An Ethnobotanical and Ethnomedicinal Investigation of Phytomedical Knowledge and Practice of Medicinal Plants in Lingchuan County, Shanxi, China

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Abstract

Background

Lingchuan County is the main producing area of Chinese medicinal materials in Shanxi Province, rich in medicinal plant resources. The aboriginal residents of Lingchuan County have certain traditional knowledge and experience in the use of medicinal plants and can effectively use medicinal plants to treat common diseases.

Methodology

A field survey in 53 villages was carried out over one year, i.e., November 2017—August 2018. Ethnomedicinal data was collected through designed questionnaires/interviews by involving 180 informants familiar with medicinal plants utilization. Documented data were evaluated using the quantitative indices.

Results

A total of 138 traditional medicinal plants were investigated, belonging to 123 genera of 60 families. Among them, Asteraceae was the dominant plant family with 19 species. Roots were the most commonly used plant parts, and the dominant life form was herbs. Quantitative analysis revealed that Forsythia suspensa was with higher (0.33) RFC value, and Scutellaria baicalensis was recorded with higher (0.91) UV. Treated diseases were categorized in 12 groups and evaluated by their FIC value, in which gynecological diseases having higher (0.93) FIC value followed by urinary system diseases. The most medicinal plants are used to clear away heat and relieve the surface. At the same time, people use boiled water to use medicinal plants. Most of the plants investigated are non-toxic.

Conclusion

This study reported traditional herbal medicines for the first time to be used against various disorders in Lingchuan County, China and are still practiced by the local communities. Some of the new ethnobotanical claims documented in this investigation should need to be further explored clinically. The medicinal plants with the highest use values recorded in this study may signpost the probable existence of valuable phytochemical compounds that requires a search for prospective new drugs to cure many human disorders.

1. Background

With social development and population growth, some diseases have become more and more complex and incurable, which greatly endangers people's health. Although modern synthetic drugs have solved some problems, but they are also difficult to develop in-depth due to the high cost of research in the development of new drugs as well as have higher side effects [1]. Therefore, 'green' traditional drugs are more and more favored by scientists and are an important part of medicines [2]. It has received widespread attention, and at the same time, it has become a trend to discover new drugs from the folk and expand the resources of folk medicinal plants. China is one of the countries with the richest medicinal plants in the world, with more than 12,000 kinds of medicinal plants. However, in many remote areas of China, due to various factors such as living in poverty and a large number of people turning to cities, coupled with the lack of special records of traditional medicinal plant knowledge, and the impact of the modern medical system and new medical culture, some medicinal plant resources have suffered [3]. Due to the continuous destruction, the knowledge of traditional medicinal plants cannot be protected and passed on and, is rapidly disappearing. Therefore, the collection, arrangement, and inheritance of traditional folk knowledge of medicinal plants is very important [4].

The research of traditional medicinal plants as ethnobotany's content is regional; however, China has a vast territory and complex topography; therefore, plant types, medicinal plant names, and methods of use are not the same in each region. Traditional medicinal knowledge is closely related to local culture, history, economy, politics, and natural conditions. In recent years, some scientific researchers have conducted a certain degree of research on traditional medicinal knowledge in the northwest and southwest of China and most of the research objects are ethnic minorities, while the central area (Han nationality) has not been well explored regarding traditional knowledge of medicinal plants. However, the Han nationality is the most populous ethnic group in China. In the course of historical development, it has also accumulated valuable medicinal knowledge and experience [5]. Therefore, the research site selected was the central area with a large Han population.

Lingchuan County is located in the Southeast of Shanxi Province and has a long history. According to records, humans lived here as early as the Paleolithic era. It is the main producing area of Chinese medicinal materials in Shanxi Province and is rich in medicinal plant resources. In the process of production and life, local residents use plants in the surrounding environment to treat diseases and have accumulated a lot of knowledge and experience of medicinal plants. In addition, many villages in this area are located in remote mountainous areas, and modern medical conditions are poor, which to a large extent cannot satisfy people's needs. Therefore, local barefoot doctors may convince them to collect medicinal plants, and to use them for basic health needs, so that traditional medical knowledge can be preserved, which has certain research values [6]. Therefore, it is necessary to investigate traditional knowledge of medicinal plants in Lingchuan County, Shanxi Province, using the ethnobotanical methods.

2. Methodology

2.1 Study area
Lingchuan County is located in Jincheng City with a higher altitude in the southern section of Taihang Mountain (Fig. 1). It has 12 towns and villages under its jurisdiction, with a population of more than 250,000, and the total area of the county is 1,751 square kilometers. The average elevation is about 1058 m. It is a rocky, hilly area. It is mainly divided into three different terrain areas: the rocky mountainous area in the east, the rocky, hilly area in the middle, and the Pingchuan area in the southwest. The east and south have large elevation differences and steep terrain. The relative height difference is generally between 600 and 1000 m, which is high in the northeast and low in the southwest. The local plant diversity corresponds to the topography. The area has a continental monsoon climate with a cool climate and abundant rainfall. The annual average temperature is 7℃ to 9℃, and the annual precipitation is 700 to 1000 mm. The county has a frost-free period of 160 days throughout the year, and the average sunshine duration is 2380 to 2730 h [7]. The forest coverage rate in Lingchuan County is 51.07%, and the timber stock volume is 1.48 million cubic meters. There are not only natural forests and artificial forests but also unique tree species and Taxus Chinensis. More than 400 kinds of wild medicinal materials have provided a material basis for the formation of knowledge of Lingchuan traditional medicinal plants. However, in recent years, due to environmental changes and human activities, many rivers in Lingchuan County have dried up, reducing the diversity of medicinal plants [8].

2.2. Ethnobotanical field survey and data collection

Ethnomedicinal information about the use of plant species for the treatment of various disorders in the study area were documented from 53 localities. This survey was carried out from November 2017 to August 2018, following the protocols for ethnobotanical data documentation [9]. Mainly adopt key person interview method, structured interview method, and free enumeration method, ask according to the previously designed questions, record the local name, use part, use method, efficacy, etc. of medicinal plants and ethnographical information of the total informants (180) such as age, class, gender, experience, and educational background (Table 1, Fig. 2) [10].

| Variables      | Demographic categories | Number of people | Percentage |
|----------------|------------------------|------------------|------------|
| Gender         | Male                   | 113              | 63         |
|                | Female                 | 67               | 37         |
| Education      | Primary school         | 73               | 42         |
|                | Junior high school     | 39               | 22         |
|                | High school            | 6                | 3          |
|                | Technical secondary school | 6         | 3          |
|                | Junior college         | 8                | 4          |
|                | Undergraduate          | 4                | 2          |
|                | Uneducated             | 44               | 24         |
| Profession     | Farmer                 | 127              | 70         |
|                | Barefoot doctor        | 12               | 7          |
|                | Chinese Medicine       | 14               | 8          |
|                | Vendor                 | 11               | 6          |
|                | Village cadre          | 10               | 6          |
|                | Forest keeper          | 2                | 1          |
|                | Teacher                | 4                | 2          |
| Age group      | 25–45                  | 38               | 21         |
|                | 46–60                  | 47               | 26         |
|                | above 60               | 95               | 53         |

| Barefoot doctor | Chinese Medicine |
|-----------------|------------------|
| Farmer          | Farmer           |
| *Pinellia ternata* (Thunb.) Makino (Araceae) | *Pteris cretica* L. (Pteridaceae) |
the school. The plant name and family are determined by the Flora of China. These specimens are stored in the herbarium of the Department of Biology, Changzhi University, Shanxi, China [12].

