

MEDICINAL PLANTS USED IN TRADITIONAL HERBAL MEDICINE IN THE PROVINCE OF CHIMBORAZO, ECUADOR.

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Abstract

Background: Phyto-therapy studies on Chimborazo province in Ecuador are really limited. This area, located within the Andes, is considered a millenarian and intercultural province, where multiples cultures and ethnic groups coexist.

Materials and Methods: The study was conducted through direct interviews with 84 ancestral healers from the Province of Chimborazo, Ecuador.

Results: We presented ten most used species by ancestral healers of Chimborazo province to cure different illnesses and their medicinal uses. We also provided the application mode and some features of healing that should be emphasized.

Conclusion: The nettle was the medicinal plant employed for more different illness and the chamomile was the one with higher prevalence. We could confirm that the Native Ecuadorians have a vast variety of traditions and popular medicinal practices that have great value and are needed to be researched and studied extensively.

Keywords: Medicinal plants, Chimborazo, Ecuador, ancestral use.

Introduction

In recent years, many researchers have focused on medicinal plants derived from natural products due to their wide range of pharmacological significance (Shukla et al., 2010). Moreover, natural resources of vegetable origin represent an important source of drugs in the process of developing new pharmacologically active compounds (Vieira et al., 2014). The World Health Organization established that, in many developing countries, traditional medicine plays an important role in meeting the primary health care needs of the population, and highlights specific types of this medicine (WHO, 2014). They play an important role in the development of the indigenous population of Ecuador (De la Torre et al., 2006). These people live in The Andes, an area with different topographies climates, grounds and vegetation, that offers a great variety of medicinal plants (Acosta-Solís, 1968). Herein, 9865 plant species have been identified, being 64% of them indigenous to Ecuador (Jørgensen and León-Yáñez, 1999).

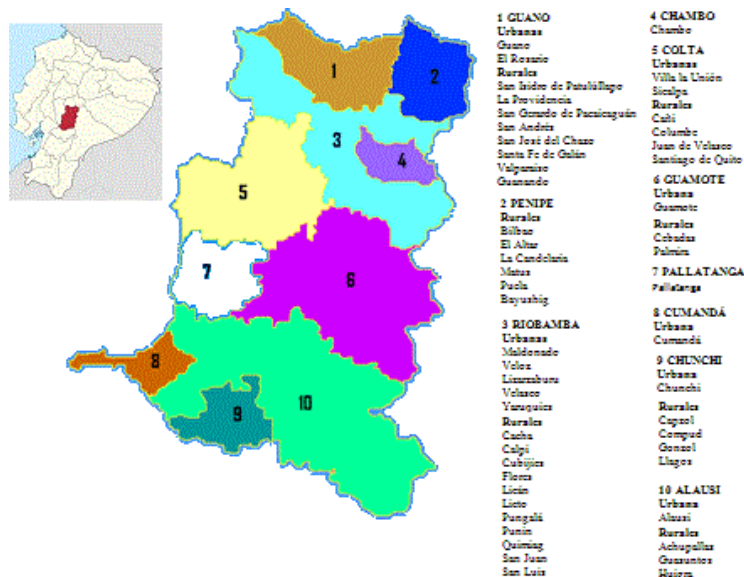


Figure 1: Map of Chimborazo Province.

The Andean region of Ecuador has witnessed a marked expansion of nature conservation initiatives (Himley, 2009). Specifically, the province of Chimborazo (Figure 1), with 59.3% of indigenous population living in rural areas (Bretón, 2008), is considered a millenarian and intercultural province, where multiples cultures and ethnic groups coexist. It owns a rich cultural heritage, with diverse life styles in rural communities. Particularly, in the urban marginal and rural areas of Chimborazo, the native traditional medicine covers the prevention, promotion and cure health services. For that reason, several initiatives have been carried out in order to strengthen the knowledge and wisdom of the ancestral healers of the region (PDOT, 2011).

Although there are many studies about medicinal plants in the regions of Quito (Haro, 1971), Buitrón (Ortega, 1988), Cotopaxi (Bianchi, 1984) and Imbabura (Kothari, B., 1993), the phyto studies on Chimborazo province are really limited. Only Abdo et al. (1995) carried out a phytochemistry analysis of Asteraceas plants with medicinal properties registered within the province of Chimborazo. A similar study covers the species, with pharmacological purposes, that have been sold in the market of Riobamba, the capital of Chimborazo (Cerón and Montalvo, 1994). There were 175 different plants species identified; however, there is no inventory that compiles all the medicinal plants used within the region.

