir-fried or boiled | 2.3 | 0.40 |
| *Aralia chinensis* L., Araliaceae, 20171022 | Congmu Heiahuozaizai | Tree | Bark and roots | Decoction | Tonifying the liver; rheumatism | Tender shoot | Stir-fried or boiled | 2.8 | 0.45 |
| *Metapana x delavayi* (Franch.) J. Wen & Frodin, Araliaceae, 20171010 | Liangwangucha Laibuluoyuzai | Shrub | Leaves | Soaked in boiling water | Laryngopharyngitis | Tender Leaves | Soaked in boiling water | 2.0 | 0.40 |
| *Panax notoginseng* (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 | Stewed with chicken | 2.5 | 0.55 |
| *Saruma henryi* Oliv., Aristolochiaceae, 20171016 | Matixiang Gongbunizai | Herb | Rhizome and Root | Stewed with chicken or pig feet | Tonifying the spleen; stomachache | Rhizome and Root | Stewed with chicken or pig feet | 1.9 | 0.45 |
| Code | Species Name | Genus | Part | Use 1 | Use 2 |
|------|--------------|-------|------|-------|-------|
| 20171020 | Cynanchum motophyllum C. K. Schneid., Apocynaceae, 20171020 | Qingyang shen | Vine | Root | Stewed with chicken | Tranquilizing and allaying excitement; epilepsy |
| 20171020 | | | | | | Eaten fresh | 2.0 | 0.50 |
| 20171020 | Marsdenia tenacissima (Roxb.) Moon Apocynaceae, 20171099 | Tongguan gsan | Vine | Root and stem | Stir-fried with eggs | Anti-tussive; lactogenesis; diuresis |
| 20171020 | | | | | | Flowers and tender shoot | Stir-fried | 1.4 | 0.37 |
| 20171020 | Auricularia auricula Judae, Auriculariaceae, 20171082 | Muer | Fungus | Fruit body | Stir-fried or boiled | Deafness; reducing blood pressure |
| 20171020 | | | | | | Fruit body | Stir-fried or boiled | 4.2 | 0.89 |
| 20171020 | Adenophora stricta Miq., Campanulaceae, 20171045 | Shashen | Herb | Root | Stewed with chicken | Tonifying the kidney; moistening lung |
| 20171020 | | | | | | Root | Stewed with chicken | 1.8 | 0.42 |
| 20171020 | Codonopsis foetens Hook. f. Thomson, Campanulaceae, 20171026 | Choushen | Herb | Root | Stewed with chicken | Tonifying the kidney; strengthening yang-qi |
| 20171020 | | | | | | Root | Stewed with chicken | 2.7 | 0.58 |
| 20171020 | Lonicera japonica Thunb., Caprifolaceae, 20171042 | Jinyinhua | Vine | Flowers, leaves and stem | Decoction | Abatement of fever; anti-tussive |
| 20171020 | | | | | | Flowers | Stir-fried or boiled | 3.1 | 0.60 |
| 20171020 | Silene asclepiadea Franch., Caryophyllaceae, 20171034 | Wacao | Herb | Root | Decoction | Acne; anti-tussive and reducing sputum |
| 20171020 | | | | | | Leaves | Stir-fried or boiled | 1.9 | 0.40 |
| 20171020 | Chenopodium album L., Amaranthaceae, 20171017 | Huitiaocai | Herb | Whole plant | Decoction | Removing liver fire to improving eyesight |
| 20171020 | | | | | | Leaves and stem | Stir-fried or boiled | 2.8 | 0.54 |
| 20171020 | Arctium lappa L., Compositae, 20171041 | Niubangzi | Herb | Root | Stewed with chicken | Gastric disorders; tinnitus |
| 20171020 | | | | | | Root | Stewed with chicken | 2.0 | 0.58 |
| 20171020 | Cirsium japonicum (Thunb.) Fisch. ex DC., Compositae, | Dajiiaoshu | Herb | Root | Stewed with meat | Tonifying the kidney; detumescence |
| 20171020 | | | | | | Root | Stewed with meat | 1.8 | 0.38 |
| ID          | Common Name                  | Latin Name                                   | Family       | Part Used | Preparation | Pharmacological Actions                                                                 |
|------------|------------------------------|----------------------------------------------|--------------|-----------|-------------|-----------------------------------------------------------------------------------------|
| 10171052   | Cirsium setosum (Willd.)     | Cirsium setosum (Willd.) Besser ex M.Bieb.  | Compositae   | Root      | Stewed with meat | Tonifying the kidney; detumescence                                                        |
| 10171054   | Gynura bicolor (Roxb. ex Willd.) | Gynura bicolor (Roxb. ex Willd.) DC.        | Compositae   | Whole plant | Decoction   | Hepatitis; improving vision; Tender plant Stir-fried or boiled                         |
| 10171048   | Taraxacum mongolicum Hand.-Mazz., Compositae | Taraxacum mongolicum Hand.-Mazz., Compositae | Compositae   | Whole plant | Stir-fried with eggs | Relieving pain; diuresis; Whole plant Stir-fried or boiled |
