Ethnomedicine investigation of the medicinal plants and animals in Daur, Inner Mongolia, China

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Research

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Abstract

Background: The traditional medical practices of the Daur region are an important element in Chinese ethnomedicinal knowledge. However, relatively little recording of traditional Daur medicine has been carried out. As Daur medicine is gradually being replaced by traditional Chinese medicine (TCM) and modern medicine, further research is urgently needed.

Methods: We collected ethnobotany and ethnozoology data through semi-structured interviews with 114 informants (18 sessions), focus group discussions (6 sessions), and extensive literature reviews. Medicinal samples and specimens were collected during field investigations from June 2015 to October 2018. The diseases and ailments reported as being treated were classified according to the International Classification of Diseases 11th (ICD-11). The expression correlation of medicine classification, medicine, and disease was assessed using Cytoscape 3.6.1 software. Quantitative indices such as informant consensus factor (ICF) and use value (UV) were used to evaluate the importance of ethnomedicinal data.

Results: We documented 30 plant species (from 19 families) and 21 animal species (from 11 families). In the past, the majority of plant species were collected from natural habitats, but now they are mainly cultivated. The most widely utilized plants were herbs (21 species), followed by shrubs (4), trees (3), and fungus (2). The most utilized groups of animals were mammals (14 species), followed by birds (5), amphibians (1), and reptiles (1). Medicines were mostly administered orally (43) but were also applied externally (11) or delivered via both routes (9). Informants indicated that medicines were prepared via decoction (21), grinding (11), boiling (10), extraction (8), and burning (7). Medicines were taken as a drink (37), eaten (16), or made into pills and powders (7), but could also be administered as an ointment/wash (6), wrap/dressing (5), in the nose, eyes, and mouth (4), or as a fumigate (2). The traditional Daur medicines investigated in this study treated 76 human diseases or ailments classified under 13 disease categories, based on the ICD-11. The highest ICF (1.00) was reported for neoplasms and visual system diseases and childbirth or the puerperium, followed by injury, poisoning, or other diseases resulting from external causes (0.92), and symptoms, signs or clinical findings, not elsewhere classified (0.82). The most used medicinal species were *Cervus elaphus*, *Cervus nippon*, *Capreolus*, *Gallus*, *Canis lupus familiaris*, *Betula platyphylla*, and *Artemisia integrifolia*.

Conclusions: The current research can make an important contribution to the body of knowledge about the national medicine of the Daur people. This is particularly important because the younger generation is not interested in learning and preserving their traditional medical practices. A substantial body of ethnobotanical and ethnozoological knowledge could lead to the development of new medicines. Therefore, research into Daur ethnic medicines is urgently required. The information documented in the present study will provide a useful basis for future investigations into the ethnopharmacological and traditional knowledge of the Daur region.

Background

In the past, many ethnic groups have identified a wide variety of valuable plants and animals that can be used for therapeutic purposes. This empirical knowledge has led to the development of ethnomedicine, i.e., a summary of the experience of different nationalities regarding the treatment of diseases via the use of plants, animals, and minerals in the environment [1–3]. Nowadays, ethnobotany, which includes the study of phytotherapy, is a discipline that can transform popular knowledge into scientific knowledge [4].

The Daur nationality is one of China's ethnic minorities, and it is one of the "three minors" (Olunchun, Ewenki, and Daur), centrally distributed in Olunchun Autonomous County, Ewenki Autonomous County, and Moridawadaer Autonomous County, respectively, in the Inner Mongolia Autonomous Region. Since the 1970s, research into ethnic minority medicine in China has received increasing attention, especially in the field of medical literature collation, drug resource investigation, development, and utilization. The 2010 Census found that the Daur population in Inner Mongolia was 76255, accounting for 0.31% of the resident population in Inner Mongolia [5]. However, the influence of other ethnic groups has exacerbated the loss of medical knowledge of the ethnic group, which has underestimated the traditional value of the younger generation. Over thousands of years, the Daur people developed medical knowledge with local ethnic characteristics in the struggle against various diseases, and folk medicines that have real curative effects are still used in the Daur region. Records of the use of Daur medicine go back more than 300 years to the Qing Dynasty [6]. Zhang [7] et al. investigated the traditional medicine practices of the Daur ethnic group in Inner Mongolia, especially the traditional authentic medicinal materials and important ethnic medicine resource by consulting the literature records, visiting practitioners, investigating folk traditional knowledge, collecting medicinal fungi and plant specimens, and organizing the original records of the herbarium. The investigation and arrangement according to the geographical distribution of the population provided an objective and scientific basis for the development and utilization of the resource of Daur traditional medicine. Apart from this, Liu [8] et al. researched and investigated 31 ethnic medicines and their uses by the Daur people living in the Hulunbuir League of Inner Mongolia, which reflected the characteristics of Daur ethnic medicine.

The Daur people mainly believe in Shamanism and Buddhism. Shamanism is an important part of the traditional culture of the Daur people, and it has profoundly affected all aspects of their social life [9]. However, little attention has been paid to the research and development of modern Daur medicine and even less effort has been made to preserve traditional Daur medicine. In addition, there are few related research reports, and few reports have been written on the ethnomedical resource of the Daur people in China. Plants have always been humanity's primary source of treatments for disease and injury. Although a high level of cultural and biological diversity has been preserved in the region, research into the utilization of medicinal resource by the Daur people is lacking, research and development of modern Daur medicine attract little attention, and little is done to strengthen the protection of traditional Daur medicine. In addition, the expansion of modern education and medical treatment has further aggravated the loss of knowledge, resulting in the younger generation being unaware of the value, use, and preparation methods of traditional Daur medicine [8].