Chimborazo province presents popular medical practices that are usually employed and are needed for scientific study. For this purpose, it is necessary to determine medicinal plants mostly used for treatment of different illnesses within this area. Here, we presented ten most used species by ancestral or traditional healers of Chimborazo province to cure different illnesses and their medicinal uses. We also provided the application mode and certain attributes of these healers we considered worthy of note.

Materials and methods

Study design and setting.

The study involved 84 traditional healers from Chimborazo province who consented to participate in the study on a voluntary basis. The study began in February 2012 and was concluded in December 2014.

Sample size and recruitment.

The sample size was calculated using the formula $n = (Z^2 \cdot p \cdot q \cdot N) / [(N \cdot E^2) + (Z^2 \cdot p \cdot q)]$ (Kothari, C.R., 2004); being n : sample size, Z : standard value of Z-test (1.96 for 5% two tailed), p : probability of population with same characteristics (0.95), q : probability of population without same characteristics (0.05), N : population (504 ancestral healers from Chimborazo province), E : standard error (0.05). The estimated sample size was 64 individuals, but a 30% buffer was included to allow for incomplete datasets (totalling: 84). We calculated the sample size with the population of traditional healers registered in the Health Department of Riobamba. The sample size was collected through meetings in different towns of the province: Guano, Penipe, Riobamba, Chambo, Alausí, Colta, Pallatanga, Cumanda and Guamate with the help of the Health assistants in the area. We explained the research project to the healers before delivering the surveys to them. Five researchers (Celio García, Félix Falconí, Eliana Martínez, Susana Padilla and Ángel Mayacela) helped the those participants who did not know how to write.

Main variables of the study

Medicinal plants: We measured the names and frequency of mention (%) of different medicinal plants used by the healers. Diseases/Symptoms: We collected the diseases or symptoms for which each medicinal plant is used for.

Origin of the plant: Where the healers got the plant was noted. Medicinal fraction of the plant: Fraction of the plant that the healers utilized for medicinal use was also noted. Plant preparation method: How the traditional healer/doctor prepared the medicinal plant for their patients. Age of patients: We took note of the age brackets of their patients by infants, toddlers, teenagers, adults or elderly people. Knowledge of the substances that each plant contains by the shaman: We asked yes or no response questions in this regard. Variables to characterize the study sample. The following variables were compiled and classified by different communities in the province of Chimborazo: origin, gender; educational level (no education; primary or secondary school; university studies); employment auto-apellation (“partero/a”= midwife; “sobador/a”= physiotherapist; “hierbatero/a”= herbs chemist; “Yachag”= wise; “limpiador/a”= witch doctor); years of experience.

General procedure of the study.

The survey was compiled by Dr. Carlos Baralezo, Lic. Susana Padilla, Dr. Ángel Mayacela, Dr. Celio García and Ing. Félix Falconí. They met, agreed and formulated the survey. The statistics assistant of The National University of Chimborazo (UNACH) also gave technical advice in the process. Participants were called by the Health assistants in each

rural town for a meeting. The researchers informed the healers based on the study scope, and collected data from them. Each traditional healer completed the survey during the study.

Data collection.

All datasets were collected by the researchers. A standard form (survey) had been designed to systematically register the information taken at the rural towns mentioned earlier and all variables that characterize the study sample.

Statistical analysis.

Excel version 2010 was used to analyze the data.

Ethical considerations

All participants received information on the research study, its benefits for the Community and possible collaboration involved in it. Participation in the study was voluntary, and all individuals were asked if they wanted to collaborate in the research project during the survey.

Results and Discussion

The Intercultural Health's Direction of Chimborazo province had 503 traditional healers registered in 2012. Eighty-four (84) healers of these number accepted to complete the survey that was designed for the study. Traditional healers within the province used medicinal plants to cure different illness. The knowledge of this practice is being transferred from generation to generation for centuries. Although healers are not always on-ground to share information, a total of 84 registered healers were involved in the study. Some of them have been dedicated as traditional healers for more than 45 years. It should be noted that the use of medicinal plants by women was higher (66.7 %) than by men (33.3 %). The therapists were self-called mainly as "parteras/os"= midwives (37.2 %, Table 2) followed by "yachags"= wises (21.2 %), and witch-doctors ("limpiador/a", 16.1%), herb chemist ("hierbatero/a", 13.1%) or physiotherapist ("sobador/a", 12.4%) also.

