Accepted Manuscript

Title: Xki yoma' (our medicine) and xki tienda (patent medicine) - Interface between traditional and modern medicine among the Mazatecs of Oaxaca, Mexico

Authors: Peter Giovannini, Michael Heinrich

PII: S0378-8741(08)00634-X
DOI: doi:10.1016/j.jep.2008.11.003
Reference: JEP 5312

To appear in: *Journal of Ethnopharmacology*

Received date: 8-3-2008
Revised date: 2-11-2008
Accepted date: 3-11-2008

Please cite this article as: Giovannini, P., Heinrich, M., Xki yoma' (our medicine) and xki tienda (patent medicine) - Interface between traditional and modern medicine among the Mazatecs of Oaxaca, Mexico, *Journal of Ethnopharmacology* (2008), doi:10.1016/j.jep.2008.11.003

Xki yoma' (our medicine) and xki tienda (patent medicine) - Interface between traditional and modern medicine among the Mazatecs of Oaxaca, Mexico

Peter Giovannini and Michael Heinrich*

Centre for Pharmacognosy and Phytotherapy,

The School of Pharmacy, University of London,

29-39 Brunswick Sq., London WC1N 1AX, UK.

Fax.: 0044-20-7753-5909, Tel.: 0044-20-7753-5844,

E-mail: Michael.heinrich@pharmacy.ac.uk

Abstract

Objectives Little is known about the interface of traditional (generally plant based) medicines and of commercially available pharmaceutical (and related) products. Here we provide a case study to understand how and to what extent *traditional* and *modern* medicine have been integrated in an indigenous community and whether these two categories offer a meaningful model for understanding medicine selection. Consequently, this paper explores the use and knowledge of medicinal plants and patent medicines among laypeople living in a rural Mazatec indigenous community in Oaxaca, Mexico.

Methods. This paper is based on field study over a period of approximately 20 months using participant observation, unstructured and structured interviews including freelisting. The medicinal plant species and commercially available pharmaceuticals were assessed using published biomedical information.

Main outcomes The local ethnopharmacopoeias, emic concepts of illness, epidemiology, and case studies on therapeutic choice were documented. We found that self-treatment is the most common first therapeutic choice. Many of the plant species used by Mazatecs have recognized therapeutic properties, in some cases *in vivo* and *in vitro* studies point to well defined pharmacological effects, and in a few cases clinical evidence is available. Likewise, people commonly use patent medicines that are effective in the treatment

of the most common health conditions. However, we also documented the medicinal use of some toxic plant species (*Aristolochia* spp) and of some patent medicines that are held to be unsafe in developed countries (sodium metamizole).

Conclusions When looking at a complex pluralistic medical system an approach that goes beyond the externally imposed dichotomic categories of traditional and modern medicine can be very useful to shed light on other dimensions that underlie the local use of medicines. With the increasing integration of the Mazatecs with the outside world, the concomitant use of both types of resources is constantly changing and helps the Mazatecs in their struggle for health.

Keywords: Traditional medicine; self-treatment; pharmaceutical anthropology; ethnopharmacy; ethnobotany; Mazatecs; Oaxaca (México)

1. Introduction

Ethnopharmacology focuses on the use and knowledge of local *materia medica*, or ethnopharmacopoeias, and the biological and cultural basis of their therapeutic action.On the other hand, research in the field of medical ethnobotany and ethnopharmacology has initially focused on compiling inventories of botanical ethnopharmacopoeias among remote and, therefore, more *conserved* (traditional) societies (Plotkin, 1994). From the 1950's, ethnobotanical inventories were integrated with biochemical and ethnographic data (Schultes and Raffauf, 1990; Weiman and Heinrich 1997; Frei et al., 1998; Heinrich et al. 1998). However, by definition medical ethnobotany has limited its focus to medicinal plants and overlooked other forms of treatment used in the same context. The study of laypeople knowledge and use of pharmaceuticals has been neglected by anthropologists looking firstly for more exotic aspects of medical cultures, and secondly for *traditional* medicine (Van der Geest, 1987; Whyte and Van der Geest, 1988). In this paper the term "*chemically defined medicine*" (CDM) will be used throughout the text to refer to commercially

available pharmaceuticals and supplements. This includes over the counter and prescription medicines sold locally, but also vitamins, which – while not a medicine – are used in the community for medical purposes. Research on people's use of CDMs, is usually done in a sociocultural context where biomedicine is dominant while there is a lack of studies on marginalized populations in developing countries (Van der Geest, 1987). Recently, ethnopharmacologists and medical anthropologists have started to look at the local uses of CDMs as a consequence of the growing evidence that CDMs are becoming an important part of local *materia medica* and of the cross-cultural observation that self–treatment is usually the first therapeutic choice in both urban and rural areas (Kleinman, 1980; Haak, 1988; Logan, 1988). While today local pharmacopoeias in communities in developing countries includes both herbal medicines and pharmaceuticals there are few studies that have looked at the use of both herbal medicines and pharmaceuticals in the context of self-treatment (Etkin et al., 1990; Ngokwey, 1995; Waldstein, 2006). This paper analyses the use and knowledge of medicinal plants *and* CDMs among Mazatecs as a case study to understand how and to what extent *traditional* and *modern* medicine have integrated with each other and question whether the separation between these two systems offers a meaningful dichotomy especially from an emic viewpoint. Research that looks at the whole local *materia medica* is needed in ethnopharmacology since such studies better represent the health care system in which these pharmacopoeias are currently used and such research can help to understand adaptative and maladaptative local uses of medicines. Instead of separately studying the use of medicinal plants and CDMs we propose an approach where these are analysed together by group of locally recognized illness categories.

2. Background and Methods

2.1 The study site and population

The state of Oaxaca is dominated by rural communities, which have a particularly high rate of marginalised indigenous populations, a high prevalence of morbidity from infectious diseases, and high infant mortality (SSA, 2004; SSA, 2006). The Mazatecs live in the Sierra Madre Oriental, located in

northern Oaxaca, Mexico (Figure 1). The Mazatec language belongs to the Olmec-Otomangue linguistic group, subgroup Otomian-Mixtec, Popoloca family, and is spoken by a high percentage of the population, especially in the more remote communities (Boege, 1988). The Mazatec region is highly biodiverse and includes a range of altitudes from 0 to 3200 m above sea level with the flora varying from temperate, tropical and to cloud forest. The population is spread in communities with great variation for market integration. Huautla de Jiménez is the main Mazatec urbanized center where the impact of modernization on traditional lifestyle is evident. People living in the region weekly come to Huautla de Jiménez for market days. A paved road connects Huautla de Jiménez with Teotitlán del Camino the political and administrative center of La Cañada (Boege, 1988; Neiburg, 1988; Feinberg, 2003).

The nearest government hospital, where free patient care is offered, is in Huautla de Jiménez. Small government health clinics spread over the area provide basic biomedical assistance, consisting of national vaccination campaigns, consultation with a non-indigenous doctor, and dispensing some medicines.

INSERT FIGURE 1 HERE

Mazatec medicine is most famous for the use of hallucinogenic plants and mushrooms documented in a study conducted by a team consisting of Robert Gordon Wasson, his wife Valentina Pavlovna Guercken, Richard Evans Schultes and Albert Hoffmann. The popularisation of this sacred and highly specialised information and the subsequent influx of non-natives resulted in considerable problems to the local population unforeseen by the researchers (Estrada 1981, Heinrich 2009).