2.4. Quantitative analysis of the ethnomedicinal information

Relative frequency Citation (RFC)

The RFC was calculated without taking into account the use categories by following the formula [13].

\[
RFC = FC / \left(1 > RFC > 1\right)
\]

RFC shows the importance of each species in the study area given by the FC (FC is the number of local informants reported the uses of the species) divided by the total number of informants (N).

Use value (UV) of plant species

Use value (UV) determines the relative importance of plant species uses. It was calculated using the following formula [14].

\[
UV = UR / N
\]

Where “UV” indicates the use-value of individual species for a given disease range from 0 to 1, “UR” is the number of uses for particular disease of a given species by each informant, and “N” represents the number of informants who reports the given species.

Information consensus factor (FIC)

The knowledge of medicinal ethnobotany will vary to a certain extent due to different investigators and interviewees in the survey process. Therefore, in order to examine the distribution of information and find plants with biological activity, the consistency index can be used for evaluation [15].

\[
FIC = (\text{nur-nt}) / (\text{nur-1})
\]

Where: FIC is the information provider's information consistency index (informant consensus factor); nur is the number of a certain information provider using plants to treat a certain type of disease; nt is the amount used by all information providers to treat the disease Number of plant species.

FIC is between 0 and 1. The larger the value, the higher the consistency between herbalists. In other words, the greater the FIC value, the more concentrated the plant species used by herbalists to treat a certain disease.

Regression analysis and Pearson correlation

Regression analysis was performed between demographic variables in response to gender (male, female) variables using SAS 9.4. Pearson's correlation, SPSS (ver. 16) tested correlation analysis between the RFC and UV.