We noted the education level of the healers who participated in the survey as registered in the WHO document - WHO Traditional Medicine Strategy (2014–2023). According to the data obtained from the survey, 50% of the healers showed primary studies at school and 29.8% without education; 15.5% were secondary school leaver but only 4.7% reached university/graduate level. This result corroborates the inherited use of medicinal plants, passed from their ancestors, from one generation to another. We asked if they knew what substances the plant contained and if not, whether they are interested in knowing. Our findings revealed that these healers have no idea, what substance the plants contained and that they would like to know. Hence, after the study, we promised to report the needed information on all medicinal plants to them, since they have indicated interest in knowing. During the ethnobotanical investigation, a total of 153 different medicinal plants were mentioned by the traditional healers in the survey. They used the plants for 179 different symptoms or illnesses. We also selected the 10 most used plants as indicated by the study (Figure 2) and we included the medicinal use of each plant in the study. Chamomile (*Matricaria recutita* L., Family *Asteraceae*) was the medicinal plant most employed in the province of Chimborazo. The medicinal use of chamomile is based on pre-Columbian traditions with their ancestral knowledge that we still conserve today (Gispert et al., 1998). The medicinal effects of the plant are due to the activity of their flavonoids with antioxidant properties (Muñoz-Velázquez et al., 2012; Del Valle-Pérez et al., 2012).

The second plant in prevalence in Chimborazo province was the nettle (*Urtica dioica* L., Family *Urticaceae*) and the third one was the ragweed (*Ambrosia arborescens* Mill., Family *Compositae*). The nettle is a native plant of Europe and Asia, that is distributed all over the world. It grows in rural places, rather in wet grounds rich in nitrogen, such as farmyards and gardens. Clinically, it is used to enhance urine output, reduce jaundice, renal pain and tuberculosis. It is also used to treat bleeding, hemorrhoids and pleurisy (Segundo et al., 2014). The third one was the ragweed, a medicinal plant that is used for its medicinal properties in the different ethnic groups of Ecuador. They employ it to treat injuries and gastrointestinal disorders. A recent study detected that the sesquiterpene of the plant is active against leukemia (Cotugno et al., 2012). Rue (*Ruta graveolens* L., Family *Rutaceae*), eucalyptus (*Eucalyptus obliqua*, Family *Myrtaceae*) and plantain (*Plantago major*, Family *Plantaginaceae*) presented a similar percentage of frequency (31-33%). *In vivo* studies have shown that eucalyptus improves significantly hyperglycemia, polydipsia, polyphagia and also compensates the loss of weight in diabetic rats (Bokaeian et al., 2010). The popularity of the feverfew (*Tanacetum parthenium* L., Family *Asteraceae*), borage (*Borago officinalis*, Family *Boraginaceae*), field horsetail (*Equisetum arvense*, Family *Equisetaceae*.) and mallow (*Malva sylvestris*, family *Malvaceae*) were good enough (25-29%) as well. Studies *in vitro* with feverfew show that it can be used to treat migraine and arthritis (Pareek et al., 2011, Rosen et al., 2013).