Mazatecs distinguish several kinds of traditional healers according to their specific domain of knowledge and practice, namely shamans (*chjota chjine*), herbalists (*chjota chjine xka*), midwives (*chjine kjindi*), bonesetters (*chjota chjine b'ekjaoninda*), etc (Campos et al., 1994; Abse, 2007). Mazatec shamans, *chjota chjine* ("men of knowledge") cure illnesses such as witchcraft and evil eye using psychotropic plants, candles and maize kernels, as means to communicate with the other worlds (Abse, 2007). *Chjota chjine-xka*, herbalists, are specialists in medicinal plants. Sometimes the same person can be a shaman and a

herbalist, as the two categories are not mutually exclusive. While these *specialists* are believed to have a larger and more secret corpus of knowledge, most *laypeople* share some knowledge on "home remedies".

This study was conducted in a community of about 400 people in the municipality (*municipio*) of San Jose' Tenango which in this paper we name "Paloma Alta" (due to previous experiences of the Mazatecs with outsiders and concerns in the region we use a pseudonym, full details on the study site are available from the authors on request if required for research purposes). This community is about 800 m above sea level, and is only accessible by hiking for about one and a half hours from the nearest dirt road which connects the surrounding village of Cañada de Mamey with the municipality. Everyone speaks Mazatec as first language and few individuals are also fluent in Spanish. The nearest public health clinic, which provides health services for the uninsured, is located in Cañada de Mamey. The nearest pharmacy is located in the municipal capital. Traders sell some core medicines in community shops (*tiendas*) – generally simply a space of their house open to the path. Coffee cultivation is the only source of cash for most of the population, except for the cash dispensed by national cash transfer schemes such as PROCAMPO and OPPORTUNIDADES. As a part of a more extensive survey, we asked the quantity and the price of coffee sold by villagers during the previous year and we calculated that the median of individual annual income earned from coffee is 1500 Mexican pesos (137 US $). As a consequence CDMs are considered expensive and in many cases unaffordable.

2.2 Epidemiological background

The public health clinic in Cañada de Mamey keeps records on the visits and diagnoses conducted. This data, while incomplete and somehow biased by the ministry of health care policy at national level, provides a useful overview on local epidemiology. Not surprisingly, the statistics (Table 1) show a large prevalence of acute infective diseases of the respiratory tract and of the gastrointestinal system. Dental disease and musculoskeletal chronic problems also appear to be common in the adult and young population. Climate,

poor nutrition, poverty, and lack of sanitation and hygiene are held responsible for the high frequency of infectious diseases.

INSERT TABLE 1 HERE

2.3 Methods

Fieldwork was carried out by P.G. from April 2005 to August 2006 in Paloma Alta. Permits for research and for the collection of voucher specimens were obtained from Mexican authorities. A bilingual translator was hired when necessary to carry out interviews with monolingual informants.

Open interviews were conducted with 22 respondents on general concepts of health and sickness. Moreover, we asked 23 respondents to list all the illnesses they knew. Semi-structured interviews with 9 respondents were carried out about aetiology, symptomatology, illness classification and attributes, and treatments of the most salient 20 health conditions as elicited previously by freelisting. In this text, following Kleinman (1980), we refer to these concepts as explanatory models of illness. More informal interviews on the same topics were carried out with the population throughout all the fieldwork period. 38 case studies of specific illness episodes were recorded from 32 respondents. We asked respondents if they had been sick in the last 8 days and, if so, whether they used herbal and/or pharmaceutical medicines. We also asked if they visited the health clinic or a traditional healer. Some of the case studies were discussed in depth with the respondents.

In order to define the medicinal plants and pharmaceutical that are most used and known in the community, we asked 33 and 43 respondents to freelist, respectively, all the medicinal species and all the pharmaceuticals they knew. Freelisting interviews of the two cultural domain were carried out with a convenience sample. Most of the respondents participated in only one of the two different freelisting. We deemed unnecessary to elicit the freelisting of the two domains from the same persons, as our aim was to define the items that belong to the two cultural domains at the community level. The names of the plants

and of the illnesses were asked and recorded in Mazatec, and the Spanish lexeme was also recorded. For each plant mentioned during freelisting, use, part(s) used and the preparation were elucidated. Evidences supporting local uses were searched in the scientific literature and on PUBMED and BIOSIS electronic databases. The protocol used four different levels of efficacy as a benchmark to evaluate local uses: same use of the species in a different culture (1), *in vitro* evidence (2), *in vivo* evidence (3) and clinical evidence (4).

For each CDM mentioned the use was elicited. The items were rank ordered on the basis of Smiths's index, which is a measure of salience that takes into account both the frequency and the order with which items are listed (Borgatti, 1996). The active principle, formulations, recommended uses and potential adverse effects of the CDMs were searched for in national and international drug directories [SPM (Swiss Pharmaceutical Society, 2004), the British National Formulary (Mehta, 2007), the Mexican academic Vademecum of pharmaceuticals (Rodríguez-Carranza, 2005), and the on-line version of the Mexican dictionary of pharmaceuticals (UNAM, 2007)]. Registered trademark (®) are indicated in the text according to our search in literature.

When the field identification of the species was certain, for example in the cases of *Psidium guajava* L. (Myrtaceae) and *Zingiber officinale* Roscoe (Zingiberaceae), voucher specimens were not collected. In the other cases, voucher specimens of the plants mentioned were collected after the interviews or during walks in the woods with key informants. Plants were mainly identified and deposited at the National Herbarium of Mexico (MEXU) and at the Centre for Pharmacognosy and Phytotherapy, The School of Pharmacy, University of London.

3. Results and Discussion

Mazatecs perceive illness not only as a deviation from normality, but rather as a threat to life or, in other words, as a path that can lead to death. Indeed, *ti-mee-nia* in Mazatec means both "I am sick" and "I am dying". This concept has been found in other American indigenous groups (Maffi, 1994; Alexiades, 1999).

Mazatecs use medicine in order to *fight* illness, or its ultimate causes, and to stop the progression to death and restore health. Therapy and treatment are active processes that people carry out against illness. Seeking the therapy that fits the illness is the beginning of the fight between the sick and the sickness. According to this concept, a person who is passive when confronted with sickness is considered partially responsible for his/her condition.

The native (emic) categories of illness as elicited by respondents during freelisting are shown in Table 4 together with the medicinal species and CDMs mentioned by respondents for their treatment during the open and structured interviews.

Respondents distinguished between "illnesses that can be cured with medicines and illnesses that can be cured by the shaman". The latter (personalistic) are usually believed to be caused by the malevolent agency of a external agent (Abse 2007) and the former (naturalistics) are often based on the humoral theory. In particular, a thermal shock is often cited as the cause of sickness. The 28 most salient illnesses as elicited by freelisting are usually deemed to have a naturalistic aetiology.

A shared set of symptoms is associated with each specific illness. Some symptoms are cues of primary importance to identify a specific disease while others are seen to offer only circumstantial evidence and can be absent. People compare symptoms when they judge similarities among illnesses. The frequency of occurrence and severity of an illness are also attributes that people consider when judging similarities among different conditions. In section 3.3 we discuss more specific elements of the explanatory models of few selected emic diseases together with their herbal and pharmaceuticals treatments

Two kinds of medicines: *Xki-yoma'* and *xki-tienda* are known in Paloma Alta. The word *xki* in Mazatec means "medicine" and *yoma'* translates as "ourselves" (Mazatec lexeme for Mazatec people is: chjota yoma which translate as "our people"). Therefore, *xki-yoma'* literally translates as "our medicine" or "Mazatec medicine" but people refer to it in Spanish also as "*remedio caseros*" (household's medicines). The literal translation of *xki-tienda* is "medicine from the shop". Alternatively people sometimes use the term *xki-*

farmacia, "medicine from the pharmacy", or the Spanish expression "*medicina de patente*" [patent (or licensed) medicine].

