Full Length Research Paper

Knowledge and Preference of Medicinal Plants in three Rural Communities of Tezonapa, Veracruz, Mexico

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For millennia, medicinal plants have been used for therapeutic human needs and healing. In the Tezonapa region, there are two ethnic groups, Nahuatl and Mazatec who use medicinal plants for ages. However, there is a lack of information about the current preference for traditional medicine among local people and the local knowledge of medicinal plants. This study assessed the current use of medicinal plants and the variation of traditional knowledge in three rural communities in Tezonapa, Veracruz, Mexico. During 2013, traditional medical doctors were interviewed about the use of medicinal plants. A questionnaire with open dichotomous questions, and Likert scale were used to gather respondent's opinions and to assess knowledge. Data was analyzed using Statistica®. Traditional doctors use on average forty-six medicinal plants, although they know individually an average of 4 (± 5.2) plants. 94% of respondents have free public medical service and most get the surgery by walking (Caxapa, Naranjastitla, 93% and 92%), or using public transport (La Luna, 66%). Willingness of residents to treat illnesses with traditional medicine is relatively low on Likert scale (2.7 ± 3.7), with most disagreeing and preferring the surgery. Local knowledge of traditional medicine among inhabitants is low and there is a trend toward abandonment as people have access to free public health services and facilities for healthcare. Traditional medicine has to be acknowledged by local health authorities and be promoted along with the conventional medicine.

Keywords: Traditional medicine, ethnobotany, homegarden, preference, local knowledge

INTRODUCTION

The World Health Organization estimates that more than 80% of the world population uses traditional medicine routinely (WHO, 2003). A medicinal plant is defined as any plant species containing substances that can be used for therapeutic purposes or whose active ingredients may serve as precursors for the synthesis of new drugs (Bermúdez *et al.*, 2005). Traditional medicine

also is defined as "the sum total of knowledge, skills and practices based on the theories, beliefs and experiences indigenous to different cultures that are used to maintain health, as well as to prevent, diagnose, improve or treat physical and mental illnesses and it is referred as "alternative or complementary medicine" (WHO, 2003).

In Mexico, medicinal plants and traditional medicine have been widely used by the indigenous groups to cure diseases and ailments. Such knowledge has been transferred from generation to generation (Bermúdez *et al.*, 2005). This traditional medicine has been strongly associated with pre-hispanic indigenous cultures. The

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primary evidence available is the historical document called the "Codice Badiano" that reports the traditional use of 227 medicinal plants used in the Aztec medicine (De la Cruz, 1940). Mexican indigenous traditional medicine is a set of systems of healthcare that has its roots in knowledge of health and diseases that have been guarded over generations (Heinrich et al., 1998; RE&PB-Conacyt, 2014). In fact, the General Law of Health -2015 (DOF, 2015) in its article 6^0 states (VI bis) states: "Promoting the understanding and development of traditional indigenous medicine and its practice in appropriate conditions". The intention of this statement is to infer that the development and promotion of homeopathy is a health option in many indigenous communities.

Currently, ethnobotanical research has gained special importance due to the increasing loss of traditional knowledge from indigenous societies and due to the degradation of natural ecosystems. Ethnobotanical studies focus on interrelationships between human beings and plants (Gómez, 2002) and has an important role in rescuing and revaluing indigenous knowledge for the benefit of the communities themselves; particularly in the context of loss of traditional knowledge and biodiversity.

During the last ten years, analyses of nature and ethnobotanical studies have helped to unify a theoretical background and highlight its role in the conservation of biodiversity and the development of local communities (Gheno-Heredia et al., 2011; RE&PB-Conacyt, 2014). Biological diversity coexists closely with indigenous communities in many regions of Mexico, including the state of Veracruz.