3. Results And Discussion

3.1. Medicinal plants survey, documentation and ethno-demography of the inhabitants

The present study reported the uses of 138 species of medicinal plants disseminated in 123 genera belonging to 60 families for the treatment of various types of diseases (Table 2). By querying the IUCN red list of plants, one of the plants (Daucus carota) amongst the total 138 plants is data deficient, and the others are not present in the list. The degree of people's use is related to the distribution of plants, so most of the plants used by local residents are plants that grow more locally, and most of them are not on the IUCN red list. A total of 180 informants were interviewd and categorized into different demographic categories (Table 1). Among the total 180 interviewed, it was noted that older people have a better grasp of traditional medicinal knowledge, while younger generations know less. Locals also said that young people spend a long time working and studying in other places and have little demand for traditional medicinal plants. Therefore, fewer people know about traditional medicinal plants. The reason why men know more about medicinal knowledge may be because they work more in the field compared to women and have more experience accumulated. Most of the local residents are farmers with low education levels, mainly uneducated and elementary school. It also shows that lower educated people dependent on traditional medicinal plants, while those with higher education levels are not so dependent. Most of young educated people believe on modern medical treatment [16]. According to theory, the older people have more traditional knowledge. However, the 75–91 age group has a smaller population base, results less contribution to the documentation of traditional knowledge. It was noted in regression analysis that all the demographic category were significant in response to gender group except age group (Table 3).
| S.no | Taxonomic name, Family, Voucher No. | Local name | Life form | parts used | Mode of utilization | Types of diseases | Toxicity |
|------|-----------------------------------|------------|-----------|------------|---------------------|-------------------|----------|
| 1.   | Paris verticillata M.Bieb. Melanthiaceae YZW0011 | Peng lou | Herb | Ro | External application, With other medicines | Animal bites | Small poison |
| 2.   | Allium fistulosum L. Amaryllidaceae YZW0023 | Chong | Herb | Ro | Boil water | Under fire, Cold, Abdominal pain | Non-tox |
| 3.   | Aletris spicata (Thunb.) Franch. Nartheciaceae YZW0016 | Mai dong | Herb | Ro | Boil water | Detoxification, Cough, Nourishing | Unknown |
| 4.   | Lilium brownii var. viridulum Baker Liliaceae YZW0031 | Hong dianhua | Herb | Ro | Edible | Cough, Nourishing | Non-tox |
| 5.   | Asparagus cochinchinensis (Lour.) Merr. Asparagaceae YZW0064 | Tian mendong | Herb | Ro | Boil water | Detoxification, Under fire, Cough | Non-tox |
| 6.   | Allium ramosum L. Amaryllidaceae YZW0139 | Jiu cai | Herb | Fl | Edible | Nourishing | Unknown |
| 7.   | Polygonatum multiflorum (L.) All. Asparagaceae YZW0145 | Yu zhu | Herb | Ro | With other medicines | Nourishing | Unknown |
| 8.   | Allium macrostemon Bunge Amaryllidaceae YZW0070 | Xiao suan | Herb | Wh, Ro | Edible, External application | Skin diseases | Non-tox |
| 9.   | Polygonatum sibiricum Redouté Asparagaceae YZW0094 | Ji tou shen | Herb | Ro | Boil water, Edible | Nourishing | Non-tox |
| 10.  | Platycladus orientalis (L.) Franco Cupressaceae YZW0055 | Bai shu | Tree | Se, St | Boil water, External application | Gynecological diseases, Laxative, Skin diseases | Non-tox |
| 11.  | Patrinia scabiosaefolia Link Caprifoliaceae YZW0137 | Bai jiang | Herb | Wh | Boil water | Cough, Detoxification, Cold | Non-tox |
| 12.  | Plantago asiatica L. Plantaginaceae YZW0019 | Che erzi | Herb | Ro, L, Se, Wh | Soaking in water, Boil water | Diuretic, Under fire, Anti-inflammatory, Hemostasis, Cure diarrhea | Non-tox |
| S.no | Taxonomic name, Family, Voucher No. | Local name | Life form | parts used | Mode of utilization | Types of diseases | Toxicity |
|------|----------------------------------|------------|----------|------------|-------------------|-------------------|----------|
| 13.  | Mentha canadensis L. Lamiaceae YZW0052 | Bo he | Herb | L,Ab | Soaking in water,Edible | Detoxification,Cold | Non-tox |
| 14.  | Scutellaria baicalensis Georgi Lamiaceae YZW0058 | Huang qin | Herb | Ro, L | Soaking in water | Detoxification,Cold,Under fire,Anti-inflammatory,Tuberculosis | Unknown |
| 15.  | Agastache rugosa (Fisch. & C.Â. Mey.) Kuntze Lamiaceae YZW0061 | Huo xiang | Herb | Ab | Boil water | Cold,Prevent heatstroke | Non-tox |
| 16.  | Nepeta tenuifolia Benth. Lamiaceae YZW0080 | Jing jie | Herb | Ab, Ro, Wh, Fl | External application, Boil water, Edible | Animal bites,Detoxification,Cough,Cold,Gynecological diseases,Under fire,Hemostasis,Hypotensive | Unknown |
| 17.  | Salvia rosmarinus Lamiaceae YZW0090 | Xue shen | Herb | Ro, Wh | Soaking in water,Boil water,Sparkling wine,Edible | Nourishing,Hypotensive,under fire,Activating blood to remove blood stasis | Non-tox |
| 18.  | Leonurus japonicus Houtt. Lamiaceae YZW0043 | Yi mucao | Herb | Wh,Ab | Boil water | Gynecological diseases,Treat hematuria,Diuretic | Non-tox |
| 19.  | Perilla frutescens (L.) Britton Lamiaceae YZW0047 | Zi shu | Herb | Se,St,L | Boil water | Cold,Cough | Non-tox |
| 20.  | Isodon rubescens (Hemsl.) H.Hara Lamiaceae YZW0154 | Dong lingcao | Herb | Wh | Soaking in water | Sore throat, Under fire | Unknown |
| 21.  | Stellera chamaejasme L. Thymelaeaceae YZW0096 | Lang du | Herb | Ro | Wash outside | Deworming,Skin diseases | Poisonc |
| 22.  | Lablab purpureus subsp. purpureus Fabaceae YZW0103 | Bian dou | Vine | Ro,Fr | Wash outside,Edible | Deworming,Prolactin | Non-tox |
| 23.  | Glycyrrhiza uralensis Fisch. ex DC. Fabaceae YZW0156 | Gan cao | Herb | Ro | Soaking in water | Detoxification | Non-tox |
| 24.  | Glycine max (L.) Merr. Fabaceae YZW0159 | Hei dou | Herb | Se | Boil water | Nourishing | Non-tox |
| S.no | Taxonomic name, Family, Voucher No. | Local name | Life form | parts used | Mode of utilization | Types of diseases | Toxicity |
|------|----------------------------------|------------|----------|------------|--------------------|-------------------|----------|
| 25.  | Caragana rosea Turcz. ex Maxim. Fabaceae YZW0066 | Jin jier | Herb | Ro,Fl | With other medicines | Cough | Unknown |
| 26.  | Sophora flavescens Aiton Fabaceae YZW0071 | Ku ahen | Shrub | Ro | Wash outside, Boil water | Detoxification, Treat waist and leg pain, Reduce swelling, Activating blood to remove blood stasis, Skin diseases | Non-tox |
| 27.  | Lespedeza bicolor Turcz. Fabaceae YZW0131 | Shan dougwn | Shrub | Ro | With other medicines | Detoxification | Non-tox |
| 28.  | Styphnolobium japonicum (L.) Schott Fabaceae YZW0148 | Tu huai tiao | Tree | St | Wash outside, Boil water | Skin diseases | Non-tox |
| 29.  | Robinia pseudoacacia L. Fabaceae YZW0098 | Yang huaishu | Tree | Fl | Edible | Treat hemorrhoids, Cure stool bleeding, Cold | Unknown |
| 30.  | Pteris cretica L. Pteridaceae YZW0038 | Ji zhuaicao | Herb | Wh | With other medicines | Numbness | Unknown |
| 31.  | Imperata cylindrica (L.) R‘Beauv. Poaceae YZW0144 | Bai maocao | Herb | Ro | Soaking in water | Detoxification, Stop nosebleeds | Unknown |
| 32.  | Taxus wallichiana Zucc. Taxaceae YZW0152 | Hong doushan | Tree | L | Boil water | Under fire | Unknown |
| 33.  | Juglans regia L. Juglandaceae YZW0141 | He tao | Tree | Fr | Edible, Boil water | Nourishing, Heart disease | Non-tox |
| 34.  | Trichosanthes kirilowii Maxim. Cucurbitaceae YZW0149 | Gua lou | Vine | Ro,Fr,Se | Edible, Boil water | Detoxification, Laxative, Cough | Unknown |
| 35.  | Cucurbita moschata Duchesne Cucurbitaceae YZW0054 | Nan gua | Herb | Fr,Se | Edible | Deworming, Nourishing | Non-tox |
| 36.  | Tribulus terrestris L. Zygophyllaceae YZW0155 | Ji li | Herb | Fr | Boil water | Headache, Eyesight, Vitiligo | Non-tox |
| S.no | Taxonomic name, Family, Voucher No. | Local name | Life form | parts used | Mode of utilization | Types of diseases | Toxicity |
|------|----------------------------------|------------|-----------|------------|------------------|------------------|----------|
| 37. | Viola philippica Cav. Violaceae YZW0051 | Gong jihua | Herb | Ro | Soaking in water | Under fire, Anti-inflammatory, Skin diseases | Non-tox |
| 38. | Orostachys fimbriata (Turcz.) A.Berger Crassulaceae YZW0127 | wa wei | Herb | Wh | External application | Skin diseases, Insomnia | Unknown |