We observed 38 illness cases among which 13, 6 and 17 relate to treatment with only medicinal plants, only pharmaceuticals and concomitantly both forms of treatment, respectively. In 2 cases no treatment was used. Among the same illness cases we reported 13 visits to the local health clinic and 2 visits to a traditional healer.

3.1 Local use of herbal medicine

The structured interviews provided detailed information about the species used (Table 2). The respondents recalled 82 species used medicinally. Among these only 39 are mentioned more than once and a small subset of 4 plants are clearly more salient, as the Smith's S index shows: *Cestrum nocturnum*, *Psidium guajava*, *Aristolochia odoratissima* and *Zingiber officinale*. These species are frequently used as a first resource to treat acute diseases that are very common, such as: fever, diarrhoea, stomach pain and vomiting. This pattern is very similar to the "consensus within diversity" observed in other studies (Barret, 1995; Casagrande, 2002). All four are used in a similar way in other Mexican regions. Interestingly, *Z. officinale* is an introduced plant.

Mode of use: Preparation, plant parts and uses.

Medicinal plants are used internally (orally) as teas, as a decoction or infusion, and externally in the form of topical applications or in the preparation of medicinal baths. Most frequently leaves are used (64%). Fresh or processed leaves are usually applied externally, often together with *aguardiente*, the local sugar-cane based alcoholic drink. For example, fresh leaves of *Ricinus communis* are applied to the head to cure fever, while ground tobacco (*Nicotiana tabacum*) leaves mixed with *aguardiente* are used as a body ointment to treat body aches.

Medicinal teas from the leaves and bark of trees like *Psidium guajava* are used in the treatment of gastrointestinal diseases. Mixtures of different plants are also employed. The mixtures can be composed of plants that address different symptoms of the illness, that have different strength (*ngan'ió*), or that are held to be more efficacious when put together. Knowledge of medicinal plants includes knowledge about storage, processing, quantity, and administration. In some cases the use of plants is based on symbols and meanings that people assign to the species' morphological characteristics.

Some of the species used have been introduced, in some cases so recently that people still remember it. For example, some respondents recalled that *Zingiber officinale*, a species originally from India, was introduced into the community some years ago. In other cases, species that are originally from the Old World are considered natives because people no longer remember their introduction into the area. In many cases, having a Mazatec name is a good indicator that the species has been growing in the area for several generations. Medicinal plants are mostly obtained by collection in the area surrounding the community. Usually none are bought at the weekly market of the municipality or in Huautla de Jiménez.

Among the 39 species analysed, the same use in a different culture (level 1), *in vitro* evidence (2), *in vivo* evidence (3) and clinical evidence (4) were found in 64%, 36%, 36% and 5% of the species, respectively. This indicates that, while there is considerable ethnobotanical evidence highlighting possible pharmacological effects of a species (level 1), practically no clinical evidence (level 4) is available, Where pharmacological information is available for the species used, it often suggests that the local uses are adaptative and beneficial to health.

For example, *Psidium guajava* is used to treat diarrhoea in most tropical countries and its phytochemicals have been widely studied. An extract of the leaves has shown antimicrobial activity against *Staphylococcus aureus* (Colliere, 1949), some enterobacteria (Cáceres et al., 1993), and inhibition of cell growth in other cell cultures (Nickel, 1959; Malcolm and Sofowora, 1969; Singh, 1984). *In vivo* studies of the leaf extract from *Psidium guajava* have also shown mild sedative and antispasmodic properties (Lutterodt, 1992). It has been suggested that the flavonoid quercetin, and its derivatives, are linked to the antimicrobial and

antispasmodic properties of *Psidium guajava* (Khadem and Mohammed, 1958; Berlin and Berlin, 1996). Finally clinical studies demonstrated the medicinal value of *P. guajava* especially in the management of diarrhoea (Heinrich, 1998; Lozoya et al., 2002).

Zingiber officinale is used to treat nausea, vomiting, mucoid diarrhoea, and also for the common cold and cough. Similar uses have been documented cross-culturally in Central and South America (Duke and Vasquez, 1994; Arvigo and Balick, 1998) and elsewhere. This species is well known for its antimicrobial, antipyretic, anti-inflammatory and hypoglycaemic properties (Mascolo et al., 1989; Young et al., 2005). 8-Gingerol, one of the chemicals responsible for ginger's pungent taste, has hepatoprotective properties (de Padua et al., 1999). Ginger has been found effective in the treatment of pregnancy-induced and postoperative nausea and vomiting (White, 2007). The acetone extract and gingerols have been shown to stimulate gastrointestinal motility *in vivo* (de Padua et al., 1999).

The leaves of *Persea americana* are used to treat sprains and fractured bones. In a recent study, an extract from the leaves of this species showed *in vivo* analgesic and anti-inflammatory effects (Adeyemi et al., 2002). Avocado constituents were found to prevent the inhibition of the production of matrix molecules in osteoarthritis osteoblasts and chondrocytes and it was suggested that these compounds could promote cartilage repair (Henrotin et al., 2006). A mixture of unsaponifiable materials from soybean and *Persea americana* has been proposed as a treatment for periodontitis, and is also used for arthritis pain (Bruneton, 1995).

The use of *Chenopodium ambrosioides* against gastrointestinal parasites has been documented widely in Central and South America (Morton, 1981). The essential oil of this species contains anthelmintic but also neurotoxic ascaridol (Montoya-Cabrera et al., 1996). Extracts showed *in vitro* nematocidal activity (MacDonald et al., 2004).

The leaves of *Tagetes erecta* are used to prepare a bath to treat fever. The topical medicinal use of this species has been documented in India for earache and eye infections (Caius, 1940) in China for conjunctivitis and mumps (Duke and Ayensu, 1985), and in Belize for fever, common cold, flu and

diarrhoea in children (Arvigo and Balick, 1998). Several flavonoids have been isolated from *T. erecta*. This class of compounds are known to have an anti-inflammatory effect by inhibiting the arachidonic acid cascade (Della Loggia et al., 1986; Khan, 1999). Khan (1999) showed that an ethanolic crude extract of *Tagetes erecta* leaves and petals has in vitro anti-platelet aggregating effects and significant anti-inflammatory and analgesic activity in the treatment of hallux abducto valgus [("an enlarged and deformed knuckle joint of the great toe (first metatarsophalangeal joint) with overlying bursitis" (Walton, Barondess et al, 1994)].

Overall, considerable evidence exists that the species have relevant pharmacological effects and in a few cases clinical evidence is available.

Species with Toxicological risk

Aristolochia odoratissima and *A.a pentandra* are among the most frequently mentioned species and used to treat a wide range of conditions affecting the stomach and the digestive system. Decoctions of the roots of *Aristolochia* species are commonly used as a stomachic, emmenagogue and febbrifuge in other cultures (de Padua et al., 1999, Leonti 2002, Leonti et al. 2001). Members of the genus contain aristolochic acid, notorious for its long-term nephrotoxicity, carcinogenicity and mutagenicity (Chen, 2000; Grollman et al., 2007). People clearly have observed beneficial short term effects following the use of these plants, but are unaware of the long term toxic effects since the period until clinical symptoms are noted make it impossible for an observer to establish a causal link.

INSERT TABLE 2 HERE

3.2 Chemically defined medicine

Respondents cited 81 different CDMs, of these 36 were mentioned more than once (Table 3). As in case of the herbal medicine, few CDMs at the top of the list are known widely: Neo-melubrina®[i], Terramicina®, 666®, Mejoral® and Alka-Seltzer®.