The medicinal flora of Veracruz has been reported by Zamora-Martínez and Pascual Pola, (1992), who found that out of 399 species, 237 (59.3%) were used as remedies for 57 diseases, with the most frequent diseases being those related to the digestive system, skin, reproductive system, or religious-cultural practices (often referred as "*limpias*"). Gheno-Heredia et al., (2011) conducted a study in Ixhuatlancillo where they described the treatment of some diseases with medicinal plants represented by 91 species belonging to the following families: Compositae, Solanaceae, Lamiaceae, Euphorbiaceae, Plantaginaceae, Malvaceae, Fabaceae y Amaranthaceae. In the indigenous town of Zongolica, several studies have taken place such as those of Navarro and Avendaño (2002) and Alafita et al., (2003) who worked with the Organization of Traditional Indigenous Doctors (OMIT) called "Masehual Ixtlama-Chislistli AC" and Cervantes (2009) who worked with OMIT in Huitzila, Soledad Atzompa, Veracruz. In the region of Tezonapa, only one study has been carried out describing the use of plants in traditional medicine Zamora-Martinez and Pascual Pola (1992). Therefore, there is no current information on the diversity of knowledge in this region related to the use of medicinal plants and the degree of loss of local knowledge regarding the use of such plants. Thus, the objective of this study was to determine the current use of traditional medicine and diversity of use of local knowledge on medicinal plants in three rural communities of Tezonapa, Veracruz. A quantitative ethnobotanical approach was used to describe and analyze the use of medicinal plants and to determine the diversity of knowledge.

METHODS AND MATERIALS

Study area and climate

This work was conducted in three rural communities in the region of Tezonapa (La Luna, Caxapa and Naranjastitla). It is located at 18° 36′ N and 96° 41′ W at 220 masl. The mean annual rainfall is 2885 mm and the mean annual temperature is 24.4 °C within a tropical humid climate (http://www.inafed.gob.mx/).

Traditional healer interviews

A field survey was undertaken from February to August 2013, covering all traditional healers to gather information on each medicinal plant used by them. Traditional healers were informed previously of the objectives of the research and their consent was obtained. A 30-minute semi-structured interview was conducted, covering wild and cultivated plants used with medical purposes. All plants collected and cited by the traditional healers were cross-verified for authentication. Traditional medical doctors were located and interviewed to assist in the collection of plants they used for therapeutic purposes. Twelve field trips were carried out with the traditional healers in the surrounding areas focusing on natural and cultivated vegetation near to each doctor´s residence. The doctors showed which and how plants should be collected, the main parts used, and in which growth stages. All plant material was geo-referenced (GPS), pressed and labelled according to Lot and Chiang (1990). Plant specimens were identified using taxonomic keys and by comparison with reference material in the Dr. Jerzy Rzedowski Rotter Herbarium (CORU) at Universidad Veracruzana, Campus Córdoba, Veracruz, Mexico; where examples of collected specimens also were deposited.

Traditional doctors were considered key informants because of their position, extensive knowledge and access to information for the area of study. Traditional doctors were interviewed four times at different moments, to validate information. The questions asked were: What are the main medicinal plants you use? and For what kind of disease or ailment were these plants used?

Household surveys

Local people in each location were surveyed using a questionnaire with open and dichotomous responses on a Likert scale, yielding 418 people interviewed in three communities to determine the current knowledge of medicinal plants used by traditional healers (Table 1). Household sampling was estimated by dividing the community into blocks and using a random number generator to choose the houses. In cases that occupants were absent, the closest neighbour was interviewed. The intention of this interview was to understand the preference for traditional medicine. Respondents were asked to freely list all the medicinal plants they use and know. The variables recorded were socioeconomic characteristics, access to health services, roads, knowledge and preference level for traditional medicine.

Table 1. Traditional healers and household interviewed in the three communities in Tezonapa, Veracruz

Interviewee	Community		
	La Luna	Caxapa	Naranjastitla
Healers	1 (mazateco)*	1(nahua)	1(mazateco)
Household	81	244	93

*Correspond to the indigenous group

Statistical analysis

Descriptive statistics were performed using Cluster analysis for each location. Then, by using linear regression, quantitative variables were related. For each group formed, an analysis of variance was performed. Statistica® Software version 6.0. was used for the statistical analyses.