| 39. | Hylotelephium erythrostictum (Miq.) H.Oba Crassulaceae YZW0133 | wuducao | Herb | L | External application | Animal bites | Unknown |
| 40. | Platyctdon grandiflorus (Jacq.) A.DC. Campanulaceae YZW0158 | Bai yao | Herb | Ro | Boil water, Edible | Under fire, Anti-inflammatory, Cold, Cough, Sore throat | Small poison |
| 41. | Codonopsis pilosula (Franch.) Nannf. Campanulaceae YZW0173 | Wu huashen | Herb | Ro, St | Boil water, Sparkling wine, Wash outside | Nourishing, Black hair | Unknown |
| 42. | Adenophora remotiflora (Siebold & Zucc.) Miq. Campanulaceae YZW0177 | Ling danghua | Herb | Ro | Boil water | Nourishing, Cough, Reduce swelling | Non-tox |
| 43. | Bidens pilosa L. Asteraceae YZW0147 | gui ge zhen | Herb | Wh | Boil water | Appendicitis, Diuretic, Cold | Non-tox |
| 44. | Artemisia umbrosa (Besser) Turcz. ex Verl. Asteraceae YZW0193 | Ye aihao | Herb | Wh, L, Ab | Cupping, External application, Wash outside, Boil water, Soaking in water | Joint pain, Headache | Non-tox |
| 45. | Chrysanthemum × morifolium (Ramat.) Hemsl. Asteraceae YZW0187 | Bai juhua | Herb | Fl | Soaking in water | Eyesight, Headache, Detoxification | Non-tox |
| 46. | Xanthium strumarium Asteraceae YZW0182 | Chang er | Herb | Fr | Boil water | Sinusitis, Cold | Small poison |
| 47. | Atractylodes lancea (Thunb.) DC. Asteraceae YZW0168 | Chang zhu | Herb | Ro | Boil water | Headache, Diuretic | Non-tox |
| S.no | Taxonomic name, Family, Voucher No. | Local name | Life form | parts used | Mode of utilization | Types of diseases | Toxicity |
|------|------------------------------------|------------|----------|------------|-------------------|------------------|----------|
| 48.  | Cirsium arvense (L.) Scop. Asteraceae YZW0162 | Ci ercai | Herb | Ab | External application, Boil water | Traumatic bleeding, Stomach ulcer, Cure diarrhea, Skin diseases | Non-tox |
| 49.  | Cirsium japonicum DC. Asteraceae YZW0153 | Da cijiao | Herb | Ab, Ro, L, Wh | External application | Traumatic bleeding, Detoxification, Under fire, Reduce swelling, Hemostasis, Diuretic | Non-tox |
| 50.  | Carthamus tinctorius L. Asteraceae YZW0054 | Hong hua | Herb | Fl | Soaking in water | Hypotensive, Gynecological diseases, Treat waist and leg pain | Non-tox |
| 51.  | Artemisia scoparia Waldst. & Kit. Asteraceae YZW0146 | Huang hao | Herb | Ro, Fr | Edible, Boil water | Nourishing | Unknown |
| 52.  | Artemisia capillaris Thunb. Asteraceae YZW0060 | Huang huamiao | Herb | Wh, Ab | Boil water, Edible | Liver disease, Detoxification, Scars | Non-tox |
| 53.  | Ixeris polycephala Cass. Asteraceae YZW0069 | Ku maicai | Herb | Ab | Edible | Under fire, Cold | Non-tox |
| 54.  | Tussilago farfara L. Asteraceae YZW0067 | Kuai donghua | Herb | Fl | Boil water | Cough, Anti-inflammatory | Non-tox |
| 55.  | Leuzea uniora (L.) Holub Asteraceae YZW0062 | Lou lu | Herb | Ro | Boil water | Bone and tendon | Non-tox |
| 56.  | Artemisia verlotiorum Lamotte Asteraceae YZW0136 | Nan aihao | Herb | Wh | Boil water | Burn | Unknown |
| 57.  | Taraxacum mongolicum Hand.-Mazz. Asteraceae YZW0074 | Bu buying | Herb | Wh, L | Edible, Soaking in water, Boil water | Anti-inflammatory, Detoxification, Under fire, Cold, Breast pain | Non-tox |
| 58.  | Sonchus arvensis L. Asteraceae YZW0095 | Qu qucai | Herb | Ab, Wh | External application, Edible | Traumatic bleeding, Anti-inflammatory, Appendicitis, Hypotensive, Activating blood to remove blood stasis | Non-tox |
| 59.  | Inula japonica Thunb. Asteraceae YZW0210 | Xuan fuhua | Herb | Fl | Boil water | Cough | Unknown |
| S.no | Taxonomic name, Family, Voucher No. | Local name | Life form | parts used | Mode of utilization | Types of diseases | Toxicity |
|------|-------------------------------------|------------|-----------|------------|--------------------|-------------------|----------|
| 60.  | Arctium lappa L. Asteraceae YZW0181 | You bangzi | Herb | Se | Edible, Boil water | Sore throat, Under fire, Detoxication, Skin diseases | Non-tox |
| 61.  | Chrysanthemum indicum L. Asteraceae YZW0195 | Ye juhua | Herb | Fl | Wash outside, Soaking in water | Foot pain, Cold | Small poison |
| 62.  | Selaginella tamariscina (P. Beauv.) Spring Selaginellaceae YZW0076 | Juan bai | Herb | Wh | Boil water | Activating blood to remove blood stasis | Unknown |
| 63.  | Ailanthus altissima (Mill.) Swingle Simaroubaceae YZW0129 | Chun shu | Tree | Ro, St | Boil water, Edible | Activating blood to remove blood stasis, Sore throat | Unknown |
| 64.  | Gastrodia elata Blume Orchidaceae YZW0097 | Tian ma | Herb | St, Ro | Boil water | Anti-inflammatory, Diuretic | Unknown |
| 65.  | Bassia scoparia (L.) A.J.Scott Amaranthaceae YZW0093 | Sao zhoumiao | Herb | Fr, Wh | Edible, Boil water | Diuretic, Skin diseases | Non-tox |
| 66.  | Dysphania ambrosioides (L.) Mosyakin & Clemants Amaranthaceae YZW0024 | Hui huicai | Herb | L, Fr | Edible | Detoxification, Liver disease | Poison |
| 67.  | Toona sinensis (Juss.) M.Roem. Meliaceae YZW0082 | Xiang cun | Tree | L | Edible | Digestion, Detoxification | Unknown |
| 68.  | Polygonum aviculare L. Polygonaceae YZW0160 | Bian xu | Herb | Wh, Fl | Soaking in water | Eyesight, Digestion, Cough, Gynecological diseases | Unknown |
| 69.  | Reynoutria multiflora (Thunb.) Moldenke Polygonaceae YZW0169 | He shouwu | Vine | Ro, St | Wash outside, Boil water | Black hair, Fixed tooth, Cough, Laxative, Nourishing, Lower blood lipids, Insomnia | Non-tox |
| 70.  | Cyrtomium fortunei J.Sm. Polypodiaceae YZW0171 | Guan zhong | Herb | Ro | Soak directly into the water tank | Cold, Plague prevention, Detoxification | Non-tox |
| S.no | Taxonomic name, Family, Voucher No. | Local name | Life form | parts used | Mode of utilization | Types of diseases | Toxicity |
|------|-----------------------------------|------------|-----------|------------|---------------------|-------------------|----------|
| 71.  | Vincetoxicum auriculatum (Royle ex Wight) Kuntze Apocynaceae YZW0178 | Lao wabutirang | Shrub | Ws | Drip on the wart | Skin diseases | Unknown |
| 72.  | Periploca sepium Bunge Apocynaceae YZW0089 | Yang getaoye | Shrub | Ro,L | Edible,Boil water | Skin diseases | Unknown |
| 73.  | Ephedra sinica Stapf Ephedraceae YZW0143 | Ma huang | Shrub | St | Boil water | Cold | Non-tox |
| 74.  | Portulaca oleracea L. Portulacaceae YZW0092 | Wu Rocao | Herb | Ab | External application,Edible | Skin diseases, Reduce swelling, Anti-inflammatory, Hypotensive, Abdominal pain | Non-tox |
| 75.  | Aristolochia clematisit L. Aristolochiaceae YZW0206 | Mu tong | Vine | Ro | Boil water | Laxative, Diuretic, Detoxication | Unknown |
| 76.  | Asarum sieboldii Miq. Aristolochiaceae YZW0157 | Herb | Ro | Boil water, With other medicines | Joint pain | Small poison |
| 77.  | Aristolochia contorta Bunge Aristolochiaceae YZW0028 | Vine | Fr | Soaking in water | Tuberculosis, Abdominal pain | Non-tox |
| 78.  | Aconitum carmichaeli Debeaux Ranunculaceae YZW0163 | Cao wu | Herb | Ro | Boil water | Heart disease, Tuberculosis | Poisonc |
| 79.  | Pulsatilla chinensis (Bunge) Regel Ranunculaceae YZW0138 | Bai touweng | Herb | Ro | With other medicines | Cure diarrhea, Sore throat | Non-tox |
| 80.  | Coptis chinensis Franch. Ranunculaceae YZW0086 | Huang lian | Herb | Ro | Soaking in water | Under fire, Reduce swelling | Non-tox |
| 81.  | Paeonia × suffruticosa Andrews Paeoniaceae YZW0083 | Mu dan | Shrub | Ro | Boil water | Nourishing | Unknown |
| 82.  | Schisandra chinensis (Turcz.) Baill. Schisandraceae YZW0166 | Wu weizi | Vine | Fr | Edible, Boil water | Cough, Nourishing, Under fire | Non-tox |
| S.no | Taxonomic name, Family, Voucher No. | Local name | Life form | parts used | Mode of utilization | Types of diseases | Toxicity |
|------|-----------------------------------|------------|-----------|------------|-------------------|------------------|----------|
| 83.  | Forsythia suspensa (Thunb.) Vahl. Oleaceae YZW0123 | Qing qiao | Shrub | Fr, Fl | Soaking in water | Detoxification, Cold, Under fire | Non-tox |
| 84.  | Pueraria montana var. lobata (Wild.) Maesen & S.M.Almeida ex Sanjappa & Predeep Fabaceae YZW0077 | Gi gen | Vine | Ro | Edible, Soaking in water | Eyesight, Ear disease | Non-tox |
| 85.  | Cotinus coggygria Scop. Anacardiaceae YZW0102 | Huang lu | Shrub | St | Grinding fine water suit | Skin diseases | Non-tox |
| 86.  | Rubia cordifolia L. Rubiaceae YZW0196 | Herb | Ro | | Sparkling wine, Boil water | Traumatic bleeding, Skin diseases, Hemostasis, Joint pain | Non-tox |
| 87.  | Agrimonia pilosa Ledeb. Rosaceae YZW0189 | Xian hecao | Herb | L, Fl, Ro | With other medicines | Hemostasis, Deworming | Non-tox |