| 10171037   | Merremia hungaiensis (Lingelsh. & Borza) R. C. Fang, Convolvulaceae | Merremia hungaiensis (Lingelsh. & Borza) R. C. Fang, Convolvulaceae | Convolvulaceae | Root | Decoction | Tonifying the spleen; abate jaundice; Fruits and root Boiled or stir-fried |
| 10171021   | Cornus kousa subsp. chinensis (Osborn) Q.Y.Xiang Cornacea | Cornus kousa subsp. chinensis (Osborn) Q.Y.Xiang Cornacea | Cornaceae    | Leaves and root | Decoction | Ascaricide; Tender shoot and fruits Buds stir-fried; ripe fruits eaten fresh |
| 10171032   | Capsella bursa-pastoris (L.) Medik., Brassicaceae | Capsella bursa-pastoris (L.) Medik., Brassicaceae | Brassicaceae | Whole plant | Decoction | Nephritis; hydroncus; Leaves Stir-fried or boiled |
| 10171084   | Sechium edule (Jacq.) Sw., Cucurbitaceae | Sechium edule (Jacq.) Sw., Cucurbitaceae | Cucurbitaceae | Fruit and seeds | Decoction | Ascaricide; Fruits and seeds Fruit boiled; Seeds stir-fried |
| 10171040   | Solena amplicicau lis | Solena amplicicau lis | Cucurbitaceae | Root | Decoction | Pneumonia; anti-tussive; Fruits Ripe fruits eaten fresh |

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| Species | Species | Wt | Treatment | Dose |
|---------|---------|----|-----------|------|
| Trichosanthes Kirilowii Maxim., Cucurbitaceae, 20171044 | Tianhuafen | Mudenga | Vine | Root | Decoction | Relieving asthma; anti-tussive and reducing sputum | Fruits | Ripe fruits eaten fresh | 2.1 |
| Dioscorea alata L., Dioscoreaceae, 20171019 | Mooshu | Abunibazi | Vine | Tuber | Stewed with meat | Tonifying the spleen; help digestion | Tuber | Boiled or stewed | 2.2 |
| Dioscorea nipponica Makino, Dioscoreaceae, 20171031 | Yeshanya | Laigelai | Vine | Tuber | Stewed with meat | Tonifying the spleen; tonifying the kidney | Tuber | Boiled or stewed | 1.6 |
| Diospyros kaki L. f., Ebenaceae, 20171044 | Shizishu | Sanbaomezai | Tree | Root | Decoction | Killing parasites; emesis | Fruits | Ripe fruits eaten fresh | 2.3 |
| Diospyros kaki var. silvestris Makino, Ebenaceae, 20171039 | Yeshizhi | Laigusanbazai | Tree | Root | Decoction | Enteritis; cystitis | Fruits | Ripe fruits eaten fresh | 2.4 |
| Diospyros lotus L., Ebenaceae, 20171035 | Ruanzao | Sanbaniguoai | Tree | Root | Decoction | Diuresis; expelling toxins | Fruits | Ripe fruits eaten fresh | 2.2 |
| Rhododendron mucronatum (Blume) G. Don, Ericaceae, 20171023 | Baihuadujuan | Caigumiluotongzai | Shrub | Root | Decoction | Cystitis; hepatitis | Flowers | Stir-fried or boiled | 2.6 |
| Euphorbia helioscopi L., Euphorbiaceae, 20171011 | Naijiangcao | Anengdongzi | Herb | Whole plant | Decoction | Abatement of fever; detumescence | Leaves | Stir-fried or boiled | 2.1 |
| Phyllanthus emblica L., Phyllanthaceae, 20171052 | Yuganzi | Elengmezai | Tree | Fruits | Decoction | Pharyngitis; anti-tussive | Fruits | Ripe fruits eaten fresh | 4.9 |
| Castanea mollissima Blume, Fagaceae, 20171036 | Banli | Ganme | Tree | Fruits and roots | Decoction | Tonifying the kidney; quenching thirst and helping to | Fruits | Stir-fried or boiled | 2.7 |
| Plant Name                      | Country     | Stage     | Part     | Preparation       | Secondary Uses                                      | Dosage | I. | M. |
|--------------------------------|-------------|-----------|----------|-------------------|-----------------------------------------------------|--------|----|----|
| Lophatherum gracile            | Bronn.     | Tree      | Leaves   | Decoction         | Anti-tussive; relieving asthma                      | 2.3    | 0.45 |
| Zea mays L.                    | Poaceae    | Herb     | Corn silk| Decoction         | Removing urinary calculus                           | 4.9    | 0.93 |
| Juglans regia L.               | Poaceae    | Tree      | Bark and root | Decoction       | Killing parasites; relieving itching                | 4.9    | 0.91 |
| Elsholtzia bodinieri            | Lamiaceae  | Herb     | Whole plant | Decoction     | Headache; abatement of fever                        | 2.3    | 0.48 |
| Elsholtzia ciliata (Thunb.)     | Lamiaceae  | Herb     | Whole plant | Decoction       | Pharyngolaryngitis chronica                        | 1.7    | 0.43 |