RESULTS

Current use of medicinal plants

Traditional doctors from the three locations were interviewed regarding their use of medicinal plants to treat ailments of the digestive system (28%), skin (25%), circulatory system (16%), respiratory system (12%), nervous system (7%), skeletal system (7%) and cultural affiliation syndrome (5%). To treat ailments, traditional healers use diverse plant structures such as leaves (33%), stems and leaves (29%), fruit (19%), stems (15%), roots (2%), and roots and leaves (2%). Plant structures used corresponded to 46 identified species belonging to 33 botanical families; with the Rutaceae and Cucurbitaceae being the families most frequently used. It is likely that the number of plants found relates to local biological diversity. A similar study in the same region found the use of 83 species belonging to 46 families with the families Compositae, Solanacea and Lamiacea most

represented (Gheno-Heredia *et al*., 2011). The parts of the plants most used were leaves (28.15%), trunk/branches (14.6%), whole plant (13.0%), and the whole plant without root (12.0%).

Local knowledge of medicinal plants in the three communities

Older respondents knew more about medicinal plants, influencing the number of plants traditionally used (Figure 1). This suggests that knowledge and experience regarding traditional medicine and medicinal plants increases with age and that newer generations are less interested in them and therefore less acquainted with their medicinal value.
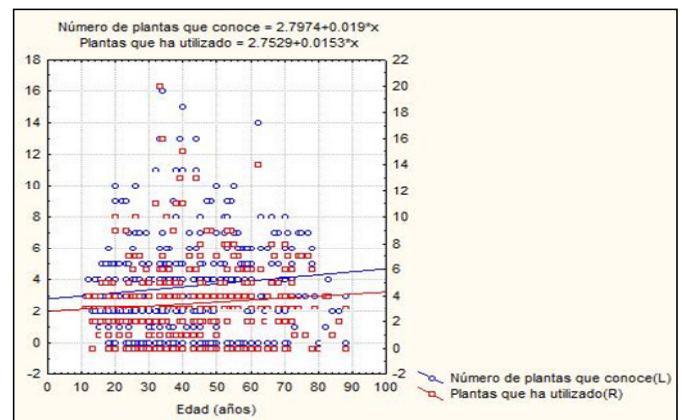

Figure 1. Trend among number of medicinal plants known and used and the age of the traditional doctors interviewed.

Women knew more medicinal plants than men (Figure 2). This is because most women are housewives (in La Luna 97%, Caxapa 86%, Naranjastitla 97%) and they are more frequently responsible for keeping child healthcare. They take any sick family member to the traditional doctor, indicating that there is a duty responsibility in the communities based on gender.
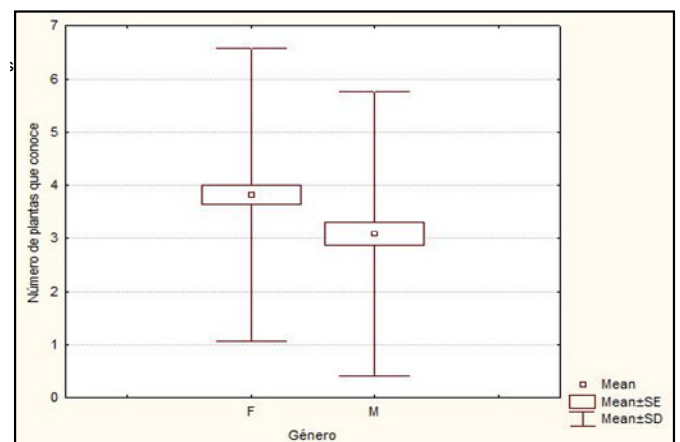

Figure 2. Mean of plants known by genera in the three communities

Table 2. Plants known and used by the people in the three communities.

Community	People interviewed (n)	Plants known		Plants used	
		Mean	Std. Dev. Std.	Media	Std. Dev.
La Luna	81	4	± 2.7	4	± 3.2
Caxapa	244	4	± 2.6	3	± 2.6
Naranjastitla	93	4	± 10.5	4	± 10.5

Table 3. Groups and their differences regarding to the knowledge and use of medicinal plants.