Four main categories encompass most of the pharmaceuticals cited by respondents: analgesics and antipyretics, antibiotics, anti-histaminics, and vitamins. The prevalence of these categories matches well the epidemiological statistics from the health clinic, and the salient illnesses in the community as elicited through freelisting (Table 4).

CDMs are mostly used internally as capsule, tablets, or injections. The external use of topical creams is far less common. Injections are widely believed to be more powerful, having more *ngan'ió* than tablets, as recorded in many regions of South and Central America. Because CDMs are very expensive when compared to local income, in the small *tiendas* in Paloma Alta they are sold loosely in quantities smaller than the ones contained in the original package.

Knowledge on the use is acquired from sellers, whether at a little shop or a pharmacy, through advice within the social network and through empirical use. Often people conserve little papers with the name of a CDM in order not to forget it when needed. CDMs are administered until symptoms reduce or vanish. No symbolic use based on their colours, shape or taste was observed or recorded.

Analgesics and antipyretics

NSAIDs

The use of several nonsteroidal anti-inflammatory drugs (NSAIDs) was documented in this study. Metamizole sodium, an aminopyrine derived compound, is the active ingredient of Neomelubrina®, Prodolina®, and Conmel® (Rodríguez-Carranza, 2005). In Paloma Alta these CDMs are used orally and injected to treat fever, headache, belly cramps, toothaches and body aches. Injections are preferred when the fever or the pains are deemed stronger. This compound has analgesic, antipyretic, and moderate anti-inflammatory effects. It can increase the pain threshold of the dentary pulp up to 50% and specifically inhibits cerebral cycloxygenase, which causes persistent antipyretic effect (Paroli, 1997).

Acetylsalicylic acid, the prototype of NSAIDs, has very well known analgesic, antipyretic and anti-inflammatory properties (Munson, 1996). It is one of the active ingredients of several CDMs used in Paloma Alta to treat fever: Aspirin®, Alka-seltzer®, 666® and Cafi-aspirin®. Alka-seltzer® also contains sodium bicarbonate, an anti-acid, and accordingly is also used to relieve nausea and heartburn. 666® tablets combine acetylsalicylic acid, with paracetamol, caffeine, and chlorphenylamine maleate. Compounds with analgesics and antipyretics, stimulant and antihistaminic effects, respectively. In Paloma Alta this CDM is used to treat fever, common cold and body aches.

Paracetamol

Its analgesic, antipyretic and minor anti-inflammatory effects are very well documented (Munson 1996). Mazatecs in Paloma Alta treat fever, headaches and common cold with paracetamol-containing CDMs like XL-3® and Desenfriol®. Both also contain an anti-histaminic and an adrenergic agonist. The latter has a nasal decongestant effect, but also has dangerous side-effects. Paracetamol lacks many side-effects of acetylsalicylic acid but it can be hepatotoxic, especially in the case of alcohol abuse (Munson, 1996).

Antibiotics

Tetracyclines

They were the broadest-spectrum antibiotics before many pathogens became resistant (Paroli, 1997). In Paloma Alta Terramicina® (oxy-tetracycline) is used to treat the widespread GI infections that are locally recognized by the symptoms of diarrhoea, mucoid diarrhoea, vomiting, and fever.

The use of oxytetracycline in Paloma Alta can be explained only partially by its activity. This compound can be effective against some of the pathogens causing diarrhoeas: *Escherichia coli* strains, *Vibrio cholera* and *Shigella* infections. However, this would hold true only when resistance has not yet developed (Levy, 1984). Oxytetracycline would not be very efficacious for many others of the pathogens causing GI in the

area, but on the contrary, could actually prolong diarrhoeas symptoms. From a biomedical perspective such use cannot be recommended as a general cure as in many cases such infections are self-resolving and/or viral (Chetley, 1995).In addition, very often only a few tablets are administered and the treatment schedule is not completed.

Penicillins

CDMs containing penicillins are used in Paloma Alta to treat infected wounds, or ones associated with fever. Penicillins are antibiotics highly effective in the treatment of an array of bacterial infections (Andriole, 1996), which can produce fever as a symptom. As for the tetracyclines, it is possible that pathogens have not yet developed resistance to penicillins as in other areas where biomedical care has been used more intensively.

Vitamins and minerals

Several CDMs containing Vitamins B-complex are used in Paloma Alta. Their use is based on the syncretism with Mazatec concept of *ngan'io*. Treatment can be prompted by a general feeling of fatigue perceived as a lack of *ngan'io* as the Mazatec term for vitamins, *xki-ngan'io*, highlights well. Fatigue can be a symptom of anaemia. The diet in Paloma Alta and the statistics from the health clinic (Table 1) suggest that anaemia is likely common in these communities. Vitamins are administered as tablets, capsules, liquid solutions, and injections. Vitamins are also freely dispensed to children at the health clinic when they show signs of malnutrition.

In Paloma Alta, some of the CDMs containing B-complex vitamins (Dolo-neurobion® and Bedoyecta-tri®) are also used to treat body aches. Indeed, vitamins of the B group are also neurotrophic and antineuritic and can be used to relieve neuropathies. Moreover, Dolo-neurobion® also contains diclofenac an NSAID specifically recommended to relieve musclular-skeletal pains. Neuropathies and muscular-skeletal pains are

generally caused by the heavy loads carried by people during their daily tasks, as suggested by the high incidence of dorsopathies documented by the health clinic.

INSERT TABLE 3 HERE

Safety, toxicity and iatrogenic uses

While the CDMs freely dispensed in the health clinic are exclusively essential medicines (WHO, 2007), many medicines used by respondents are not. The active principles contained in the CDMs in Table 3 were compared with the WHO reference list (WHO, 2007) and their regulatory status was assessed especially to see if their use has been restricted or banned in other countries. 65% of the CDMs of Table 3 are non-essential, and this figure suggests that the pharmaceutical pharmacopoeia in Paloma Alta is far from being "the most efficacious, safe and cost-effective" (WHO, 2007), but on the contrary is highly influenced by market forces and by local perceptions on medicines' *strength*. Indeed, there is the widespread belief that CDMs dispensed freely at the health clinic are less strong than the drugs that can be bought in the municipal pharmacy.

Many CDMs contain sodium metamizole (Table 3). Such medications have been withdrawn in many developed countries because they have been shown to carry a small risk of agranulocytosis, an acute disease consisting in a drastic and potentially fatal leukopenia, and they can be easily replaced by safer CDMs.

Irrational formulations of CDMs combining several active compounds with the same, non-synergic, properties are also found. The abuse of alcohol and the high rate of alcoholism in the area increase the risk associated with the use of CDMs. For example, the risk of paracetamol hepatotoxicity, or of intestinal bleeding following the use of acetylsalcylic acid, increases with alcohol abuse.

The empirical use of pharmaceuticals may in many cases be iatrogenic. For example, injecting antibiotics is a common practice even to treat minor ailments most notably in children. Oxy-tetracycline antibiotics are not recommended for children as one possible side-effect consist in damaging calcium-rich organs (Munson, 1996) and can cause abnormalities in tooth enamel (Crowley, 1996). For economic reasons treatment is generally discontinued as soon as the symptoms vanish. The main and well-known risk of such incomplete treatment schedules is the development of bacterial resistance.

Overuse of NSAIDs could also pose health risks. NSAIDs are known for being nephrotoxic and favour gastritis because they damage the prostaglandine-component of the gastric mucosa. The high number of cases of gastritis, a disease typical of wealthy countries, could be explained by a combination of a diet rich in chilli peppers, the abuse of alcohol and coffee drinks, but also by the overuse of NSAIDs.