With changes in the lifestyle, natural condition, and social environment of the Daur people, their traditional medical knowledge is disappearing under the influence of mainstream ethnic medicine, such as TCM and Mongolian medicine. The phenomenon of integration is gradually occurring, and unique ethnic characteristics are gradually being lost. It is important to accelerate research into the Daur nation's traditional knowledge, consolidate the results, and document the inheritance to help with the development of medicines in the future. In this study, we interviewed the few remaining healers in Daur and documented as much ethnic medicinal knowledge as possible with the aim of increasing awareness of the availability and value of ethnic medicines in this region and worldwide. The application of inherited knowledge is a growing field of interest. Research of this type and the comprehensive documentation of traditional medical knowledge are important to increase the chance of discovering new drugs as well as to enhance knowledge about the sustainable use of natural resource. At the same time, it provides a scientific basis for the development and utilization of the resource of the Daur national traditional medicine.

Methods

Selection of study area

The population of the Daur ethnic group in the Hulunbuir area accounts for more than 90% of the population of this ethnic group in Inner Mongolia. It is mainly distributed in Ewenki county, Arun county, ZhaLanTun county, and Molidawar Daur autonomous county [9], which are in the Greater Khingan Mountains (GKM) and the eastern part of the GKM. Most of the area has a temperate continental monsoon climate, while a small portion lies in the cold temperate zone. Seasonally, the area experiences cold, long winters and cool, short summers. In addition, the region receives an abundance of sun and little precipitation, which occurs mainly between July and August. The area comprises many geographical types, such as the GKM, Hulunbuir Grassland, Inner Mongolia Plateau, and the grasslands at the base of the mountains. The Daur ethnic group, concentrated in the area of Hulunbuir, a district in the northeastern part of Inner Mongolia, is located between longitude 118°48'02" to 125°13'32" east and latitude 47°05'40" to 49°49'18" north in the northeast part of Inner Mongolia (Fig. 1). The topography of the ethnic minority area is characterized by a temperate climate plus a cold temperate zone within an altitudinal range of 198.0–1706.6 m above sea level, and consists of a plateau, prairie, basin, mountain, and plain. The annual average rainfall and temperatures range from 350.0 mm to 500.0 mm and from -2.4 °C to 2.2 °C, respectively. This area supports a range of minorities that include not only Daur, but also Mongolian, Olunchun, and Ewenki ethnic groups. Therefore, the area has not only a variable topography and highly diversified medicinal flora and fauna, but also multi-ethnic groups and a rich cultural diversity. [10–11].

Social characteristics of study area

The ethnomedicinal survey comprised semi-structured interviews with 114 people and focus group discussions with 12 traditional healers. The study informants were divided into different groups according to age: <30, 31–40, 41–50, 51–60, and >60 years old. Most informants were in the 51–60 (50.9%) and 41–50 (20.2%) age groups, i.e., the main users of ethnic medicine and inheritors of related knowledge. There were few young people under 30 (6.1%) and or older people over 60 (7.9%) years of age (Table 1).

Data collection

Reconnaissance survey

The fourth national survey of Chinese medical material resource was conducted from June 2015 to October 2018 in Hulunbuir to gain a better understanding of the species, distribution, and reserves of medicinal plants [12]. During this investigation, we carried out a series of traditional knowledge surveys of ethnic medicine, which included Daur medicine. A survey team consisting of botanists, taxonomists, and indigenous people conducted the resource surveys, mainly in summer and autumn, in areas where the medicinal species were extensively found. The team collected specimens of the plants used in Daur medicine, recorded information on the habitats in which they were found, and took photographs for future reference [13,14]. Collect and organize ethnic medicine through the Census of TCM resource, realize the inheritance of traditional medicine, promote the diversity of ethnic culture, improve the theoretical system of innovative ethnic medicine, and welcome the renaissance of ethnic medicine. Additional information on the abundance and distribution of medicinal plants in the study area was also collected. Due to the limited production and preservation facilities for specimens of animal origin, ethnozoological information was obtained only from the interviews with informants, and animal medicinal material samples were not collected.

Ethnomedicine data source and collection

Daur ethnomedicine data were collected from two source: primary source comprising interviews, focus group discussions, and field observations in the study area, and secondary source comprising relevant publications and reviews related to the present study [15]. Semi-structured interviews were conducted with 114 informants. Local therapists automatically become key providers of information (key informants). They are the experts and advisors on traditional indigenous knowledge and its application. Healers can provide basic information on treatment methods, while laypersons described the effects of the treatments on their diseases. The interviews were conducted using a prepared list of questions; however, enough time was allowed for discussions related to any of the questions raised. We then visited experts from the Daur society and key informant healers who had been using Daur medicine for at least 3 years. This group comprised 12 people in total. Our interviewees were chosen through comments and suggestions from religious leaders, elders, administrators, and students, and personal observations by researchers in community groups. The selection of key informants was also based on the quality of the explanations given by specific informants in the interviews.

The data collection team paid particular attention to the choice of language in the informant interviews, whether it was Chinese or Mongolian, or the Daur language used by the local people. Prior to the visits, we obtained oral consent from the interviewees that the information provided could be made public.

Key informants, i.e., those expected to have extensive knowledge of Daur medicine, were selected at the village level with the help of the village committee. Two focus group discussions were conducted in the Daur Autonomous Township, during which healers, ethnic medicine gatherers, and local village committees helped facilitate an understanding of the current medical situation of the Daur ethnic minority. Throughout all the investigations, specific information regarding the traditional Daur medicinal materials was recorded. This information included the local name, parts used, disease treated, dosage, and route for administration. The diseases were assigned to different categories according to the International Classification of Diseases 11th (ICD-11), and all the summarized survey information and supplementary information are presented in Tables 2 and 3.