| 88.  | Prunus persica (L.) Batsch Rosaceae YZW0225 | Tao | Tree | Fr | Boil water, Edible | Cold, Activating blood to remove blood stasis, Headache, Insomnia | Poisono |
| 89.  | Potentilla discolor Bunge Rosaceae YZW0151 | Fan baicao | Herb | Wh | External application | Traumatic bleeding | Non-tox |
| 90.  | Dasiphora glabra (G.Lodd.) Sojak Rosaceae YZW0044 | Guan yincha | Shrub | Ab | Soaking in water | Detoxification | Unknown |
| 91.  | Akebia trifoliata (Thunb.) Koidz. Lardizabalaceae YZW0142 | Mu gua | Shrub | Fr | Edible | Edema | Non-tox |
| 92.  | Prunus davidiana (Carrière) Franch. Rosaceae YZW0056 | Qi tao | Tree | Se | Boil water, Edible | Headache, Activating blood to remove blood stasis, Detoxification | Unknown |
| 93.  | Crataegus monogyna Jacq. Rosaceae YZW0216 | Hong guo | Tree | Fr | Boil water, Edible, Soaking in water | Nourishing, Digestion, Lower blood lipids | Non-tox |
| S.no | Taxonomic name, Family, Voucher No. | Local name | Life form | parts used | Mode of utilization | Types of diseases | Toxicity |
|------|-----------------------------------|------------|-----------|------------|--------------------|--------------------|---------|
| 94.  | Rosa xanthina Rosaceae YZW0072   | Xiang lihua | Shrub     | Fl         | Soaking in water   | Detoxification, Under fire, Reduce swelling, | Unknown |
| 95.  | Potentilla indica (Andrews) Th.Wolf Rosaceae YZW0046 | Jia caomei | Herb      | St, L      | Boil water         | Detoxification    | Poisonc |
| 96.  | Prunus armeniaca L. Rosaceae YZW0048 | Heng       | Tree      | Se         | Edible, Boil water | Detoxification, Cough, Activating blood to remove blood stasis | Small poison |
| 97.  | Datura stramonium L. Solanaceae YZW0084 | Mai tuoluo | Herb      | Ws         | Put the juice on the towel and apply externally | Anesthesia | Poisonc |
| 98.  | Alkekengi officinarum Moench Solanaceae YZW0164 | Hong denglong | Herb | Fr         | Soaking in water, Edible, Boil water | Hemostasis, Cough, Detoxification, Reduce swelling | Non-tox |
| 99.  | Lycium chinense Mill. Solanaceae YZW0079 | Di gu pi shrubs | Ro, Fr | Soaking in water, Sparkling wine, Edible, Boil water | Bone and tendon, Nourishing, Eyesight, Under fire, | Non-tox |
| 100. | Solanum melongena L. Solanaceae YZW0073 | Qie        | Herb      | Fr         | Boil water         | Cough              | Non-tox |
| 101. | Lonicera japonica Thunb. Caprifoliaceae YZW0045 | Yin yanghua | Vine      | Fl         | Soaking in water, Boil water | Detoxification | Non-tox |
| 102. | Saposhnikovia divaricata Apiaceae YZW0161 | Pang feng  | Herb      | Ro         | Boil water         | Cold, Headache     | Non-tox |
| 103. | Kitagawia praeruptora (Dunn) Pimenov Apiaceae YZW0134 | Qian hu Herb | Ro         | Boil water, Soaking in water, External application | Cough, Cold, Reduce swelling, Anti-inflammatory, Asthma | Non-tox |
| 104. | Cnidium monnieri (L.) Cusson Apiaceae YZW0057 | She chuangzi | Herb    | Fr         | With other medicines | Skin diseases      | Non-tox |
| 105. | Bupleurum chinense DC. Apiaceae YZW0063 | Chai hu Herb | Ro         | Soaking in water, Boil water, Edible | Cold, Detoxification, Digestion | Non-tox |
| S.no | Taxonomic name, Family, Voucher No. | Local name | Life form | parts used | Mode of utilization | Types of diseases | Toxicity |
|------|-----------------------------------|------------|-----------|------------|-------------------|-----------------|----------|
| 106. | Humulus scandens (Lour.) Merr. Cannabaceae YZW0018 | La lateng | Vine | Wh | Soaking in water | Treat hemorrhoids | Non-tox |
| 107. | Cannabis sativa L. Cannabaceae YZW0065 | Ma zi | Herb | Se | External application, Boil water | Laxative | Poisonc |
| 108. | Morus alba L. Moraceae YZW0068 | Sang baipi | Shrub | Ro, St, Fr, L | Soaking in water, Sparkling wine, Boil water | Cough, Asthma, Under fire, Detoxification, Diuretic, Laxative | Non-tox |
| 109. | Sinapis alba L. Brassicaceae YZW0105 | Bai jiezi | Herb | Fr | Edible | Cough | Non-tox |
| 110. | Isatis tinctoria L. Brassicaceae YZW0075 | Bai lanRo | Herb | Wh, Ro, Fl | Boil water | Cold, Detoxification | Non-tox |
| 111. | Raphanus raphanistrum subsp. sativus (L.) Domin Brassicaceae YZW0117 | Bai luobo | Herb | Ro, Fr | Edible, Boil water | Cure diarrhea, Cold | Non-tox |
| 112. | Punica granatum L. Lythraceae YZW0191 | Shi liupi | Tree | Fr | Edible, Soaking in water | Cure diarrhea, Nocturnal emission | Non-tox |
| 113. | Gypsophila vaccaria (L.) Sm. Caryophyllaceae YZW0207 | Wang buluxing | Herb | Se | With other medicines | Prolactin | Non-tox |
| 114. | Dianthus chinensis L. Caryophyllaceae YZW0176 | Shi zhu | Herb | Fl | Boil water | Detoxification | Non-tox |
| 115. | Dianthus superbus L. Caryophyllaceae YZW0183 | Qu mai | Herb | Wh | Boil water | Diuretic | Non-tox |
| 116. | Diospyros kaki L.f. Ebenaceae YZW0041 | Shi | Tree | Fr | Boil water | Hiccup | Non-tox |
| 117. | Ziziphus jujuba Mill. Rhamnaceae YZW0037 | Suai zao | Shrub | Fr, Ro | Edible, Soaking in water, Boil water | Insomnia | Non-tox |
| 118. | Dioscorea nipponica Makino Dioscoreaceae YZW0184 | Chuan dilong | Vine | Ro, Fr | Edible | Nourishing | Unknown |
| S.no | Taxonomic name, Family, Voucher No. | Local name | Life form | parts used | Mode of utilization | Types of diseases | Toxicity |
|------|-----------------------------------|------------|-----------|------------|---------------------|------------------|----------|
| 119. | Dioscorea esculenta (Lour.) Burkill Dioscoreaceae YZW0124 | Hong shu | Vine | Ro,L | Edible | Nourishing, Hypotensive | Non-tox |
| 120. | Pinus tabuliformis Carrière Pinaceae YZW0006 | Xiong xu | Tree | Fl, Fr | Apply oil from the stick stove, Soaking in water | Skin diseases, Lower blood lipids, Insomnia, Nourishing, Bone and tendon | Non-tox |
| 121. | Sauromatum giganteum (Engl.) Cusimano & Hett. Araceae YZW0198 | Bai fu zi | Herb | Ro | Boil water | Skin diseases | Unknown |
| 122. | Daucus carota Apiaceae YZW0125 | Bai xia | Herb | Ro | Boil water | Cough | Poisonous |
| 123. | Typha orientalis C.Presl Typhaceae YZW0205 | Mao la | Herb | Fl | External application | Traumatic bleeding | Non-tox |
| 124. | Arisaema erubescens (Wall.) Schott Araceae YZW0188 | Tian nanxing | Herb | Ro | With other medicines | Reduce swelling | Non-tox |
| 125. | Pinellia ternata (Thunb.) Makino Araceae YZW0199 | Xiao baixia | Herb | Wh | With other medicines | Mouth ulcers | Poisonous |
| 126. | Phryma leptostachya L. Phymaceae YZW0165 | Tou gucao | Herb | L, Wh, Ro | External application, Wash outside, Boil water | Reduce swelling, Bruises, Numbness, Activating blood to remove blood stasis, Anti-inflammatory, Stop nosebleeds | Poisonous |
| 127. | Opuntia dillenii (Ker Gawl.) Haw. Cactaceae YZW0081 | Xian renzhang | Shrub | L | External application | Reduce swelling, Skin diseases | Non-tox |
| 128. | Berberis amurensis Rupr. Berberidaceae YZW0104 | Shi dagonglao | Shrub | Fl | With other medicines | Detoxification, Under fire | Unknown |
| 129. | Epimedium brevicornu Maxim. Berberidaceae YZW0035 | Yin yanghuo | Herb | Wh | Boil water | Nourishing, Abdominal pain | Non-tox |
| S.no | Taxonomic name, Family, Voucher No. | Local name | Life form | parts used | Mode of utilization | Types of diseases | Toxicity |
|------|-----------------------------------|------------|----------|-----------|-------------------|------------------|----------|
| 130. | Ipomoea purpurea (L.) Roth Convolvulaceae YZW0078 | Hei baichou | Herb | Se | Boil water | Digestion, Diuretic | Poisonc |
| 131. | Cuscuta chinensis Lam. Convolvulaceae YZW0174 | Fen tiao | Herb | Se | Boil water | Nourishing | Non-tox |
| 132. | Ginkgo biloba L. Ginkgoaceae YZW0203 | Bai guo | Herb | Fr | Edible | Cough | Poisonc |
| 133. | Corydalis repens Mandl & Muhldorf Papaveraceae YZW0179 | Yan husuo | Herb | Ro | With other medicines | Activating blood to remove blood stasis, Bruises | Unknown |
| 134. | Zea mays L. Poaceae YZW0192 | Yu mi xu | Herb | Fl | Boil water | Diuretic | Non-tox |
| 135. | Iris domestica (L.) Goldblatt & Mabb. Iridaceae YZW0185 | She gan | Herb | Wh | Boil water | Headache, Under fire, Detoxication | Poisonc |
| 136. | Polygala tenuifolia Willd. Polygalaceae YZW0172 | Yuan zhi | Herb | Ro | With other medicines, Boil water | Insomnia, Under fire, Anti-inflammatory | Non-tox |
| 137. | Zanthoxylum bungeanum Maxim. Rutaceae YZW0175 | Hua jiao | Tree | Fr, L | Wash outside | Reduce swelling, Cure diarrhea | Non-tox |
| 138. | Hemionitis micheli (Christ) Christenh. Pteridaceae YZW0186 | Qu feng cao | Herb | Wh | Wash outside | Gynecological diseases, Pediatric shock | Unknown |