In sum, it is likely that the empirical assessment of the long-term toxicity of pharmaceuticals is more difficult than the short-term assessment of efficacy in relieving symptoms. In some cases this discrepancy can pose considerable health risks and will negatively impact on public health. The use of both herbal medicines and CDMs also raises concerns about possible interactions, since little is know about the concomitant effect of the species and the CDMs documented in this study.

3.3 Comparison of herbal medicines and patent medicines by group of diseases

In order to understand how and to what extent *traditional* and *modern* medicine have integrated with each other, in this section we discuss and compare the use of both herbal medicine and CDMs using native (emic) categories of illness as elicited by respondents during freelisting (Table 4). The illnesses are further grouped according to the interviews held on explanatory models of illness, disease classification and the pile sorting of illnesses.

INSERT TABLE 4 HERE

Chijin ndae group: - fever, headache, common cold, cough

Fever in Mazatec medicine is both an illness and a symptom of many other illnesses. Fever is perceived as a severe threat to health and treatment is almost always sought. Mazatecs distinguish two kinds: *chijin-ndae* (*calentura caliente*) and *chijin-ndae-njaa* (*calentura fria*). Their aetiology can often be traced back to humoral concepts and, interestingly, fever is also sometimes considered the cause of other illnesses. The two kinds of fever, cold and hot, are believed to be internal and external, respectively. The first is considered a more serious threat to health than the latter.

Treatment of the external fever usually consists of baths in cold water using crushed, foam-forming leaves of *Cestrum nocturnum*, *Tagetes erecta* or *Valeriana scandens* rubbed on the skin. "Cold" leaves such as *Ricinus communis, Eupatorium morifolium* Mill. (Asteraceae) and *Tournefortia glabra* L. (Boraginaceae) are applied on the body especially on the head. Fresh leaves from the same species are also put on the head to treat headache, as it is commonly held that headache is caused by fever. CDMs are often used to treat fever at the same time as medicinal plants. They are usually oral analgesics and antipyretics based on acetyl-salicic acid, paracetamol and sodium metamizole. These are commonly sold in the community's shop, dispensed from the health clinic or bought in the municipal pharmacy (666®, Neo-melubrina®, Aspirina®, Mejorales®).

Treatments of "cold/internal" fever consists of baths in warm water until the body gets heated, a sign indicating that fever is leaving the body. Afterwards, often sodium metamizole based CDMs (Neo-melubrina® and Prodolina®) are injected. In some cases respondents mentioned the use of injectable antibiotics to treat this condition. In these cases fever could be the symptom of a bacterial infection to which treatment is directed. Indeed, as said above, fever is also a symptom that Mazatecs use to discern between different diseases. For example, diarrhoea is differentiated from diarrhoea *with* fever and,

accordingly, treatments can be different. Fever can co-occur with illnesses belonging to different categories such as: GI, respiratory, muscoloskeletal, etc. The centrality of fever in Mazatec ethnoepidemiology could be explained by both human physiology and the importance of heat imbalance in humoral theory. Accordingly, a wide array of herbal and chemically defined medicines are known and used by Mazatecs to treat this condition.

The following is an example of multiple treatments for fever (from PG fieldnotes 18-12-2005):

> A mother telling PG about the last time one of her children had fever: She explains she bathed the child with fresh water containing crushed leaves of *Tagetes erecta.* Later she applied the leaves of *Ricinus communis* topically and rubbed *aguardiente* on the body. Along with these treatments the child was also given 666® and Neo-melubrina® tablets.

Common cold and cough are perceived as strongly linked to fever, which often accompanies them, and consequently fever treatments are also used for cold. Herbal treatments may consist of drinking lemon juice, ginger tea (*Zingiber officinale*) that is said to "burn" the mucous layer, or the topical use of the leaves of *Lycopersicon esculentum* Mill. (Solanaceae) and *Pedilanthus tithymaloides* L. (Poit.) (Euphorbiaceae) on the throat. A variety of analgesics based on paracetamol and acetylsalicylic acid are also used commonly (666®, Mejoral®, XL-3®, Desenfriol®). Vicks-vaporub® is put in small quantities inside the nasal mucosa for treatment.

Chijin-kine-nzua group (Gastrointestinal conditions)*: - diarrhoea, vomiting, dysentery, stomach pains, abdominal pains, and epigastric pains.*

Treatments for gastrointestinal (GI) illnesses are often used for more than one GI condition especially if the treatment is known to relieve symptoms that co-occur among diseases. For example, if a plant species is known to be anti-emetic it will be also used for diarrhoea, as vomiting can come along with it.

Diarrhoea, (*diarrea*; *chijin-faja*), the prototype of this group, is a prevalent disease and a cause of infant morbidity in rural indigenous communities in Mexico. Aetiology is commonly perceived as a broad definition of food poisoning or food incompatibility with the body (*comida que no cae bien*). In some cases respondents held contagion from person to person responsible for the disease. Respondents often linked it with fever and vomiting as they can co-occur or follow each other. Mazatecs recognize diarrhoea as a very dangerous disease and know several herbal treatments to cure it. The most popular herbal treatments are tea made with the leaves or bark of *Psidium guajava.* A beverage made by crushing or boiling *Zingiber officinale* is also prepared. Additionally, people drink a tea obtained by boiling the bark of *Pouteria sapota* (Jacq.) H.E. Moore & Stearn (Sapotaceae), or water where the root of *Aristolochia pentandra* was crushed and filtered. The latter and *Zingiber officinale* are also used to treat vomiting. In Paloma Alta ORT (Oral rehydratation therapy) pre-packaged powder preparations are dispensed by the health clinic in Cañada de Mamey and are often used to self-treat diarrhoeal diseases along with herbal teas. Treatment with CDMs for diarrhoea usually consists in injecting or orally taking Oxy-tetracycline (Terramicina®). Antibiotic treatment is usually discontinued as soon as symptoms disappear.

Chijin-kine-to corresponds to mucoid diarrhoea. This is recognized by pain in the lower abdomen and frequent and small evacuations with mucous and blood in the stool. The perceived aetiology is similar to diarrhoea but more often includes parasite infection (*chu-jaja*; *lombrices*). Treatments cited include the same plants and pharmaceuticals used for diarrhoea. A more specific treatment is a mixture of *Psidium guajava*, *Croton draco* Schltdl. & Cham (Euphorbiaceae), *Bursera simaruba* (L.) Sarg. (Burseraceae) and *Pouteria sapota*. It is believed that these species have more medicinal strength when mixed together. As for normal diarrhoea, oxy-tetracycline is often used. Sometimes antiparasite drugs such as Metronidazol® are used for mucoid diarrhoea.

Chu-jaja group-: parasites .

Parasites are often considered the primary cause of other GI conditions. Parasites are diagnosed when people have peculiar stomach pains, when expelled through vomiting and stools, or when having diarrhoea or mucoid diarrhoea. The category *chu-jaja* probably includes intestinal parasites (worms) but also amoebiasis, as the pathogens of the latter are not visible to the human eye and presents similar symptoms. Most people distinguish only *Ascaris* worms but some other individuals know also about tapeworm (*Taenia sp.*). The treatment of choice is usually by means of CDMs (Albendazol®, Vermus®), but people also use herbs *Chenopodium ambrosioides*, *Psidium guajava*]. In some cases, children feeling discomfort in the 'belly' start self-treatment by eating unripe guajava (*Psidium guajava*) fruit.