Botanical and zoological identification

We collected the voucher specimens of the plants for identification by the expert taxonomist with the help of the Flora of Inner Mongolia and Flora of China [16, 17]. Family and scientific names were confirmed with the Angiosperm Phylogeny Website (<http://www.mobot.org/MOBOT/research/APweb>) and the Plant List database (<http://www.theplantlist.org>) (Fig.2). Voucher specimens of plants were prepared and deposited at the Baotou Medical College, Inner Mongolia University. Family and scientific names of medicinal animals were determined according to the Fauna of Inner Mongolia and Medicinal Fauna of China [18, 19].

Data analysis

Expression correlation network

The topological relationships between Daur medicine and attending disease classifications were analyzed using Cytoscape 3.6.1 software (<https://cytoscape.org/>) to obtain the key factors and to visualize the network [20, 21]. The size of each node in the disease-classification-disease-medicine network was based on the prevalence of the uses.

Informant consensus factor

The informant consensus factor (ICF), was analysis of the general use of plants and animals using the following formula:

See formula 1 in the supplemental files.

where Nur refers to the number of use reports for a particular disease category, and Nt refers to the number of taxa used for a particular use category by all informants. ICF values are near 0 if medicinal resources are chosen randomly or if there is no exchange of information about their use among informants and close to 1.0 when there is a well-defined selection criterion in the community or if information is exchanged between informants [22, 23].

Use value for individual species

The use value (UVs), a quantitative measure of the relative importance [24, 25], was calculated for all species in the study area using the following formula:

See formula 2 in the supplemental files.

where $\sum U_i$ is the total number of use reports cited by each informant for a given species and N represents the total number of informants.

UVs approach zero (0) when there are few reports related to use. Higher UVs indicate that there are many use reports for a plant or animal species, thus implying the importance of the species.

Results And Discussion

Ethnomedicine in Daur

Diversity of Daur ethnobotany

In total, 30 medicinal plants were identified, from 19 families (Table 1). Among them, the Compositae was the dominant plant family used (4 species), followed by the Ranunculaceae and Rosaceae (3 species each), and the Gramineae, Betulaceae, and Cucurbitaceae (2 species each). There were 13 other commonly used families including Tricholomataceae, Auriculariales, Typhaceae, Salicaceae, Moraceae, Polygonaceae, Euphorbiaceae, Araliaceae, Umbelliferae, Ericaceae, Labiatae, Solanaceae, and Caprifoliaceae (1 species each).

While it has been observed that, these days, many medicinal plants are cultivated, in our study most plant medicines were collected from the natural environment. Herbs (21 species, 70.0%) were the most commonly used plant type, followed by shrubs (4 species, 13.3%), trees (3 species, 10.0%), and fungus (2 species, 6.7%) (Fig. 3a).

Several parts of different plants are used to deal with various diseases. According to the interviews with the informants, the most commonly used parts are the seeds (8); followed by the roots and fruits (6, each); whole plant (5); branches (3); barks, rhizomes, flowers, and fruiting bodies (2, each), and root nodules and leaves (1, each) (Fig. 3b). Daur medicine differs from TCM in which the most used plant parts are the roots. These differences may be influenced by factors involving the ease of collection and application.

Diversity of Daur ethnozoology

In the present study, 20 animal species from 11 families were documented from the study site (Table 2). The most widely used family was Cervidae (4 species), followed by Phasianidae, Canidae, and Bovidae (3 species each). Other families that were commonly used were Ranidae, Trionychidae, Picidae, Corvidae, Erinaceidae, Mustelidae, and Suidae (1 species, each).

Mammals were the dominant animal group, accounting for 14 species (66.6%), followed by birds (5, 23.8%), and amphibians and reptiles (1, 4.8%) (Fig. 3c). Animal-based drugs mainly came from organs (12), such as the kidney, liver, gallbladder, heart, gizzard, uterus, and viscera, involving numerous applications. Animal-based drugs were also prepared from tissues (11), including meat, hamstrings, grease, hair, and blood; from bones and the whole body (3 each); secretions and antlers (2 each); and carapaces (1) (Fig. 3d).

Traditional application of Daur ethnomedicine

Diversity of route, preparation, dosage, and usage of ethnomedicines

We collected information regarding the Daur ethnomedicine administration route, preparation, dosage, and usage. According to the interviews with the informants, the most popular route was oral (39, 66.1%), followed by external administration only (11, 18.6%), and both oral and external administration (9, 15.2%) (Fig. 4).

According to the present study, plant and animal medicines were prepared via decoction (21), grinding (11), boiling (10), extraction (8), and burning (7) (Table 4). Among them, decoction, the most used preparation technique in Chinese medicine, was the method used most often (36.9%). Other preparation methods represent the unique characteristics of traditional Daur medicine. In particular, various medicinal and food ingredient are boiled together and eaten as a meal, which reflects the characteristics of the theory which is medicinal and edible.

Most medicines are taken/consumed as a drink (37), which involves decoction, extraction (i.e., solutions and oils), and other methods; eaten (16), made into pills and powder (7), but also used as an ointment/wash (6), wrap/dressing (5), in the nose, eyes, and mouth (4), or as a fumigate (2). (Table 5). Dosages were estimated for most medicines and were dependent on the age of the patient, degree of the illness, diagnosis, and experience of the healers.