Table 3
Regression analysis of demographic variables in response to gender

| Variable | DF | Likelihood | Chi-Square | Sig. |
|----------|----|------------|------------|------|
| Education | 6 | 84.496 | 14.932 | 0.021 |
| Profession | 6 | 90.096 | 20.533 | 0.002 |
| Age | 2 | 70.861 | 1.297 | 0.523 |
| Over-all | 14 | 69.564 | 27.735 | 0.015 |

3.2. Description and life form of folk traditional medicinal plants
Amongst the plant families, Asteraceae was the dominant with 19 plant species, followed by Rosaceae (10 spp.), Fabaceae (9 spp.), and Lamiaceae with eight species and so on (Fig. 3A). The other plant families were recorded with only one species (Fig. 3B). The recorded medicinal plants are categorized according to their life form (Fig. 5A). Among them, herbs (96 spp.) were dominant, followed shrubs and trees (15 spp. each), and vines with 12 species only. The domination of herbs in utilization over other life form may not only because the efficacy of medicinal plants but also because the density of the distribution of herbs is...
higher, the growth cycle is fast, and the yield is higher [17]. They are determined by the characteristics of the collection [18]. Some of the medicinal plant materials collected by local inhabitants for medicinal purposes are shown in Fig. 4.

3.3. Parts used of folk traditional medicinal plants

The recorded traditional medicinal plants in Lingchuan County are classified according to their parts utilization (Fig. 5B). Among them, the most used parts were roots, with 58 species, accounting for 42%, followed by whole plant and fruit (28 spp., 20% each), flower (20 spp., 14.4%), leaves (19 spp., 13.7%), seeds (14 spp., 10%), above ground (12 spp., 8.6%), stem (11 spp., 8%), and watery sap with two species accounting for 1.4%. The same plant has different medicinal parts, and its medicinal effects are quite different. For example, Trichosanthes kirilowii can be used as medicine in multiple parts. Such as, the root is called 'Tian hua fen' which can be used to clear away heat and detoxify, and the fruit can be used as a medicine for a laxative, and the seeds can be used to treat coughs. The same part of the plant collected at different times has different efficacy. For example, Artemisia capillaris collected in March can be used to treat liver disease, but it cannot be used at other times. People are needs to distinguish correctly when using medicinal plants.

Most of the medicinal plants in the study area are perennial herbs, and roots as widely used part as medicine. It may be because the roots can be collected in all seasons and are easier to preserve compared to other parts. At the same time, plants co-exist with a variety of microorganisms in the soil, and the secondary metabolites of microorganisms may have important medicinal effects compared to the aboveground parts [19]. It has certain timeliness and is not easy to collect and store. Therefore, in order to obtain medicines in time, people are looking for more plant roots with medicinal value as medicine.