Kine-ya group: body aches, cramps, backpain

A group of illnesses/symptoms mainly encompassing limb and musculoskeletal pains is also widely recognized. It includes body aches (*kine-ya*; *dolor de cuerpo*), *Kine ya-ka-nzia* (*dolor de cintura*), cramps (*Chahan-koto*; *calambre*), bone aches (*kine-ya-ninda'*; *dolor de huesos*).

Kine-ya and *kine-ya-ninda'* are often believed to be the result of a thermal shock to the body. For example, the body can be overheated because of hard work and the thermal shock caused by a cold bath can provoke fever and pain of the body. Fever and the common cold are often linked to body pains. Treatments may involve rubbing the body with undiluted *aguardiente*, or alternatively with *aguardiente* in which crushed plants [(*Nicotiana tabacum, Ruta chalepensis* L. (Rutaceae)] were left to simmer. *Balsamo*, a cream for massages sold at markets and in pharmacies, is also used. Medicinal plants [*Ageratum corymbosum* Zuccagni ex Pers. (Asteraceae)*, Piper umbellatum* L. (Piperaceae)*, Lippia myriocephala* Schltdl. & Cham. (Verbenaceae)*, Hyptis mutabilis* (Rich.) Briq. (Lamiaceae)] are put in water that is then boiled to make a steam bath. A tea obtained by boiling *Pimenta dioica* (L.) Merr. (Myrtaceae) leaves is also drunk. When the pain is stronger, analgesics (Neomelubrina®) and antineuritics (Dolo-neurobion®) are injected. Sprains (*torcedura*) are treated with heated leaves of *Persea americana* or *Nicotiana tabacum,* a split onion [*Allium cepa* L. (Liliaceae)] applied locally or a tea made from *Pimenta dioica* leaves.

Often plants with similar or different uses are mixed in order to achieve the desired effects.

4. Conclusion

In this study we looked at the pharmacopoeia of a rural indigenous community. We found that self-treatment is the most common first therapeutic choice in the study site, and is based on a pharmacopoeia of medicinal plants and CDMs that seems to be adapted to local epidemiology and explanatory models of diseases. These findings correspond well to previous work that has shown a high prevalence of self-treatment (Kleinman, 1980; Cosminsky and Scrimshaw, 1980; Waldstein, 2006), the complementary use of pharmaceuticals and medicinal plants (Higgins, 1975; Cosminsky and Scrimshaw, 1980), and the importance of local explanatory models of illnesses in shaping their use (Haak, 1988; Finerman, 1989; Etkin et al., 1990).

Many of the plant species used by Mazatecs have recognized therapeutic properties and in some cases *in vivo* and *in vitro* studies point to well defined pharmacological and in a few cases clinical effects. Likewise, people commonly use CDMs that are effective in the treatment of the most commons health conditions they face. The main classes of CDMs documented in the study are similar to the ones observed elsewhere (Cosminsky and Scrimshaw, 1980; Haak, 1988; Ngokwey, 1995; Okumura et al., 2002) presumably because they reflect similar epidemiological patterns.

Within the pharmacopoeia we found both a small number of medicinal plant species that have serious long-term toxic effects as well as some CDMs that are considered unsafe in developed countries, or that may be used with iatrogenic effect highlighting what could be called maladaptive practices (Lindenbaum, 1979; Fuller and Fuller, 1981).

The data presented in this paper confirm the medical use of many species documented in previous ethnobotanical work in the area (Schultes, 1941). At the same time our work highlights that shamanic healing studied in previous works on Mazatec medicine (Wasson, 1957; Inchaustegui, 1994; Campos and et al., 1994) may not be as prominent in the culture as commonly assumed. There is evidence suggesting that,

at least today, the empirical aspects of Mazatec medicine are as important as symbolic healing [here we use the term "symbolic healing" to refer to the rituals and processes carried out to heal illnesses of personalistic etiology according to Foster's (1976) classification], or they may well be more important now. It is arguable that this could be the result of the dramatic socio-economic changes that happened in the area in the last 50 years. On the other hand, it seems more likely that empirical knowledge, and use of CDMs had integrated with the previously existent empirical use of medicinal plants. Similarly in case of the Mixe, for example, empirical aspects of medicine had been overlooked prior to our systematic ethnobotanical study (Heinrich et al., 1992).

Respondents' use of medicinal plants and CDMs is not merely guided by the distinction between the traditional and the modern, or ancestral knowledge and recently acquired knowledge. Rather, contrasting attributes underlie the dichotomic categorization of medicines as *xki-yoma'* or *xki-tienda*. Indeed, identity, space and economics seem to be relevant attributes when people distinguish, and choose, *between* "our medicines" and "shop's medicine".

Firstly, the contrast between inside and outside that characterizes the categories *xki-yoma'* and *xki-tienda*. *Xki-yoma'* is local medicine. *Xki-tienda* comes from an emically ill-defined distant location outside Mazatec land and its use is often first initiated and recommended by people external to the community (medicine vendors, pharmacists) or to the ethnic group (doctors). This level of contrast has been found in studies with other ethnic groups (Gollin 2001; Calvet 2007).

Secondly, for the Mazatecs the total cost of a medicine is essential as is transportation and the time spent to get it. Mazatecs considers *xki-tienda* expensive while *xki-yoma'* is usually less costly. Medicinal plants are generally collected or exchanged within the community area, or in the surrounding woods. Few pharmaceuticals are available and sold in local shops, or freely dispensed by the health clinic in the nearby community. In many cases people have to travel to the municipality to buy pharmaceuticals. The same name "medicines from the shop" points out their perception as a cash commodity.

Thirdly, a specific *ngan'ió* (*fuerza*),"strength" is believed to be a characteristic, peculiar to each medicine. Mazatecs generally believe that *xki-tienda* have more *ngan'ió* ,than *xki-yoma'*. According to Abse (2007)*"ngan'ió, "strength" or "force,"[…] refers to the variable quantum of energy native to all life forms in one degree or another"*. Here we suggest that the Mazatec apply this concept also to non-living forms as exemplified by the case of CDMs. Notably, shamans (*chjota chjine*), having more *ngan'ió*, are considered the strongest possible treatment and people usually rely on them when the other remedies fail and an initial naturalistic aetiology is reclassified to personalistic.

There is some evidence suggesting that the concept of "strength", as an inherent property of medicines, is found cross-culturally (Alexiades, 1999). In other case, it was found that medicine's efficacy is relative and depends on the matching or compatibility between the latter and the patients (Etkin et al., 1990; Gollin, 2001).

In spite of the above mentioned cognitive distinction between *xki-yoma'* and *xki-tienda*, the *contemporaneous* use of *both* medicines according Mazatec concepts of body processes and disease suggests a malleable and integrated corpus of medical knowledge and therapeutic behaviour.

With the increasing integration of the Mazatecs with the outside world, the balance between the two types of medicines is constantly changing, but helps the Mazatecs in their struggle for health. For each medicine, access and perceived strength fall within a two-dimensional continuum ranging from very accessible and very efficacious medicine and inaccessible and inefficacious medicines. Access includes costs and theoretical and practical knowledge on the use of the medicines. In the Mazatec's case, CDMs complement the autochthonous tradition of herbal medicine. The differences on medicines' access and perception of their "strength" influence treatment choice and favours complementarity and the integrated use of these two conceptually very distinct elements of today's Mazatec medicine. Overall, ethnopharmacology needs to embrace the integration of multiple form of medicine on a local level. Our study suggests that when looking at complex pluralistic medical system an approach that goes beyond the externally imposed

dichotomic categories of traditional and modern medicine can be very useful to shed light on other dimensions that underlie the use of medicines.