The ethnic groups adjacent to the Daur group include the Olunchun and Ewenki nationalities. Bi [26] et al. analyzed the ethnic medicine application of the “three minor nationalities” in Inner Mongolia. It appears that *Artemisia argyi* is used as a medicine by all three nationalities. While the Daur people use it to treat urticaria and rheumatic pain, the Ewenki use it for chronic hepatitis, and the Olunchun use it to treat uterine bleeding and postpartum hemorrhage. The different therapeutic uses of the same medicinal materials in different ethnic groups reflect differences in national characteristics, indicating that they are closely related to the history, culture, and life of each nationality. Table 7 compares Daur medicine with TCM and Mongolian medicine. The known efficacy of the Chinese and Mongolian medicines can help predict the effectiveness of the Daur medicines and identify those that have the potential for the development of new drugs in the future.

Diseases treated by diverse medicinal resource

Tables 2 and 3 present traditional Daur medicine used to treat 76 human diseases or ailments classified under 13 disease categories, based on the ICD-11. A disease-classification-disease-medicine network of Daur medicine was constructed and visualized with Cytoscape software using the disease classifications and medicinal species targeted (Fig. 5). The availability of the network model structure may improve our understanding of the relationship between plant medicines, animal medicines, diseases, and disease classification.

According to statistical information, the classification of ‘symptoms, signs or clinical findings, not elsewhere classified’ was primary, and included 8 diseases and ailments of constipation, cough, diarrhea, dyspepsia, loss of appetite, abnormal sputum, and extravasation of blood. As shown in the constructed network, there were obvious and expressed correlations with 29 medicinal species, such as the plant medicines of *R. simsii*, *P. frutescens*, *A. integrifolia* and the animal medicines of *S. scrofa domestica*, *C. nippon*, *C. capreolus*. Other classifications included ‘Certain infectious or parasitic diseases’ (18 species), ‘Injury, poisoning or certain other consequences of external causes’ (11 species), and other disease classifications. The classification of diseases and ailments clearly indicates a link between Daur medicine and modern medicine; however, traditional medicine still has its inherent characteristics. Thousands of years ago, the Daur people learned to use natural materials (animals, plants, minerals) of their surroundings in the struggle against various diseases. Experience has been passed from generation to generation, gradually forming a body of medical knowledge with local ethnic characteristics, and folk medicines that really have curative effects are still circulating in Daur. These include “Kumula,” the Chinese name of which translates as Willowleaf Wormwood, which is derived from *A. integrifolia*. It has the effect of heat-clearing and detoxifying, and is used to treat hyperlipidemia, excessive drinking, and stomach bleeding [27]. Among the diseases, common day-to-day ailments (cough, constipation, diarrhea, trauma) and endemic diseases (rheumatism, rheumatoid arthritis) were treated with numerous medicines in traditional Daur medicine at Hulunbuir. The Ewenki and Daur people both live in Hulunbuir, Inner Mongolia. Traditional medicines of the two groups focus on different diseases. Ewenki medicine is mainly used for respiratory system diseases, digestive system diseases and skin and subcutaneous tissue diseases; Daur’s drugs are used for certain infectious diseases and parasitic infestations, digestive diseases, injuries, poisoning, trauma, and musculoskeletal and connective tissue diseases.

Quantitative assessment of ethnobotanical data

Informant consensus factor

ICF is used to identify plants of particular intercultural relevance. With the ICF, we evaluated how homogenous the information was. Thirteen disease categories were identified. The ICF was calculated for each disease category, and the range was from 0.29 to 1.00 (Table 6). The highest ICF (1.00) was

reported for the neoplasms and visual system diseases and childbirth or the puerperium all for 1 species and 1 use reports, followed by injury, poisoning or certain other medical problems arising from external causes (0.92) with 2 species and 13 use reports, symptoms, signs or clinical findings, not elsewhere classified (0.82) with 18 species and 95 use reports. The highest ICF for the neoplasms and visual system diseases and childbirth or the puerperium and injury, poisoning or certain other medical problems arising from external causes can be probably related to the low number of cases and trauma and poisoning are mainly treated by taking agaric and *Artemisia integrifolia* medicines.

Use value

The most used medicines were *C. elaphus* and *C. nippon* with UVs of 2.70 followed by *C. capreolus*, *G. gallus*, *C. lupus familiaris*, and *B. platyphylla* with UVs of 1.82, 1.81, 1.33, 1.07, respectively. Many parts of these species are used as medicine and they are readily available or are typical species of the area. Specifically, *A. integrifolia*, with an UV of 1.00, is a well-known local species that is used for both food and medicine. In the published literature, *A. integrifolia* has reportedly been used to treat various diseases including hypertension, hyperlipidemia, diabetes, and hepatitis, besides its use in traditional Daur medicine [28]. Species that are used to treat three diseases and more (39%) were dominant, followed by species used to treat single diseases (37%), and plants or animals used to treat two diseases (24%). With respect to animal parts, the Daur tribe uses bile (for example, from bear, pig, and sheep) the most. The next most commonly used animal-derived medicines are made from bone, followed by those made from meat, and those that use the whole body of the animal. The most widely used families for animal-based drugs are Corvidae (crows) (4 species), followed by Anatidae (ducks), Canidae (canines), and Bovidae (bovines) (3 species each). Animal-based medicines are mainly composed of kidney, liver, gallbladder, heart, sac, uterus, and other organs and are widely administered. With respect to the animals used, mammals dominate, accounting for 14 species (66.6%), followed by birds (5 species, 23.8%) and amphibians (1 species, 4.8%).