Community	Group	Plants known	Group	Plants used
La Luna	1	6.052632[a]	1	5.815789[a]
	2	1.967742[b]	2	1.741935[b]
		0.000112*		0.000112
Caxapa	1	2.306358[a]	1	2.075145[a]
	2	6.791045[b]	2	6.522388[b]
		0.000009		0.000009
Naranjastitla	1	1.945205[a]	1	1.931507[a]
	2	7.157895[b]	2	7.157895[b]
		0.000113		0.000113

Different letters within a column indicate a significant difference between groups (Tukey, P < .05). Tukey P α=0.05.

However, on average the knowledge and use of medicinal plants was low (Table 2). This contrasts with plants used by traditional doctors established in the three communities.

Although the respondents knew of and had used few medicinal plants, two groups were observed in each community to have significant differences (Tukey, P=0.05) regarding the number of plants known and used (Table 3).

The few plants known and used by the community arises because they have public health service. In La Luna, 89% of the people have access to public health services, in Caxapa 94% and 98% in Naranjastitla.

Preference of respondents regarding the use of traditional medicine and modern medicine

On average, people in La Luna, Caxapa and Naranjastitla with access to public health service do not treat diseases by seeking traditional healers, while those without public health service treat diseases using traditional medicine (Figure 3). The availability of public health service strongly reduces the need for treatment using traditional medicine or by visiting an herbalist. This agrees with Martínez-Pérez et al., (2012) who found that towns without public health services or very restricted services depended more on natural vegetation and the use of more species as medicinal plants.

In Naranjastitla, people without access to public health services did not want to treat diseases using traditional medicine. However, if it was known that "*Medicinal plants healed their diseases*" (Table 4), people gave a positive answer, possibly because traditional doctors cured basic health conditions and were effective in using their remedies.

On the other hand, residents of the three communities were doubtful about whether they "*consider that the healer/herbalist healed their diseases*". Also, their perspective on the statement "*To treat diseases is much better when assisted by a traditional medic/healer/herbalist*" was negative (Table 5).

The preference for medical services may be influenced by their ease of access. In La Luna, the best way to access medical service is by public transport, which costs $60.00 (± 138.50) (MXN) and the average time to reach a closest clinic or other facility is 51 min (± 45.8 min). In the communities of Caxapa and Naranjastitla, the best way to access medical services is by walking (93% and 91%, respectively) and the average time is 21 minutes (± 29.9) (Caxapa) and 18 minutes (± 22.8) for Naranjastitla.
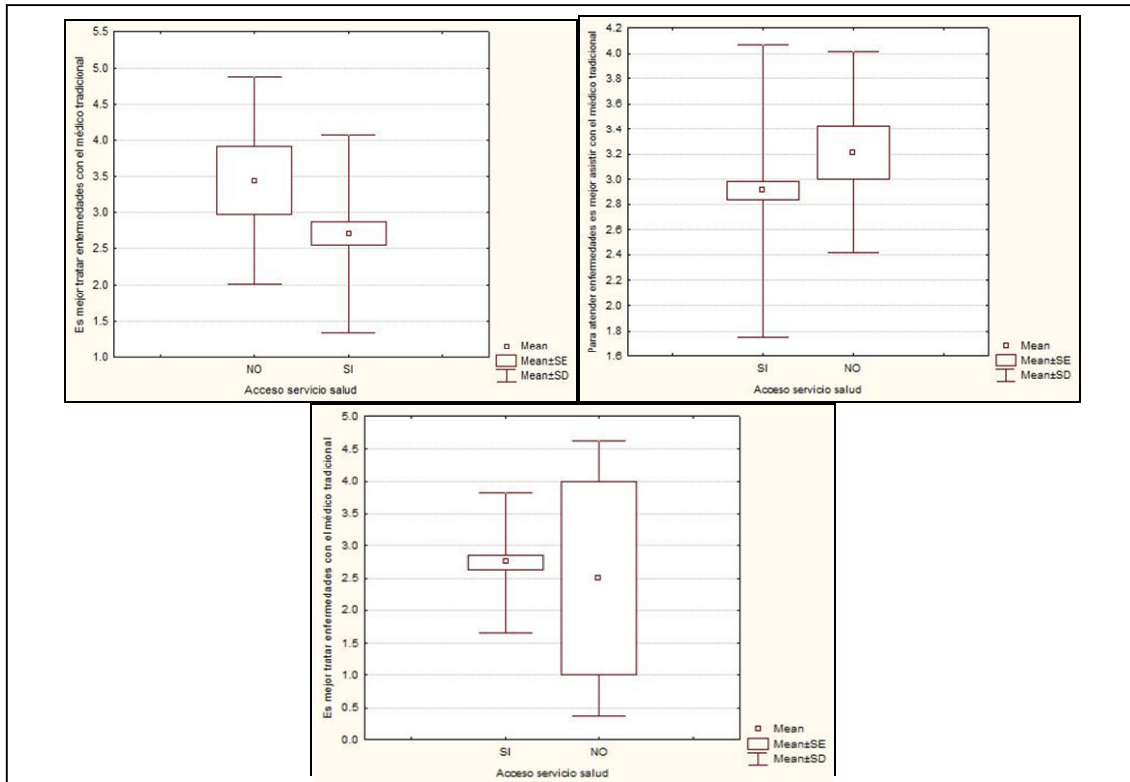
Figure 3. Attitude of interviewee with and without health public service related to trait their disease with traditional healers.