References

Abreu P, MAtthew S, González T, Costa D, Segundo MA, Fernandes E. 2006. Anti-inflammatory and antioxidant activity of a medicinal tincture from *Pedilanthus tithymaloides*. Life Science 78(14):1578-1585.

Abse E. 2007. Toward Where the Sun Hides: the Rise of Sorcery and Transformations of Mazatec Religious Life. University of Virginia, Charlottesville, VA.

Adeyemi OO, Okpo SO, Ogunti OO. 2002. Analgesic and anti-inflammatory effects of the acqueous extract of leaves of *Persea americana* Mill. (Lauraceae). Fitoterapia 73:375-380.

Akinpelu DA. 2000. Antimicrobial activity of *Bryophyllum pinnatum* leaves. Fitoterapia 71(2):193-194.

Alexiades M. 1999. Ethnobotany of the Ese Eja: Plants, Health, and Change in an Amazonian Society. City University of New York.

Amin KMY, Singhal KC, Chandra OM. 1984. The central effect of *Lycopersicon esculentum* (tomato) leaves. Indian Journal of Pharmacology 16(3):148-152.

Andersen R. 1995. Revisiting the behavioural model and access to medical care: does it matter? Journal of Health and Social Behaviour 36(1):1-10.

Andrade-Cetto A, Wiedenfeld H. 2001. Hypoglycemic effect of *Cecropia obtusifolia* on streptozotocin diabetic rats. Journal of Ethnopharmacology 78(2-3):145-149.

Andriole VT. 1996. Curent infectious disease drugs. Current Medicine, Philadelphia.

Arvigo RDN, Balick MJ. 1998. Rainforest remedies. One hundred healing herbs of Belize. Lotus Press, Twin Lakes, Wisconsin.

Atta AH, Alkofahi A. 1998. Anti-nociceptive and anti-inflammatory effects of some Jordanian medicinal plants extracts. Journal of Ethnopharmacology 60:117-124.

Barret B. 1995. Herbal knowledge on the Nicaragua Atlantic coast: consensus within diversity. Journal of Community Health 20(5):403-421.

Behm H. 1980. Socio-economic determinants of mortality in Latin America. Population Bulletin 13:1-15.

Berlin EA, Berlin B. 1996. Medical ethnobiology of the highland Maya of Chiapas, Mexico: the gastrointestinal diseases. Princeton University Press, Princeton, NJ.

Berlin E-A, Berlin B. 2005. Some field methods in medical ethnobiology. Field Methods 17(3):235-268.

Boege E. 1988. Los mazatecos ante la nacion. Siglo veintiuno editores, Mexico DF.

Borgatti S. 1996. ANTHROPAC 4.0 Methods guide. Analytyc Technologies, Natick, MA.

Bronfman M. 1992. Infant mortality and crisis in Mexico. International Journal of Health Services 22(1):157-167.

Bruneton J. 1995. Pharmacognosy, Phyotochemistry, Medicinal plants. Lavoisier, Paris.

Burkill JD. 1966. A Dictionary of the Economic Products of the Malay Peninsula. Art Printing Works, Kuala Lumpur.

Cabrera A, Inchaustegui C, Garcia A, Toledeo V. 2001. Etnoecologia Mazateca: Una approcimacion al complejo cosmus-corpus-praxis. Etnoecologica 6(8):61-83.

Cáceres A, Fletes L, Aguilar L, Ramirez O, Fugueroa L, Taracena A.M., Samoya B. 1993. Plants used in Guatemala for the treatment of gastrointestinal disorders. 3. Confirmation of activity against enterobacteria of 16 plants. Journal of Ethnopharmacology 38:31-38.

Caius JF. 1940. The medicinal and poisonous Compositae of India. Journal of Bombay Natural History Society 41:607.

Camporese A, Balick MJ, Arvigo R, Esposito RG, Morsellino N, De Simone F, Tubaro A. 2003. Screening of anti-bacterial activity of medicinal plants from Belize (Central America). Journal of Ethnopharmacology 87(1):103-107.

Campos V, et al. 1994. La Medicina Tradicional de los Pueblos Indígenas de Mexico. Instituto Nacional Indigenista., Mexico D.F.

Casagrande DG. 2002. Ecology, cognition and cultural transmission of Tzeltal Maya medicinal plant knowledge. Athens, Georgia University.

Chen JK. 2000. Neophropathy associated with the use of *Aristolochia*. Herbal Gram 48:44-45.

Chetley A. 1995. Problem drugs. Health Action International and Zed books, London.

Cimanga K, Kambu K, Tona L, Apers S, De Bruyne T, Hermans N, Totte J, Pieters L, Vlietinck AJ. 2002. Correlation between chemical composition and antibacterial activity of essential oils of some aromatic medicinal plants growing in the Democratic Republic of Congo. Journal of Ethnopharmacology 79:213-220.

Colliere WA. 1949. The antibiotic actions of plants, especially the higher plants, with results with Indonesian plants. Chronicle of Nature 105:8-19.

Cosminsky S, Scrimshaw M. 1980. Medical pluralism on a Guatemalan plantation. Social Science and Medicine 14B:267.

Costa M, Di Stasi LC, Kirizawa M, Mendaçolli SL, Gomes C, Trolin G. 1989. Screening in mice of some medicinal plants used for analgesic purposes in the state of Sao Paolo Part II. Journal of Ethnopharmacology 27:25-33.

Crowley L. 1996. Introduction to human disease. Jones and Bartlett, Sudbury, Massachussetts.

de Castillo MC, de Allori CG, de Gutierrez RC, de Saab OA, de Fernandez NP, de Ruiz CS, Holgado AP, de Nader OM. 2000. Bactericidal activity of lemon juice and lemon derivatives against Vibrio cholera. Biological and Pharmaceutical Bulletin 23(10):1235-1238.

de Padua LS, bunyapraphatsara N, Lemmens RHMJ. 1999. PROSEA 12: 'Medicinal and poisonous plants'. Backhuy Publisher, Leiden.

Della Loggia R, Tubaro A, Dri P, Zilli C, Del Negro P. 1986. The role of flavonoids in the anti-inflammatory activity of *Chamomilla recutita*. In: Biochemical , pharmacological and structure activity relationships and medicinal properties. Cody V, Middleton E, Harborne JB, editors, Alan R. Liss, New York.

Duke JA, Ayensu ES. 1985. Medicinal plants of China. Reference Publication, Algonac, Michigan.

Duke JA, Vasquez R. 1994. Amazonian ethnobotanical dictionary. CRC press, Boca Raton, Florida.

Elnima EI, Ahmed SA, Mekkawi AG, Mossa JS. 1983. The antimicrobial activity of garlic and onion extracts. Pharmazie 38(11):747-748.

Emim JA, Oliveira AB, Lapa AJ. 1994. Pharmacological evaluation of the anti-inflammatory activity of a *citrus* bioflavonoid, hesperidin, and the isoflavonoids, duartin and claussequinone, in rats and mice. The Journal of Pharmacy and Pharmacology 46(2):118-122.

Estrada, A. 1981. María Sabina. Her Life and Chants. Ross-Ericson Inc. Santa Barbara (CA)

Etkin N. 1996. Ethnopharmacology: the conjuction of medical ethnography and the biology of therapeutical action. In: Medical Antrhopology. Contemporary theory and method. Sargent CF, Johnson TM, editors, Praeger, Westport, Connecticut.

Etkin N, Ross PJ, Muazzumu I. 1990. The indigenization of pharmaceuticals: therapeutic transition in rural Hausaland. Social Science and Medicine 30(8):919-928.

Fabrega H, Silver D. 1973. Illness and shamanistic curing in Zinacantan: an ethnomedical analysis. University Press, Stanford.