Conclusions

The Hulunbuir area has a rich biodiversity and traditional culture in which numerous important ethnomedicines have been preserved. In Daur, the traditional plant and animal medicines that are used for ethnomedicinal purposes are obtained close to the place of residence of users. During the 3 years of our ethnobotany and ethnozoology investigation, we identified 30 species of medicinal plants, belonging to 19 families, and 21 species of medicinal animals, belonging to 11 families. Analyses of the collected data revealed that herbs were the dominant plant medicine, and seeds and roots were the parts most often used in ethnobiology. Mammals dominated the list of medicinal animals, and several kinds of organs and tissues were used in ethnozoology. Most medicines were administered orally. The dominant preparation technique was decoction, and medicines were most frequently taken/consumed as a drink. A comparative analysis of the medicines of the Daur nationality, TCM, and Mongolian medicine reflects the uniqueness and national characteristics of the medicines of the Daur nationality.

Apart from a handful of experienced and knowledgeable traditional therapists, the route and dosage of plant-based medicine is usually based on haphazard application. Even a qualified therapist is not perfect. The implication of this situation is that improper use of medicinal plants may have severe short-term and long-term effects on the health of patients and may sometimes even endanger life. In drug research and development, some plants with higher medicinal value are candidate plants for further phytochemical analysis.

Comprehensive documentation of traditional Daur medicines is critical to promote the discovery of new source of drugs and the sustainable use of natural resource. One of the main characteristics of traditional medicinal knowledge is its dynamism. As revealed by the analysis of the data collected from both field investigations and interviews, the use of plant and animal medicine based on traditional knowledge is gradually declining in the study region with the increased use of modern medication in recent generations. It is therefore essential to build awareness among community members of the importance of protecting traditional knowledge and medicinal plants before they disappear and to take urgent measures to protect threatened plant species. This will enable people to continue to use traditional practices, which have proven to be safe and effective.

There are many types of medicinal fungi, animals, and plants in the Daur region, most of which are folk medicines and have significant effect, but data on phytochemistry, pharmacology, and quality control is lacking. The systematic research into medicinal fungi, animals, and plants provides an objective and scientific basis for folk applications of the ethnomedicines of the Daur group.

Declarations

Ethics approval and consent to participate

Ethics approval and consent participate Permission to conduct the ethnobotanical study was obtained from the district administration and village office in the study area. The purpose of the study was explained to all participants, and they agreed to provide information.

Consent for publication

Our manuscript does not contains any individual's person data.

Availability of data and materials

The datasets used and analysed during the current study are available from the corresponding author on reasonable request.

Competing interests

The authors declare that they have no competing interests.

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Authors' contributions

XL and YQB: participated in research survey, data evaluation and wrote the manuscript as the major contributor of the study. MHL: supervised the project and designed the study. LZ: analyzed data and provided technical support. YHS: designed the research survey and collected data. SZ and MHL: contributed to the structure, discussion contents of the study, and helped with species identification. All authors read and approved the final manuscript.

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Tables

Table. 1 Socio-demographic characteristics of the informants

Basic information	Number of informants	Percentage (%)
Sex		
Male	68	59.6
Female	46	40.4
Age		
≤30	7	6.1
31-40	17	14.9
41-50	23	20.2
51-60	58	50.9
≥60	9	7.9

Table. 2 List of plant species for medicinal purposes in Daur, Inner Mongolia, China

The 13 diseases according to ICD-11 are classified as follows: (A) Certain infectious or parasitic diseases, (B) Neoplasms, (C) Diseases of the nervous system, (D) Diseases of the visual system, (E) Diseases of the circulatory system, (F) Diseases of the respiratory system, (G) Diseases of the digestive system, (H) Diseases of the skin, (I) Diseases of the musculoskeletal system or connective tissue, (J) Diseases of the genitourinary system, (K) Pregnancy, childbirth or the puerperium, (L) Symptoms, signs or clinical findings, not elsewhere classified, (M) Injury, poisoning or certain other consequences of external causes.

Or: Oral, Ex: External

Family	Scientific name	Local name	Parts used	Disease treated	Classification of diseases [ICD-11]	Taxonomic	Route, dose and usage	UV	Voucher Specimens
Tricholomataceae	<i>T. mongolicum</i> S. Imai	Qi gan mog	Fruiting body	Measles	A	Fungus	Or: 50g cut and used in decoction	0.04	20170703001
Auriculariales	<i>A. auricula</i> (L. ex Hook.) Underw	Bakerte	Fruiting body	Cervical cancer, hypertension, constipation, vaginal cancer, trauma	B, E, L, M	Fungus	Or: 5-30g used in food or burned to carbon powder	0.94	20170628021
Typhaceae	<i>Typha orientalis</i> Presl.	Laesu	Whole grass	Rheumatoid arthritis, rheumatism	I	Herb	Ex: fumigated with fresh grass for 1 hour	0.06	20170703021
Poaceae	<i>Setaria italica</i> (L.) Beauv. var. <i>italica</i> .	Narem baei tos	Fruit	Several kinds of ringworm and scabies	A	Herb	Ex: anointed the affected area with oil	0.36	20170802002
	<i>Avena sativa</i> L.	Kua lin po	Seed	Loss of appetite, constipation	L	Herb	Or: 30-60g used in decoction	0.99	20170608013
Salicaceae	<i>Populus davidiana</i> Dode	Holordaan koltus	Bark	Dental disease	G	Tree	Ex: decocted for gargling	0.10	20170703020
Betulaceae	<i>C. heterophylla</i> Fisch	Ququu	Seed	Diarrhea, loss of appetite, cough	L	Tree	Or: 30-60g used in decoction or grinded to powder	0.77	20170802003
	<i>Betula platyphylla</i> Suk.	Qaalbaan koltus	Bark	Bacillary dysentery, diarrhea, gastric ulcer	A, G, L	Tree	Or: 5g burned to carbon powder and taken with water	1.07	20170703019
		Qaalbaan tos	Branch	Open wound of lower limb	M		Ex: burned defined amount branch into oil and wiped at the affected area		
Cannabaceae	<i>Cannabis sativa</i> L.	-	Seed	Smallpox	A	Herb	Ex: grinded seeds mixed with Raphanus sativus leaves and applied the exuding latex to the affected area	0.23	20170703024
Polygonaceae	<i>Fagopyrum esculentum</i> Moench	Haul	Seed	Cholera, dyspepsia	A, L	Herb	Or: boiled seed mixed with hot cow's milk	0.99	20170608012
Ranunculaceae	<i>P. chinensis</i> (Bunge) Regel	-	Root, flower	Rheumatism	I	Herb	Or: used in decoction or extracted in wine	0.09	20170412014
							Ex: grinded fresh herbs for applying to affected area		
	<i>A. kusnezoffii</i> Reichb.	-	Root	Rheumatism	I	Herb	Or: 3- 6g used in decoction or made for pills and powder (If used in soup should be prepared 1- 2 hours in advance, in order to reduce toxicity.)	0.03	20170703011
							Ex: extracted in wine or vinegar for applying to affected area		
	<i>C. dahurica</i> L.	Cha Yang osu	Rhizome	Mumps	A	Herb	Or: used in decoction	0.08	20170713012
							Ex: 15g dried rhizome decocted or grinded fresh		