| Elsholtzia rugulosa            | Lamiaceae  | Herb     | Whole plant | Decoction       | Pneumonia; relieving asthma                        | 2.6    | 0.48 |
| Mentha canadaL.                | Lamiaceae  | Herb     | Whole plant | Decoction       | Anti-tussive; bronchitis                           | 4.2    | 0.88 |
| Elsholtzia flavia              | Lamiaceae  | Herb     | Fruits   | Decoction         | Cystitis                                            | 2.3    | 0.49 |
| Holboellia latifolia           | Lardizaba laceae | Vine | Root     | Decoction         | Ripe fruits eaten fresh                            | 4.9    | 0.90 |
| Species                                   | Origin                        | Part Used   | Preparation | Uses                                      | Preparation | Dosage |
|------------------------------------------|-------------------------------|-------------|-------------|-------------------------------------------|-------------|--------|
| *Pisum sativum* L., *Legumino sae*, 20171024 | Qingdou                      | Herb        | Seeds       | Decoction Gastralgia                      | Seeds       | 3.2    |
|                                          |                               |             |             | Boiled, eaten fresh or stewed            |             | 0.58   |
| *Pueraria montana* (Lour.) Merr., *Legumino sae*, 20171031 | Ge                           | Vine        | Root        | Decoction Reducing phlegm; relieving alcoholism | Root        | 3.1    |
|                                          |                               |             |             | Eaten fresh                                |             | 0.56   |
| *Sophora davidii* (Franch.) Pavol., *Legumino sae*, 20171012 | Kuchua                      | Shrub       | Flowers and root | Decoction Dysmenorrhea                       | Flowers     | 2.1    |
|                                          |                               |             |             | Stir-fried or boiled                       |             | 0.42   |
| *Sophora japonica* L., *Legumino sae*, 20171039 | Huaihua                     | Tree        | Fruits      | Decoction Removing liver fire to improving eyesight | Flowers     | 2.4    |
|                                          |                               |             |             | Stir-fried or boiled                       |             | 0.51   |
| *Vicia faba* L., *Legumino sae*, 20171019 | Candou                       | Herb        | Seeds       | Decoction Tonifying the spleen; detumescence | Seeds       | 3.8    |
|                                          |                               |             |             | Stir-fried or boiled                       |             | 0.71   |
| *Allium macrostemon* Bunge, *Amaryllidaceae*, 20171010 | Xiaopusu                     | Herb        | Whole plant | Decoction Killing parasites; reducing phlegm | Whole plant | 2.2    |
|                                          |                               |             |             | Stir-fried, boiled or pickled              |             | 0.42   |
| *Allium sativum* L., *Amaryllidaceae*, 20171046 | Dasuan                      | Herb        | Whole plant | Decoction Rhinitis; killing parasites      | Bulb        | 4.7    |
|                                          |                               |             |             | Flavouring                                 |             | 0.90   |
| *Allium scorodoprasum* L., *Amaryllidaceae*, 20171024 | Xiaosuan                     | Herb        | Whole plant | Decoction Killing parasites; abatement of fever | Bulb        | 2.1    |
|                                          |                               |             |             | Flavouring                                 |             | 0.47   |
| *Allium wallichii* Kunth, *Amaryllidaceae*, 20171012 | Shanjiucai                   | Herb        | Whole plant | Stir-fried with eggs                       | Whole plant | 2.3    |
|                                          |                               |             |             | Boiled or pickled                          |             | 0.50   |