3.4. Mode of utilizations of folk traditional medicinal plants

The most traditional medicinal plant use method recoded as boil water, that were used 77 times for different plant parts account for 38% of the total used methods frequency. Forty-two plant parts were utilized as edible took second place, accounting for 20.68%, followed by soaking in water (31, 15.20%), external application (17, 8.37%), kinds of plants with other medicine (15 7.38%), wash outside plants (11, 5.4%), sparking wine (5, 2.46%), and the other used method such as cupping with six times for different plant parts account for 3% of the total (Fig. 6). The use of medicinal plants is closely related to the type of disease. For example, the common method of medicinal plants used to treat colds, coughs, and other diseases are to boil in water. The usual methods for treating traumatic bleeding, skin diseases, and other diseases are external application and external washing. The medicinal plants that have the effects of clearing away heat, detoxifying, and nourishing are to eat and soak in water. Among them, edible wild fresh medicinal plants are usually boiled in hot water before eating. Hot water boiling can decompose some toxic substances in the plant and also dissolve some fibers, making the plant softer when eating [20, 21]. People will choose the most effective method of use according to the severity of the disease and other symptoms [22]. At the same time, it is also related to the medicinal parts of plants. Boiling water is the simplest and most effective way to extract the medicinal ingredients of plant roots.

3.5. Disease categories treated by folk medicinal plants

According to the efficacy and applicable diseases of medicinal plants, the medicinal plants in Lingchuan County are divided into 12 categories [23] (Fig. 7). I) Most plants were utilized as surface-relieving plants recoded as boil water, that were used 77 times for different plant parts account for 38% of the total used methods frequency. Forty-two plant parts were utilized as edible took second place, accounting for 20.68%, followed by soaking in water (31, 15.20%), external application (17, 8.37%), kinds of plants with other medicine (15 7.38%), wash outside plants (11, 5.4%), sparking wine (5, 2.46%), and the other used method such as cupping with six times for different plant parts account for 3% of the total (Fig. 6). The use of medicinal plants is closely related to the type of disease. For example, the common method of medicinal plants used to treat colds, coughs, and other diseases are to boil in water. The usual methods for treating traumatic bleeding, skin diseases, and other diseases are external application and external washing. The medicinal plants that have the effects of clearing away heat, detoxifying, and nourishing are to eat and soak in water. Among them, edible wild fresh medicinal plants are usually boiled in hot water before eating. Hot water boiling can decompose some toxic substances in the plant and also dissolve some fibers, making the plant softer when eating [20, 21]. People will choose the most effective method of use according to the severity of the disease and other symptoms [22]. At the same time, it is also related to the medicinal parts of plants. Boiling water is the simplest and most effective way to extract the medicinal ingredients of plant roots.

3.6 Toxicity of medicinal plants

According to the toxicity level of plants, plants are divided into four types: non-toxic, unknown, small-toxic, and toxic (Fig. 8). The non-toxic plants are the most, with 84 species, accounting for 61% of the total recorded plant species, followed by unknown toxicity (35 spp., 25%), poisonous plants (13 spp., 10%), and less poisonous plants (6 spp., 4%). These findings demonstrated that people are using mostly non-toxic plants. However, for some toxic drugs, people use them for
3.7 Quantitative Analysis of folk traditional medicinal plants

3.7.1 Relative Frequency citation (RFC)

The RFC value of the recorded species range from 0.04 to 0.33, where more plant species (66 species) were recorded in range 0.1 ≤ 0.13, and 45 plant species were recorded < 0.1, the other remaining plant species (27 species) RFC values were ≥ 1. Among the plant species, Forsythia suspensa were recorded with the highest RFC value 0.33, followed by Nepeta tenuifolia, and Codonopsis pilosula. with RFC value 0.27 each, Salvia rosmarinus (RFC=0.26), followed by Scutellaria baicalensis and Taraxacum mongolicum with RFC value 0.25 each. Furthermore, Polygonatum multiflorum L. and Dianthus chinensis L. were recorded with lowest (0.04 each) RFC value (Fig.9). The higher RFC value demonstrated that informants contribution were more for a particular plant species, and they have knowledge of particular plant uses. In fact, the plants with low RFC value are not medicinally less important but the informants may not know about the uses of these plants or the plants may not be common to an area. In addition, it was observed during survey that young generations were less familiar with the traditional utilization of medicinal plants, alarming threats to indigenous knowledge of medicinal plants.

3.7.2 Use value (UV)

Use value determines the importance of each species for particular diseases. The present study recorded the UV range (0.08 to 0.9 value) of the total recorded species. Among them, most of the plant species (79 spp.) were recorded at the range of 0.01 to <0.2, followed by UV range 0.2 to <0.3 with 34 plant species. Thirty-five plants species were recorded with UV value ≥ 0.3 (Fig.10). The highest UV (0.91 value) was recorded for Scutellaria baicalensis, followed by Platycodon grandifloras (UV=0.83), Taraxacum mongolicum (UV=0.82), and Codonopsis pilosula with 0.8 UV value. The lowest UV (0.08 value) was recorded for Hylotelephium erythrostictum plant species. Plants species with higher UV demonstrated that their informants have more common knowledge of plant uses, and frequently reported for the same uses. However, those diseases were included in the results which have been commonly reported (more than one time) to be treated by particular plant species, thus influences the UV values. It's demonstrated that plant species with lower UV have been reported for multiple disease treated, defining a variation in traditional medicinal knowledge. In contrast, UV are dynamics and can be change with informant traditional knowledge or an area to area [17,24]. Use values were significant correlated to RFC (R²=0.52), demonstrated that UV can be define 50% by RFC value (Fig.11). These findings revealed that the number of informants for given species reported 50% similar uses.

3.7.3 Disease categories with FIC value

The results of FIC value of the disease categories recorded medicinal plants are given in Table 4. The higher FIC value was recorded for the treatment of gynecological diseases (FIC=0.93) with total of 109 citation. The plants that cause this high consensus are Nepeta tenuifolia and Taraxacum mongolicum, which has 37 citation each. Nepeta tenuifolia is mainly used to treat colds, coughs, hypertension, and other diseases. The fresh leaves of Nepeta tenuifolia are mixed with flour, kneaded into cakes, and deep-fried; it becomes a refreshing food that can prevent colds [25]. After frying, Nepeta forms a black powder called 'Nepeta Carbon', which can be used to treat rhinitis with the fruits of burdock and mint. Nepeta tenuifolia has a glandular point and can volatilize a special fragrance. Therefore, this characteristic of Nepeta tenuifolia can be used to extract flavors as food additives or cosmetics. Taraxacum mongolicum is locally known "Bubuying", "Wooden Pueraia", "Diding", and have widespread growth in the study area, it can be collected except in winter. The informants claims that it has anti-inflammatory effect is equivalent to penicillin. As a traditional remedy, it only needs to be washed and soaked in water, and used as a wild vegetable, but it can be eaten after boiling. Modern studies have shown that dandelion has antibacterial, anti-oxidant, and anti-tumor effects. The dual-purpose of Dandelion, such as a medicine and food, will have broad research prospects [26].

The 2nd highest FIC value was recorded for the treatment of the urinary system (FIC=0.91). Among the total of 123 citations, Plantago asiatica were cited 29 times, and Atractylodes lancea with 28 citations by informants. Plantago asiatica is a plant of the Plantago genus, from which more than 60 compounds have been discovered, which can treat a variety of diseases. This single plant has a good therapeutic effect, and multiple parts can be used. such as the leaves of plantain can be eaten directly by washing [27].