Rosaceae	<i>R. davurica</i> Pall.	Jaami gada	Root nodule	Rheumatoid arthritis	I	Shrub	herbs applied to affected area Or: 7 root nodules used in decoction	0.14	20170802102
	<i>Potentilla flagellaris</i> Willd. ex Schlecht.	Suadelil eus	Whole grass	Gaseous abdominal distention, urethritis	G, J	Herb	Ex: used in decoction to wash the affected area Or: drank it like tea or used in decoction	0.15	20170602101
	<i>S. sorbifolia</i> (L.) A. Br.	Caakunku	Branch	Costal chondritis, trauma	I, M	Shrub	Or: 9- 15g used in decoction Ex: used in decoction to wash the affected area	0.82	20170703034
Euphorbiaceae	<i>E. fischeriana</i> Steud.	Temee mek	Root	Tuberculosis, tuberculosis of bones, several kinds of scabies	A	Herb	Or: 50g dried root decocted mixed with 100g jujube and eat 2 jujube twice a day	0.38	20170613024
Araliaceae	<i>Panax ginseng</i> C. A. Mey.	Aorgiden	Root	All kinds of disease	-	Herb	-	0.61	20170703018
Umbelliferae	<i>C. virosa</i> L.	Juma qin	Rhizome	Venomous snakes or insects bite, extravasation of blood, osteomyelitis, gout, rheumatism	I, L, M	Herb	Ex: decocted or grinded rhizome applying to the affected area, mixed with egg white or <i>Cicuta virosa</i> to use together	0.04	20170703023
Ericaceae	<i>R. simsii</i> Planch.	Nadeg yilga	Flower or fruit	Tracheitis, pneumonia, irregular periods, amenorrhe, uterine bleeding, rheumatism, trauma	A, F, J, I, M	Shrub	Or: 5g flowers used in decoction or extracted in wine, 2- 3g fruits grinded to powder	0.62	20170710021
Labiatae	<i>Perilla frutescens</i> (L.) Britt.	Balei tos	Seed	Abnormal sputum, cough, constipation	L	Herb	Or: drank 5- 10 ml or boiled seeds mixed with <i>G. gallus domesticus</i>	0.93	20170906011
		bal	Seed and Fruit	Hepatitis, cough, constipation	G, L		Or: 6- 10g used in decoction or made for pills and powder 15g eat as raw		
	<i>S. baicalensis</i> Georgi	-	Root	Abdominal pain, diarrhea, dysentery, cough	A, G, L	Herb	Or: drank it like tea	0.39	20170812007
Solanaceae	<i>Nicotiana tabacum</i> L.	dangalarg	Leaves	Carbuncle, furuncle, dermatitis, eczema, trauma	A, H, M	Herb	Or: 6- 9g used in decoction Ex: grinded and wrapped around the affected area	0.61	20170703016
Caprifoliaceae	<i>S. williamsii</i> Hance	Caawui mood	Branch	Trauma, costal chondritis	M, I	Shrub	Or: 25g used in decoction Ex: 25g used in decoction to wash the affected area	0.27	20170703017
Cucurbitaceae	<i>Cucurbita moschata</i> (Duch. ex Lam.) Duch. ex Poiret	Wogi Hur	Seed	Ascariasis, disease due to nematode	A	Herb	Or: 15g eat as raw	0.67	20170703015
	<i>C. sativus</i> L.	Kengki Hur	Seed	Fracture	M	Herb	Or: 15g eat as raw	0.39	20170703014

Asteraceae	<i>X. sibiricum</i> Patr. ex Widder	Zhang guozi	Fruit	Rheumatism	I	Herb	Or: used in decoction	0.52	20170703013
	<i>Artemisia argyi</i> Levl. et Vant.	Qigaan suaig	Whole grass	Urticaria, rheumatism	H, I	Herb	Or: used in decoction Ex: used in decoction to fumigate affected area	0.84	20170608011
	<i>F. sibiricum</i> (L.) Kitam.	Taoli suaig	Whole grass	Pneumonia	F	Herb	Or: 3g whole grass decocted mixed with 30g flowers and leaves of <i>R. dauricum</i> , and taken for twice a day	0.27	20170703009
	<i>A. integrifolia</i> L.	Kumile	Whole grass	Dysentery, diarrhea, laryngeal carcinoma	A, B, L	Herb	Or: defined amount bud boiled mixed with <i>Phaseolus</i> <i>vulgaris</i> or drank as tea	1.00	20170608008