| *Hemerocallis citrina* Baroni, *Asphodelaceae*, 20171015 | Xuancao                     | Root and flowers | Decoction | Scrambled eggs with flowers | Flowers | 2.7    |
|                                          |                               |             |             | Stir-fried or boiled                       |             | 0.52   |
| Scientific Name | Common Name | Family | Common Name | Part Used | Usage | Mode of Use | Quantity |
|-----------------|-------------|--------|-------------|-----------|-------|-------------|----------|
| *Lilium brownii* F.E.Br. ex Mieliez, Liliaceae, 20171034 | Baihe Amezai Herb | Fruits and bulb | Decoction | Tonifying the lung; reducing phlegm | Bulb | Stir-fried or boiled | 2.8 | 0.55 |
| *Polygonatum odoratum* (Mill.) Druce, Asparagaceae, 20171053 | Baihe Amezai Herb | Tuber | Stew with eggs or meat | Decoction | Tuber | Stir-fried or boiled | 2.2 | 0.47 |
| *Smilax mairei* H. Lév., Smilacaceae, 20171033 | Wucibaqi Shrub | Root | Decoction | Chronic colitis; irregular menses | Tender shoots | Stir-fried or boiled | 2.0 | 0.36 |
| *Smilax riparia* A. DC., Smilacaceae, 20171038 | Maweicai Vine | Whole plant | Decoction | Abatement of fever; antitussive | Whole plant | Stir-fried or boiled | 2.1 | 0.33 |
| *Linum usitatissimum* L., Linaceae, 20171091 | Yama Zhongzizai Herb | Seeds | Made oil or powder | Reducing blood pressure; skin diseases | Seeds | Made oil or powder | 2.3 | 0.45 |
| *Toona sinensis* (Juss.) M. Roem., Meliaceae, 20171054 | Xiangchun Longboto Tree | Bark and root | Decoction | Gynecopathy; dysentery | Tender shoots | Stir-fried or cold dish | 2.4 | 0.52 |
| *Cannabis sativa* L., Cannabaceae, 20171046 | Huomazi Herb | Seeds and root | Made oil | Relaxing the bowel; moistening the lung | Seeds | Made oil | 2.5 | 0.54 |
| *Ficus tikoua* Bureau, Moraceae, 20171011 | Dibanten Cisanpianlianzi Vine | Root | Decoction | Gonorrhea | Ripe fruits eaten fresh | 2.0 | 0.41 |
| *Morus alba* L., Moraceae, 20171018 | Sangshu Aheizai Tree | Root | Decoction | Anti-tussive; reducing phlegm | Fruits | Ripe fruits eaten fresh | 2.6 | 0.53 |
| *Musa basjoo* Siebold & Zucc. ex Linuma, Musaceae, 20171044 | Bajiao Gonggua buzai Tree | Root | Decoction | Tonifying the spleen; diuresis | Stem and inflorescence | Stir-fried or boiled | 3.5 | 0.65 |
| *Myrica rubra* (Lour.) Siebold & Zucc., Myricaceae | Yangmei Sangusongzai Tree | Root | Decoction | Enteritis | Fruits | Ripe fruits eaten fresh | 2.7 | 0.56 |
| Plant Name                             | Scientific Name                        | Family       | Year   | Usage                                                                 |
|----------------------------------------|----------------------------------------|--------------|--------|----------------------------------------------------------------------|
| *Syzygium aromaticum* (L.) Merr. & L. M. Perry | Myricaceae                            | 20171012     |        | Dingxianghua, Lazigumezai, Tree Root Stewed with pig feet Detumescence; relieving pain Root Stewed with pig feet 2.6 0.48 |
| *Osmanthus fragrans* Lour., Oleaceaeae | Myrtacea                               | 20171022     |        | Guihua Jiweilongzai, Tree Flowers Decoction Moistening the lung; antitussive Flowers Soaked or stir-fried 2.8 0.58 |
| *Nervilia fordii* (Hance) Schltr., Orchidaceae | Myrtacea                               | 20171040     |        | Qingtiankui Weinimesongzai, Herb Whole plant Stir-fried with eggs Hepatitis; detumescence Tender shoot Stir-fried or boiled 2.3 0.43 |
| *Trachycarpus fortunei* (Hook.) H. Wendl., Arecales | Myrtacea                               | 20171054     |        | Zongshuhua Situomiza, Tree Root, stem and fruits Decoction Reducing blood pressure; dizziness Inflorescence Stir-fried or boiled 2.5 0.48 |
| *Ceratopteris thalictroides* (L.) Brongn., Pteridaceae | Myrtacea                               | 20171021     |        | Shuijueca Riabiwujiezai, Herb Whole plant Decoction Diuresis Whole plant Stir-fried or boiled 2.9 0.54 |
| *Sesamum indicum* L., Pedaliaceae     | Myrtacea                               | 20171011     |        | Zhima Guogeimweizai, Herb Fruits Decoction Aperient bowel Seeds Eaten fresh or flavouring 2.9 0.55 |