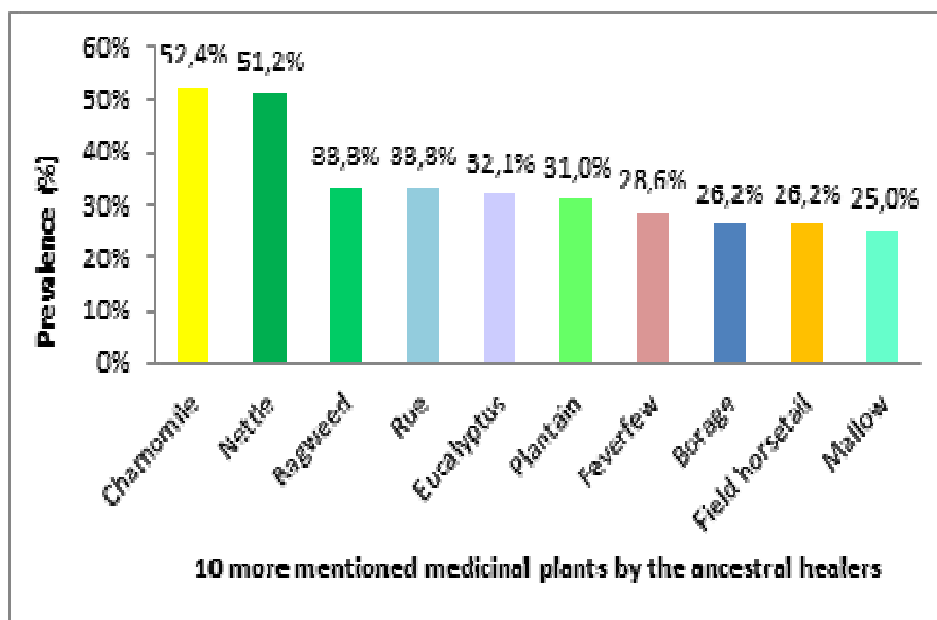


Figure 2: The ten more mentioned medicinal plants by the ancestral healers.

The different illnesses mentioned in the survey were grouped into 32 categories of medicinal uses. The categories could reflect the “cure concept” of the residents at the province. We should emphasize two related categories to *cultural diseases*: i) using the plant as a way of purification and ii) to eliminate bad energies from the body (such as witchcraft or sorcery). Data concerning its application mode, the part of the plant employed and the origin of the plant were also collected. The main way of applying, the part of the plant used, the scientific name (Cerón, 2006) and the main medicinal employment of each plant are included in Table 1. We also calculated the Fidelity Level (FL) (Friedman et al., 1986), the ratio between the number of informants who independently suggested the use of a species for the same major purpose and the total number of informants who mentioned the species for any use, in order to quantify the consensus between every plant and its chief therapeutical use. Rue and feverfew presented a high FL (62-75%). We should highlight that both plants were employed to treat the *cultural diseases*: body purification and to eliminate bad energies. The ancestral healers confessed they mix some plants in the same preparation to strengthen the medicinal effect of them. About the origin of the plant, all of the healers guaranteed that they obtain the plants from Chimborazo province, either in their own garden or bought in the market.

Table 5: Main medicinal use, application mode and part of the plant employed for the ten medicinal plants with higher prevalence.

Plant	Scientific Name	Medicinal Use	Application Mode	Part of the plant	FL (%)
Chamomile	<i>Matricaria recutita</i> L.	Stomach ache	Infusion ^a	All	31.1
Nettle	<i>Urtica Dioica</i> L.	Body pain	Infusion ^a	Leaves	35.7
Ragweed	<i>Ambrosia arborescens</i>	Body purification	Cleaning ^b	Leaves	35.7
Rue	<i>Ruta graveolens</i>	Body purification	Infusion ^a	Leaves and branches	75.0
Eucalyptus	<i>Eucalyptus obliqua</i>	Sore throat, cough	Infusion ^a	Leaves	21.4
Plantain	<i>Plantago major</i>	Fever	Infusion ^a	Leaves	36.0
Feverfew	<i>Tanacetum parthenium</i>	Bad energies ^c	Cleaning ^b	Leaves and branches	62.5
Borage	<i>Borago officinalis</i>	Sore throat, cough	Infusion ^a	Leaves and flowers	45.5
Field horsetail	<i>Equisetum arvense</i>	Inflammation ^d	Infusion ^a	Leaves	54.5
Mallow	<i>Malva sylvestris</i>	Hemorrhage and injuries	Poultice	Leaves	27.3

^a Use of boiled water. ^b Indigenous mode of application where the shaman put the liquid with the medicinal plant in his mouth and throws it to the patient. ^c Such as witchcraft or sorcery. ^d Body pain of: stomach, liver, kidney, uterus, vesicle, urinary tracts and/or intestine.

Conclusions

Ten medicinal plants were mostly used by traditional healers of Chimborazo province Ecuador have been collected. The nettle is the medicinal plant employed for more different illness and the chamomile is the one with higher prevalence. The use of medicinal plants is higher by women than by men. The medicinal plants rue and feverfew present high fidelity level with two categories related to *cultural diseases*: i) body purification and ii) to eliminate bad energies.

The healers in this Andean region employ a total of 153 different medicinal plants for 179 different symptoms or illnesses. At the end of this study, we can confirm that native Ecuadorians have a vast variety of traditions and popular medicinal practices that have great value and are needed to rescue and study deeply.

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