Table. 3 List of animal species for medicinal purposes in Daur, Inner Mongolia, China

Family	Scientific name	Local name	Parts used	Disease treated	Classification of diseases [ICD-11]	Taxonomic	Route, dose and usage	UV
Ranidae	<i>Rana chensinensis</i> David	Meleg	Whole body	Rheumatic heart disease	E	Amphibian	Or: cut 5 whole animals and boiled with 50g pork for once a day	0.42
Trionychidae	<i>Trionyx sinensis</i> Wiegmann	Kaberin miaal	Tissue (meat)	Urgency of urination	J	Reptile	Or: boiled meat or taken soup	0.19
		-	Carapace	Urgency of urination	J		Or: burned to carbon and taken with water	
Phasianidae	<i>Gallus domesticus</i>	-	Tissue (meat)	Rheumatism	I	Bird	Or: boiled meat with pork together	0.84
	<i>Coturnix japonica</i> Temminck et Schlegel	Bedeni xirbes	Tissue (hamstring)	Injury of fascia or tendon	M	Bird	Or: grinded hamstring and applied at the site of wound	0.10
	<i>G. gallus</i>	Kakera chulqi	Organ (gallbladder)	Cough, abnormal sputum	L	Bird	Or: extracted bile and mixed with sugar to drinking	1.81
		-	Organ (viscera)	Trauma	M		Ex: applied the viscera organ to affect area with hot compress	
		Kakera toturig	Organ (gizzard)	Traumatic dyspepsia	M, L		Or: grinded to powder	
		kakraa tos	Tissue (grease)	Rheumatic heart disease, coronary heart disease	L, E		Ex: applied the gizzard to affect area with hot compress	
Picidae	<i>Dendrocopos major</i> Linnaeus	Tontroookil	Whole body	Cramp or spasm	C	Bird	Or: 15ml taken for twice a day	0.17
Corvidae	<i>Corvus macrorhynchos</i> Vagler	Gawu miag	Tissue (meat)	Diseases of stomach, hepatic cirrhosis	G	Bird	Or: burned to carbon and taken with water	0.84
Erinaceidae	<i>Erinaceus amurensis</i> Schrenk	Jierie	Whole body	Urgency of urination	J	Mammal	Or: boiled meat or taken soup	0.13
Canidae	<i>C. lupus</i> Linnaeus	Guska tos	Tissue (grease)	Tuberculosis	A	Mammal	Or: lightly burnt whole body to eat meat and drink water soaked with skin	0.01
		Guske ios	Bone	Rheumatism, rheumatoid arthritis	I	Mammal	Or: 10ml take for 3 times a day	
		-	Tissue (hair)	Allergic dermatitis	H		Or: bone extracted in vinegar, and 10ml taken for twice a day	
	<i>C. familiaris</i> Linnaeus	Nowuei tos	Tissue (grease)	Tuberculosis	A	Mammal	Ex: anointed at the affected area	1.33
		Nowuei ios	Bone	Rheumatism, rheumatoid arthritis	I		Or: 10ml taken for twice a day	
	<i>Vulpes vulpes</i> Linnaeus	Hunuwuei jurwu	Organ (heart)	Palpitation, rheumatic heart disease	E	Mammal	Or: boiled water to drink	0.18
Mustelidae	<i>Meles meles</i> Linnaeus	Hewur tos	Tissue (grease)	Tuberculosis, burn	A, M	Mammal	Or: mixed with Cinnabaris, Ambrum and <i>Angelica sinensis</i> to eat together	0.51
Suidae	<i>Sus domestica</i> Brisson	<i>scrofa</i> gag chulqi	Organ (gallbladder)	Constipation, cough, carbuncle, dermatophytosis of scalp, furunculosis, eczema, trauma	A, H, F, L, M	Mammal	Or: 10ml taken for three times a day	0.87
							Ex: wrapped around the affected area	
Cervidae	<i>C. elaphus</i> Linnaeus	Bawoi jurwu qow	Tissue (blood)	Palpitation	E	Mammal	Ex: dressed at the affected area until the bile dry	2.70
		Pentu	Antlers	Cough, frostbite	L, M		Or: a little quantity for once a day	
							Or: cut into pieces, and used in decoction or extracted in wine.	
							1-3g grinded to powder, and made	