| *Abies holophylla* Maxim., Pinaceaeae | Myrtacea                               | 20171027     |        | Shasong Geizai, Tree Bark and root Decoction Setting a broken bone; detumescence Tender shoot Stir-fried or boiled 2.2 0.46 |
| *Pinus armandii* Franch., Pinaceaeae | Myrtacea                               | 20171043     |        | Kongsong Shumezai, Tree Bark and root Decoction Reducing phlegm Seeds Eaten fresh 2.1 0.42 |
| *Pinus yunnanensis* Franch., Pinaceaeae | Myrtacea                               | 20171033     |        | Yunnansong Tumumezai, Tree Pollen, leaves and Bark Decoction Lowering blood lipid Pollen Made cakes 2.4 0.47 |
| *Plantago asiatica* L., Plantagin     | Myrtacea                               | 20171033     |        | Cheqiancao Geniwozai, Herb Whole plant Decoction Cystitis Leaves Stir-fried or boiled 2.6 0.46 |
| Common Name | Scientific Name | Family | Part Used | Preparation | Condition | Dosage | Efficacy |
|-------------|-----------------|--------|-----------|-------------|-----------|--------|---------|
| Kuqiaoma | Fagopyrum tataricum | Polygonaceae | Whole plant | Decoction | Cholecystitis | Leaves, tender shoot and fruits | Stir-fried or boiled | 3.1 | 0.60 |
| Guokangmezai | Fagopyrum tataricum | Polygonaceae | Whole plant | Decoction | Cholecystitis | Leaves, tender shoot and fruits | Stir-fried or boiled | 3.1 | 0.60 |
| Achiwuiejai | Pteridium aquilinum | Dennstaedtiaceae | Whole plant | Decoction | Angina pectoris | Flowers and fruits | Stir-fried or boiled | 2.7 | 0.47 |
| Kuqiaoma | Juecai | Polygonaceae | Whole plant | Decoction | Angina pectoris | Flowers and fruits | Stir-fried or boiled | 2.6 | 0.52 |
| Sanbuzai | Punica granatum | Lythraceae | Whole plant | Decoction | Killing parasites; dysentery | Flowers and fruits | Stir-fried or boiled | 2.2 | 0.46 |
| Sinengba | Ramalina fastigiata | Ramalinaceae | Whole plant | Decoction | Tonifying the spleen; diuresis | Whole plant | Stir-fried or boiled | 2.2 | 0.46 |
| Meizishai | Aconitum hemsleyanum | Ranunculaceae | Root | Stewed with chicken | Treating rheumatism | Root | Stewed with chicken | 0.6 | 0.05 |
| Chenglengalazai | Hovenia acerba | Rhamnaceae | Fruits | Decoction | Protective liver | Flowers | Ripe fruits eaten fresh | 2.1 | 0.46 |
| Laigusanwuzai | Prunus davidiana | Rosaceae | Seeds | Decoction | Removing urinary calculus; relieving pain | Seeds | Eaten fresh | 2.2 | 0.47 |
| Sangazimezai | Prunus mume | Rosaceae | Root | Decoction | Tonifying the spleen | Fruits | Ripe fruits eaten fresh | 2.8 | 0.54 |
| Xingshuinizai | Prunus armeniac | Rosaceae | Seeds | Decoction | Anti-tussive; reducing sputum | Fruits | Eaten fresh | 2.7 | 0.51 |
| Yingtao | Cerasus pseudocecrasus | Rosaceae | Root | Decoction | Arthritis | Fruits | Ripe fruits eaten fresh | 2.8 | 0.54 |
| Rosaceae | 20171051 |  |  |  |  |  |  |  |  |
|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|
| Chaenomeles sinensis (Dum. Cours) Koehne, Rosaceae 20171017 | Mugua | Sanbuai | Tree | Fruits | Stewed with chicken | Numb limbs; rheumatism | Fruits | Boiled | 2.9 | 0.60 |
| Crataegus cuneata Siebold & Zucc., Rosaceae 20171032 | Yeshanzha | Sanwozai | Shrub | Fruits | Decoction | Reducing blood pressure; help digestion | Fruits | Ripe fruits eaten fresh | 2.0 | 0.41 |
| Docynia delavayi (Franch.) C. K. Schneider, Rosaceae 20171005 | Duoyiguo | Sanbuazeizai | Tree | Root | Decoction | Rheumatic | Fruits | Ripe fruits eaten fresh | 2.7 | 0.53 |
| Duchesnea indica (Jacks.) Focke, Rosaceae 20171010 | Shemei | Hamezai | Herb | Whole plant | Decoction | Relieving asthma | Fruits | Ripe fruits eaten fresh | 2.4 | 0.47 |
| Eriobotrya japonica (Thunb.) Lindl., Rosaceae 20171002 | Pipa | Chichishandongzai | Tree | Leaves | Decoction | Anti-tussive; reducing sputum | Fruits | Ripe fruits eaten fresh | 2.8 | 0.67 |
| Fragaria x ananassa (Duchesne ex Weston) Duchesne ex Rozier, Rosaceae 20171048 | Hongshecao | Abosanzuinhizai | Herb | Whole plant | Decoction | Detoxifying snake venom; hemorrhoids | Fruits | Ripe fruits eaten fresh | 2.4 | 0.47 |
| Fragaria nilgerrensis Schltdl. ex J. Gay, Rosaceae 20171024 | Baisheca | Abosangaontong | Herb | Whole plant | Decoction | Hepatitis | Fruits | Ripe fruits eaten fresh | 2.3 | 0.48 |