Table 4. Attitude of interviewee regarding the effectiveness of medicinal plants to cure diseases

Community	Number of persons interviewed (N)	Medicinal plants used to cure people diseases	
		Mean*	Std. Dev.
La Luna	81	4.1	± 0.8
Caxapa	244	4.0	± 1.1
Naranjastitla	95	4.0	± 0.9

Negative attitude was measured in five scales, being: 1 (Totally disagree); 2 (disagree); 3 (neutral), 4 (agree) and 5(totally agree).

Table 5. Attitude of the interviewee regarding the effectiveness of the traditional medical doctor.

Community	Number of persons interviewed (N)	The healer / herbalist healed your diseases		To treat diseases is much better assist with the traditional medical doctor / healer / herbalist	
		Media*	Desv. Std.	Media	Desv. Std.
La Luna	81	3.2	±1.2	2.7	±1.37
Caxapa	244	3.1	± 1.2	2.9	±1.14
Naranjastitla	95	3.1	± 1.0	2.7	±1.09

Negative attitude was measured in five scales, being: 1 (Totally disagree); 2 (disagree); 3 (neutral), 4 (agree) and 5(totally agree).

DISCUSSION

Medicinal plants in the three studied communities of Tezonapa were mainly used to treat four areas of disease/infirmity (respiratory, gastrointestinal, skin, and cultural afflictions/myths). A greater knowledge of medicinal plants was possessed by women, due to their predominant role as housewives and their relative availability or lack of medical service. Medicinal plants are the basis of traditional medicine.

The ailments treated with medicinal plants are similar to those reported by Sánchez González et al., (2008) for Otomíes in the municipality of Nicolas Flores (Hidalgo, Mexico) who mainly use plants to treat digestive (24.6%), respiratory (23.6%), cultural afflictions/myths (20.9%), injuries due to accidents (12.7%), infection and external parasitic diseases (10%). Other studies stress that the main diseases treated relate to gastrointestinal, respiratory and skin issues (Andrade-Cetto, 2009; Heinrich, 2000). Heinrich (1998) brings together the medicinal plants according to use categories, such as gastrointestinal, skin, respiratory, gynecological, venomous bites and ophthalmic.

Most of the plant parts used in the Tezonapa region are similar to those used and reported for other regions of Mexico and the world. According to Palomino (2013), the Bedouin tribes in the Sinai Peninsula of Egypt frequently use leaves and other aerial plant parts, followed by roots. To facilitate the use or application of the prepared remedy, plant parts are mixed either with milk, honey or sugar. Rodríguez-Echeverry (2010) observed in Putumayo, Colombia, that the plant parts used are leaves from 53 species, 13 different flowers, 12 different fruits, 7 stems, 4 roots and seeds from 3 species.