							for pills and powder	
							Ex: applied the blood of antler to affected area	
	-	Organ (uterus)	Irregular menstruation, infertility, bleeding, uterine	J			Or: 15-25g made for pills and powder, or boiled the fresh uterus	
<i>C. nippon</i> Temminck	Bawoi jurwu qow	Tissue (blood)	Palpitation	E	Mammal	Or: a little quantity for once a day	2.70	
	Pentu	Antlers	Cough, frostbite	L, M		Or: cut into pieces, and used in decoction or extracted in wine. 1-3g grinded to powder, and made for pills and powder		
	-	Organ (uterus)	Irregular menstruation, infertility, bleeding, uterine	J		Or: 15-25g made for pills and powder, or boiled the fresh uterus		
<i>Moschus moschiferus</i> Linnaeus	-	Secretion	Epilepsy, stroke, carbuncle, pyogenic abscess of the skin, trauma	A, C, E, K, L	Mammal	Or: 0.06-0.1g made for pills and powder	0.10	
<i>Moschus sifanicus</i> Przewalski	-	Secretion	Epilepsy, stroke, carbuncle, pyogenic abscess of the skin, trauma	A, C, E, K, L	Mammal	Or: 0.06-0.1g made for pills and powder	0.10	
						Ex: inhaled drugs from the nose in moderation		
<i>C. capreolus</i> Linnaeus	Juri bast	Organ (kidney)	Cough	L	Mammal	Or: Eaten with salt	1.82	
	Juri beleg	Organ (liver)	Night blindness, astigmatism, glaucoma	D		Or: Eaten with salt		
	Juri ios	Bone	Rheumatism	I		Or: bone extract in vinegar, and 10ml taken for twice a day		
<i>Bovidae</i>	<i>Ovis aries</i> Linnaeus	honi chulqi	Organ (gallbladder)	Constipation, cough, asthma, carbuncle, dermatophytosis of scalp, furunculosis, eczema, trauma	A, F, H, L, M	Mammal	Ex: dressed at the affected area until the bile dry	0.62
	<i>Capra hircus</i> Linnaeus	Honi chulqi	Organ (gallbladder)	Constipation, cough, asthma, carbuncle, dermatophytosis of scalp, furunculosis, eczema, trauma	A, F, H, L, M	Mammal	Ex: dressed at the affected area until the bile dry	0.64
	<i>Bostaurus domesticus</i> Gmelin	Wuker chulq	Organ (gallbladder)	Tracheitis, icterus, infantile convulsions, constipation, haemorrhoids, carbuncle	A, C, G, F, L	Mammal	Or: 0.3-0.9g made for pills or powder	0.30
						Ex: anointed at the affected area or dropped in eyes		

Table. 4 Methods of preparation of plant and animal parts used in Daur ethnomedicine

No.	Type of preparation	Number of medicines	Percentage (%)
1	Decoction	21	36.9
2	Grinding	11	19.3
3	Boiling	10	17.5
4	Extraction	8	14.1
5	Burning	7	12.2

Table. 5 Methods of usage of plant and animal parts used in Daur ethnomedicine

No.	Type of usage	Number of medicines	Percentage (%)
1	Drink/take	37	48.1
2	Eaten	16	20.7
3	Made for pills and powder	7	9.1
4	Anointment/wash	6	7.8
5	Wrap/dressing	5	6.5
6	Used at nose, eyes and mouth touch	4	5.2
7	Fumigate	2	2.6

Table 6 Informant consensus factor for ailment categories

Disease categories	Number of use reports (Nur)	Number of taxa (Nt)	Informant consensus factor (ICF)
Certain infectious or parasitic diseases	69	23	0.68
Neoplasms	1	1	1.00
Diseases of the nervous system	5	3	0.50
Diseases of the visual system	1	1	1.00
Diseases of the circulatory system	23	8	0.68
Diseases of the respiratory system	9	5	0.50
Diseases of the digestive system	46	6	0.89
Diseases of the skin	23	6	0.77
Diseases of the musculoskeletal system or connective tissue	32	13	0.29
Diseases of the genitourinary system	24	6	0.78
Pregnancy, childbirth or the puerperium	1	1	1.00
Symptoms, signs or clinical findings, not elsewhere classified	95	18	0.82
Injury, poisoning or certain other consequences of external causes	13	2	0.92

Table 7 Comparison of the efficacy of different ethnic characteristics

Scientific name	Daur	Traditional Chinese medicine	Mongolian medicine
Artemisia integrifolia Linn.	Hypertension, stomach bleeding	Detoxification[29]	Scabies
Allium macrostemon Bunge.	Pneumonia	Insecticide[30]	Irregular menstruation, Trauma bleeding
Pycnonotus sinensis	Detoxification	Cooling blood[31]	Fractures and tendons
Sorbaria sorbifolia (L.) A. Br	Bruises, chondritis	Activating blood removing stasis[32]	Cold
Perilla frutescens (L.) Britt.	Hepatitis	Constipation[33]	Excessive phlegm

Figures

Figure 1

Map of Daur main distribution in Hulunbuir, Inner Mongolia, 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

Parts of plants used in Daur medicine at study area ①a. *Panax ginseng* C. A. Mey., b. *Scutellaria baicalensis* Georgi, c. *Sorbaria sorbifolia* (L.) A. Br., d. *Euphorbia fischeriana* Steud., e. *Rosa davurica* Pall., f. *Cicuta virosa* L., g. *Cucumis sativus* L., h. *Rhododendron dauricum* L., i. *Auricularia auricula* (L. ex Hook.) Underw., j. *Corylus heterophylla* Fisch., k. *Cimicifuga dahurica* (Turcz.) Maxim., l. *Xanthium sibiricum* Patrin ex Widder, m. *Sambucus williamsii* Hance, n. *Pulsatilla chinensis* (Bunge) Regel, o. *Filifolium sibiricum* (L.) Kitam., p. *Aconitum kusnezoffii* Reichb.

Figure 3

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Graphical representation showing plant and animal species of taxonomic and various used parts (a. plant species of taxonomic; b. plants according to various used parts; c. animal species of taxonomic; d. plants according to various used parts)

Figure 4
Rount of diversity Daur medicines

Figure 5
Network visualization of the relationship between disease and Daur medicines (The orange nodes represent plant species, the blue nodes represent animal species, the nodes represent different diseases, and the green nodes represent disease classification. The edges represent interactions. The network was built and visualized with Cytoscape.