| Fragaria vesca L., Rosaceae 20170379 | Fanbaiyecao | Laigusanzuitong | Herb | Whole plant | Decoction | Detoxifying snake venom | Fruits | Ripe fruits eaten fresh | 2.4 | 0.45 |
| Prinsepia utilis Rovle. | Qingciguo | Babazai | Shrub | Root or leaves | Leaves Stir-fried with eggs | Cholecystitis | Leaves | Boiled or pickled | 2.7 | 0.54 |
| Name                                                                 | Genus                        | Family       | Year     | Species                      | Decoction   | Condition                      | Uses                                                                 | Notes             |
|---------------------------------------------------------------------|------------------------------|--------------|----------|------------------------------|-------------|--------------------------------|----------------------------------------------------------------------|-------------------|
| Pyrus calleryana Decne., Rosaceae                                  | Pyrus                        | Rosaceae     | 20171043| 8                            | Decoction    | Acne                           | Fruits and flowers                                                    | Ripe fruits eaten fresh; flowers stir-fried or boiled | 2.4               | 0.43               |
| Pyrus pyrifolia (Burm. f.) Nakai, Rosaceae                          | Pyrus                        | Rosaceae     | 20171029| 5                            | Decoction    | Tonifying the lung             | Fruits and flowers                                                    | Ripe fruits eaten fresh or boiled; flowers stir-fried or boiled | 2.3               | 0.46               |
| Rubus coreanus Miq., Rosaceae                                      | Rubus                        | Rosaceae     | 20171066|                               | Decoction    | Rheumatic arthritis            | Fruits                                                             | Ripe fruits eaten fresh                                           | 2.2               | 0.42               |
| Rubus ellipticus Sm., Rosaceae                                      | Rubus                        | Rosaceae     | 20171010| 1                            | Decoction    | Apoplexy; rheumatism           | Fruits                                                             | Ripe fruits eaten fresh                                           | 2.0               | 0.40               |
| Rubus nivus Thunb., Rosaceae                                       | Rubus                        | Rosaceae     | 20171049| 2                            | Decoction    | Tonifying the liver; improving vision; promoting the secretion of saliva or body fluids; rheumatism | Fruits                                                             | Ripe fruits eaten fresh                                           | 2.1               | 0.42               |
| Citrus medica L., Rutaceae                                         | Citrus                       | Rutaceae     | 20171038| 8                            | Decoction    | Enteritis; stomachache        | Fruits                                                             | Ripe fruits eaten fresh                                           | 2.6               | 0.48               |
| Zanthoxylum bungeanum Maxim., Rutaceae                              | Zanthoxylum                  | Rutaceae     | 20171055|                               | Decoction    | Skin itch                      | Fruits                                                             | Flavouring                        | 3.3               | 0.59               |
| Zanthoxylum armatum DC., Rutaceae                                   | Zanthoxylum                  | Rutaceae     | 20171042| 5                            | Decoction    | Numb limbs; rheumatism         | Fruits                                                             | Flavouring                        | 2.3               | 0.43               |
| Houttuynia cordata Thunb., Saururaceae                              | Houttuynia                   | Saururaceae  | 20171026| 8                            | Decoction    | Anti-tussive; moistenin lung   | Leaves, stems and root                                               | Cold dish or boiled               | 4.6               | 0.90               |