According to Márquez and Márquez (2009), Tezonapa is one of 20 municipalities in Veracruz state with high plant biodiversity. A total of 67 species belonging to 36 families are used to treat 55 diseases and three of cultural affliction/myth (Juárez-Vázquez et al., 2013).

The results of the present study agree with those reported for other ethnic groups (Canales et al., 2006; Sánchez González et al., 2008). Due to customs, experience, and easy access as medicinal plants can be collected around people`s house without any economic cost. Older people are always more oriented to using medicinal plants and in many communities medicinal plants are classified as "hot" and "cold" and there is an association of a large number of medicinal plants with particular therapeutic procedures, rather than with particular diseases (García-Hernández et al., 2015).

The information showed in Figure 2 coincides with Canales et al., (2006) whose also found that women know more medicinal plants as compared to men. Women mentioned knowing six species on average, while men indicated just four. This difference was statistically significant (Tukey, $P<0.005$). Jorad (2008) in Hueyapan, Puebla, found that women between 30 - 40 years old were more active in growing and using medicinal plants and that the oldest women knew of and used more plants than their peers.

According to Jorand (2008), in some Nahuas communities there are new trends in choosing medical care. The attitude of the population towards efficiency and the healing power of traditional medicine are declining. People are not hesitating to seek medical help at public health centres in case of serious illnesses, due to the slow curative effect of medicinal plants. This trend towards Western health care services and traditional medicine are resulting in changes in traditional internship and domestic groups by combining traditional medical treatment (including consultations with doctors) with utilization of allopathic medicines.

Gallardo (2003) reported that in a Huastec indigenous group in San Luis Potosi there were four factors affecting the loss of traditional healing practices: 1) the arrival of Protestant Christian religion that does not accept traditional healing practices; 2) new organizations of traditional healers who have changed their relationship among specialists; 3) the continuous critique of modern medicine against traditional healers or traditional medicine; and 4) in the case of midwives, the lack of money to move from one village to another which causes physical wear, leading some to decide not to continue practicing.

The capacity for change by the respondents may be due to a number of experiences with and some dependence on the use of modern medicine. This provision and predisposition of individuals influences people to continue preferring traditional or non-traditional medicine (Aiken, 2003). Thus, the increasing use of pharmaceuticals is a major cause of the declining use and loss of knowledge of medicinal plants among indigenous populations (Caniago and Siebert, 1998; Giovannini et al., 2011).

Ethnomedicine, or ethnopharmacology, is still a tradition in rural communities in Tezonapa, but gradually the knowledge, importance and preference for this practice are being vanish due to the availability of clinics or medical health centres also the greater availability of modern medicines, cost differences, medical treatments which are more effective and rapid, and an overall greater capacity for healing based on modern medicine. However, traditional medicine remains important for a population without access to public health services, and also because the cultural background on the uses of medicinal plants and their uses in curing or treating certain ailments and diseases. Official health programs should include traditional herbal medicine as another form of healing, as indicated by the General Law of Health, thus respecting and valuing local and indigenous knowledge.

CONCLUSIONS

Traditional medicine is still a cultural practice in the communities studied (La Luna, Caxapa and Naranjastitla) in Tezonapa, Veracruz. However, with the Westernization, modernization, urbanization and the availability of public health clinics to treat health problems, the use of traditional medicine is declining. The use of medicinal plants has the purpose to fulfil basic health needs. Overall, the group of medicinal plants used in the three communities is represented by 46 species

belonging to 33 families, with the Rutaceae and Cucurbitaceae being the most common. In the three communities, people know and use –on average- four medicinal plants, and within each locality there are two groups with significant statistical differences among them regarding knowledge and use of medicinal plants. The access to public health services diminish to treat diseases with traditional healers, and those without health service treat diseases using traditional medicine. There was a gender difference, with women (mostly housewives) knowing more medicinal plants than men. In all three communities, people knowing of medicinal plants were adults (over 40 years old), without access to public health services. Finally, the use of medicinal plants should be integrated into national public health care systems in a more harmonious manner.

ACKNOWLEDGEMENTS

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