The 3rd highest FIC value was recorded for the treatment of respiratory diseases (FIC=0.90). The more contribution was by Scutellaria baicalensis species which appeared 41 times. Its main medicinal part is root, and it takes at least 2 years of growth to have the effect of curing colds, reducing fire, and reducing inflammation. After 5 years, the root of Scutellaria baicalensis become hollow. The locals call it "Bitter Qin" which has anti tuberculosis potential. The aerial part of Scutellaria baicalensis is distilled, dried, and soaked in tea, further use it for colds prevention. Shen et al demonstrated that Scutellaria baicalensis mainly contains flavonoids, volatile oils, polysaccharides, and other compounds, which have obvious anti-virus, anti-tumor, and anti-oxidation activities [28].

Digestive system diseases were found with 0.9 FIC value, Nepeta tenuifolia and Atractylodes lancea were the plants frequently used for diseases management in the study area. Moreover, for the surface-resolving plants (FIC value = 0.89), the most important plants are Scutellaria baicalensis with 41 citations, and Forsythia suspensa with 39 citations. The fruit of Forsythia suspensa, locally called "fu pimple" is effective in colds. The best time of its collection is summer, and thought to more effective against disease than other seasons. However, because of its high price, people often collect in advance in pursuit of economic benefits, which has brought undesirable consequences.

For the treatment of orthopedic diseases (FIC=0.89), the most important plant is Nepeta tenuifolia. For nourishing plants (FIC=0.87), the most important plant is Codonopsis pilosula. it is one of the commonly used bulk medicinal materials in China, and well-known species throughout the country for their uses (wine and drink) as an authentic medicinal material and is cultivated in large scale, but most of the its medicinal materials are purchased, and only a small part is used by people. Modern research has shown that Codonopsis pilosula contains many essential substances for the human body, which can protect some internal injuries and enhance the body's immunity [29].
Another disease category is dispelling rheumatism having $F_{IC}$ value 0.85, with frequently used plants *Sophora flavescens* 15 citation and *Artemisia umbrosa* 16 citation. During our investigation, local people in Lingchuan County used *Sophora flavescens* to for skin diseases. In modern research, it has been found that *Sophora flavescens* has anti-inflammatory, analgesic, anti-tumor, and antibacterial effects [30, 31]. For the treatment of skin diseases ($F_{IC}$=0.81), the most important plant is *Arctium lappa*, which has active ingredients are inulin and polyphenols. *Arctium lappa* seeds are proceeds to deep-fry, grinded and take with water for the treatment of sore throat [32]. For the treatment of infectious and functional diseases ($F_{IC}$=0.65), the plants used by people are relatively inconsistent. This type of disease has a relatively large impact and requires timely medical treatment. However, most of the informants did not share relevant information or may feel shy to mention such diseases and generally they had not share treatment experience, which may lead to low consistency of medicinal plants to treat such diseases.

### Table 4

| Types of diseases                  | Nt | Nur | $F_{IC}$ |
|------------------------------------|----|-----|----------|
| Surface-relieving plant            | 70 | 621 | 0.89     |
| Nourishing plants                  | 28 | 206 | 0.87     |
| Respiratory diseases               | 27 | 249 | 0.90     |
| Digestive system diseases          | 26 | 260 | 0.90     |
| Skin diseases                      | 22 | 113 | 0.81     |
| Circulatory system diseases        | 19 | 192 | 0.91     |
| Nervous system diseases            | 16 | 158 | 0.90     |
| Orthopedic diseases                | 14 | 118 | 0.89     |
| Urinary system diseases            | 12 | 123 | 0.91     |
| Gynecological diseases             | 9  | 109 | 0.93     |
| Rheumatism-removing plant          | 8  | 47  | 0.85     |
| Infectious and functional diseases  | 7  | 18  | 0.65     |

### 4. Cultural Significance And Recommendation

Among the medicinal plants purchased, the economic value of the medicinal materials is significantly higher than the self-use value. Therefore, people may choose the most effective plants to keep a little bit to prevent and treat diseases. However, for their own benefit, people often go up to the mountain to collect immature plants, which reduces the efficacy of the medicine. Predatory logging also destroyed the local medicinal plant resources to a certain extent. Therefore, professionals need to calculate the diversity and universality of traditional medicinal plants, stipulate the collection time and quantity, and facilitate people to collect them in time so as to protect traditional medicinal plants and ensure people's sustainable use and strengthen detection by using sophisticated instruments. Efforts needs to ensure that every medicinal plant has a good effect. At the same time, it is necessary to strengthen the domestication and large-scale planting of wild species to relieve the pressure on wild medicinal plant resources and bring economic income to local people.

### 5. Conclusion

The present study reported the important ethnomedicinal plants of Lingchuan County, Shanxi, China. Indigenous people still practice medicinal plants for their healthcare needs. It was noted that roots were most widely used parts in the study area, which may threaten the survival of plants if over collected compared to the collection of other plant parts. Plants with high quantitative indices value, demonstrated that the plants have been practiced widely by inhabitants, which maybe because it is more common to an area or its traditional knowledge have been transferred generation after generation due to its efficacy against diseases. Thus, better understanding is required thorough scientific investigation of these recorded medicinal plants considering their traditional utilization. Sustainable utilization and scientific collection awareness of medicinal plant among communities is the need of the time. Government must ensure the conservation of these medicinal plants for future human development.

### 6. Declarations

**Ethics approval and consent to participate**

This study was authorized by the Faculty of Biological Science and Technology, Changzhi University, Shanxi, China. Informed consent was obtained from each participant prior to the interview process.

**Consent for publication**

All authors read and approved the final manuscript for publication.
Availability of data and materials

All the data are in manuscript and supporting documents

Conflict of interest

The authors do not have any conflict of interests to declare.

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Author Contributions

SJ carried out ethnobotanical studies, performed the formal analysis and drafted the manuscript. SZ participate in field survey and manuscript writing. NS and AN performed the statistical analysis, and manuscript writing – review & editing. YY and SW participated in investigation and data curation.

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Figures
Figure 1

Map of the study area (Lingchuan County, Shanxi, China).
Figure 2

Ethnomedicinal data (interviews) and plants collection
Figure 3

Taxonomic diversity of the study area
Figure 4

Collection of plant parts by local inhabitants for medicinal purposes
Figure 5

Description of medicinal plants (A) life form (B) parts used
Figure 6

Mode of utilization of medicinal plants

- Infectious and functional diseases
- Rheumatism-removing plan
- Gynecological diseases
- Urinary system diseases
- Orthopedic diseases
- Nervous system diseases
- Circulatory system diseases
- Skin diseases
- Digestive system diseases
- Respiratory diseases
- Nourishing plants
- Surface-relieving plant

Number of Species
Figure 7

Major disease categories treated by a number of remedies

![Pie chart showing the distribution of disease categories treated by remedies. The categories are: Small poison (13, 9.42%), Non-toxic (84, 60.87%), Unknown (35, 25.36%), and Poisonous (6, 4.35%).]

Figure 8

Toxicity level of recorded medicinal plants

![Pie chart showing the toxicity level of medicinal plants. The categories are: Small poison (13, 9.42%), Non-toxic (84, 60.87%), Unknown (35, 25.36%), and Poisonous (6, 4.35%).]
Figure 9

Relative frequency citation of the recorded medicinal plants
Figure 10

Use values of the recorded medicinal plants
Figure 11

Correlation between Use value and Relative frequency citation