| Brandisia hancei Hook. f., Paulowniaceae                            | Brandisia                    | Paulowniaceae| 20171027| 4                            | Decoction    | Osteomyelitis                  | Flowers                                                             | Stir-fried or boiled               | 2.1               | 0.38               |
| Species                                      | Author                  | Family      | Type          | Part Utilized | Method of Preparation       | Other Uses                                      | IEC | IED |
|---------------------------------------------|-------------------------|-------------|---------------|---------------|-----------------------------|-------------------------------------------------|-----|-----|
| Capsicum annuum L.                           | Lazi                    | Solanaceae  | Herb          | Fruits        | Decoction                  | Induce perspiration                             | 4.6 | 0.90 |
| Cyphomandra betacea (Cav.) Sendt., Solanaceae | Shufanqie               | Solanaceae  | Tree          | Fruits        | Decoction                  | Tonifying the spleen; stomachache               | 2.4 | 0.47 |
| Physalis alkekengi var. franchetii (Mast.) Makino, Solanaceae | Denglong guo            | Solanaceae  | Herb          | Root          | Decoction                  | Pharyngolaryngitis; antitussive                  | 2.8 | 0.50 |
| Camellia japonica L.                         | Shancha                 | Theaceae    | Shrub         | Fruits        | Decoction                  | Aperient bowel                                  | 2.4 | 0.46 |
| Camellia sinensis (L.) Kuntze, Theaceae      | Cha                     | Theaceae    | Shrub         | Leaves        | Soaked in boiling water    | Lowering blood lipid                            | 4.3 | 0.82 |
| Foeniculum vulgare Mill.                    | Xiaohuxiang             | Apiaceae    | Herb          | Root          | Decoction                  | Abdominal distension                            | 3.1 | 0.62 |
| Hydrocotyle nepalensis Hoo k., Araliaceae   | Maticao                 | Apiaceae    | Herb          | Whole plant   | Roots stewed with pork tripe | Hepatitis A                                    | 2.1 | 0.41 |
| Ligusticum chuanxiong S.H.Qiu, Y.Q.Zeng, K.Y.Pan, Y.C.Tang & J.M.Xu, Apiaceae | Chuanxiong              | Apiaceae    | Herb          | Root          | Stir-fried with eggs       | Nervous headache                                | 2.3 | 0.46 |
| Oenanthe javanica (Blume) DC., Apiaceae      | Shuiqincai               | Apiaceae    | Herb          | Whole plant   | Decoction                  | Reducing blood pressure                         | 4.2 | 0.83 |
| Debregeasia                                  | Shuima                  | Apiaceae    | Shrub         | Root and stem | Decoction                  | Dysentery                                       | 1.8 | 0.32 |
| 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 Jinfo, 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...
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.

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 annuum*, *Auricularia auricula*, *Taraxacum mongolicum*, *Sechium edule*, *Mentha canadensis*, *Zingiber officinale*, *Oenanthje 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 hemsleyanum* 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

| 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%          |
| 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. Yunan 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 Jinfo 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 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

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**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.

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**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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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