Feinberg B. 2003. The Devil's Book of Culture: History, Mushrooms, and Caves in Southern Mexico. University of Texas, Austin.

Fernan-Nuez M. 1927. A contribution of helminthic therapy. Journal of the American Medical Association 14:903.

Finerman R. 1989. Tracing home-based health care change in an Andean indian community. Medical Anthropology Quarterly 3(2):162-174.

Frei B, Baltisberger M, Sticher O, Heinrich M. 1998. Medical ethnobotany of the Zapotecs of the Isthmus-Sierra (Oaxaca, Mexico): documentation and assessment of indigenous uses. Journal of Ethnopharmacology 62:149-165.

Fuller GK, Fuller DC. 1981. Hydatid disease in Ethiopia: epidemiological findings and ethnographic observations of disease transmission in Southwestern Ethiopia. Medical Anthropology 5:293-312.

Galati EM, Monforte MT, Kirjavainen S, Forestieri AM, Trovato A, Tripodo MM. 1994. Biological effects of hesperidin, a *citrus* flavonoid. (Note I): antiinflammatory and analgesic activity. Farmaco 40(11):709-712.

Gereffi G. 1982. The pharmaceutical industry and depency in the third world. Princeton University Press, N.J.

Germosén-Robineau. 1996. Pharmacopée végétale caribéenne. Désormeaux, Fort-de-France.

Gish O, Feller LL. 1979. Planning pharmaceuticals for primary health care: the supply and utilization of drugs in the third world. American public health association, Washington DC.

Gollin L. 2001. The taste and smell of Taban Kenyah (Kenyah medicine): an exploration of chemosensory selection criteria for medicinal plants among the Kenyah Leppo' Ke of East Kalimantan, Borneo, Indonesia. University of Hawaii, Manoa.

Grollman AP, Shibutani S, Moriya M, Miller F, Wu L, Moll USN, Fernandes A, Rosenquist T, Medverec Z, Jakovina K, Brdar B, Slade N, Turesky RJ, Goodenough AK, Rieger R, Vukelic M, Jelakovic B. 2007. Aristolochic acid and the etiology of endemic (Balkan) nephropathy. Proceedings of the National Academy of Sciences 104(29):12129-12134.

Gupta MP. 1995. 270 Plantas medicinales iberoamericanas. SECAB, Santafe' de Bogota', Colombia.

Haak H. 1988. Pharmaceuticals in two Brazilian villages lay practices and perceptions. Social Science and Medicine 27(12):1415-1427.

Heinrich M. 1998. Plants as antidiarrhoeals in medicine and diet. In: 'Plants for Food and Medicine', Proceedings from a joint meeting of the Society for Economic Botany and the International Society for Ethnopharmacology. H.D.V.Prendergast, Etkin N, D.R.Harris, P.J.Houghton, editors, Royal Botanic Gardens, Kew, UK, London. 17-30.

Heinrich, M.2009 . Ethnopharmacology and drug development. Invited MS for Comprehensive Natural Products Chemistry II (EDITORS-IN-CHIEF: Lewis N. Mander, Australia and Hung-Wen (Ben) Liu, USA Volume 6: Discovery, Development and Modification of Bioactivity. Volume Editor: Robert Verpoorte

Heinrich M, Ankli A, Frei B, Weimann C., Sticher O. 1998. Medicinal plants in Mexico: Healers' consensus and cultural importance. Social Science and Medicine 47:1863-1875.

Heinrich M, Rimpler M., Antonio-Barrera N. 1992. Indigenous phytotherapy of gastrointestinal disorders in a Mixe Lowland community. Journal of Ethnopharmacology 36:63-80.

Henrotin YE, Deberg Ma, Crielaard JM, Piccardi NMP, Sanchez C. 2006. Avocado/soybean unsaponifiables prevent the inhibitory effect of osteoarthritic subchondral osteoblasts on aggrecan and type II collagen synthesis by chondrocytes. The Journal of Rhemautology 33(8):1668-1678.

Higgins CM. 1975. Integrative Aspects of Folk and Western Medicine among the Urban Poor of Oaxaca. Anthropological Quarterly 48(1):31-37.

IMSS health clinic report. 2005. Informacion basica. Cañada de Mamey..

Inchaustegui C. 1994. La mesa de planta: cosmogonia y curanderismo entre los Mazatecos de Oaxaca. Instituto Oaxaqueño de las Culturas, Oaxaca.

Islam M, Haque M, Mosaddik M. 2003. Cytotoxicity and antibacterial activity of *Sida rhombifolia* (Malvaceae) grown in Bangladesh. Phytotherapy Research 17(8):973-975.

Jones K. 2007. Review of sangre de drago (*Croton lechleri*) a South american tree sap in the treatment of diarrhea, inflammation,insect bites, viral infections, and wounds:traditional uses to clinical research. Journal of Alternative and Complementary Medicine 9(6):877-896.

Kamen-Kaye D. 1975. Why Not? A Primitive Form of Tobacco Still in Use in Venezuela. Economic Botany 29:47-68.

Khadem HE, Mohammed YS. 1958. Constituents of the leaves of *Psidium guajava* L. Part II. Quercetin, Evicularin, and Guajaverin. Journal of Chemical Society:3320-3323.

Khan MT. 1999. Phytochemical and biological studies of *Tagetes erecta* and its clinical evaluation in the treatment of hallux abducto valgus and its associated condition bunion. School of Pharmacy, University of London, London.

Kim JH. 1997. Anti-bacterial action of onion (*Allium cepa* L.) extracts against oral pathogenic bacteria. The Journal of Nihon University School of Dentistry 39(3):136-141.

Kleinman A. 1980. Patients and healers in the context of culture. University of California Press, Berkeley.

Kufer J, Forther H, Poll H, Heinrich M. 2005. Historical and modern plant uses -the example of the Ch'orti' Maya and Ladinos in Eastern Guatemala. Journal of Pharmacy and Pharmacology 57:1127-1152.

Leonti M. 2002. Moko/La rosa negra, ethnobotany of the Popoluca, Veracruz Mexico. Swiss Federal Institute of Technology, Zurich.

Leonti, M., Vibrans H., Sticher O. Heinrich M. 2001. Ethnopharmacology of the Popoluca, Mexico: An evaluation. Journal of Pharmacy and Pharmacology 53: 1653 - 1669.

Leslie C. 1976. Asian medical systems. University of California Press, Berkeley, Los Angeles, London.

Levy SB. 1984. Resistance to the tetracyclines. In: Antimicrobial drug resistance. Bryan LE, editor, Accademic Press, New York.

Lindenbaum S. 1979. Kuru sorcery: disease and danger in the New Guinea Highlands. Mayfield, Palo Alto, Ca.

Logan K. 1988. 'Casi como doctor': pharmacists and their clients in a Mexican urban context. In: The context of medicines in developing countries. Van der Geest S, Whyte RS, editors, Kluwer Academic Publisher, Dordrecht/Boston/London.

Lorenzetti BB, Souza GEP, Sarti SJ, Santos-Filho D, Ferreira SH. 1991. Myrcene mimics the peripheral analgesics effects of lemongrass tea. Journal of Ethnopharmacology 34:43-48.

Lozoya X, Reyes-Morales H, Chávez-Soto MA, Martínez-García MC, Soto-González Y, Doubova SV. 2002. Intestinal anti-spasmodic effect of a phytodrug of *Psidium guajava* folia in the treatment of acute diarrheic disease. Journal of Ethnopharmacology 83:19-24.

Lutterodt GD. 1992. Inhibition of Microlax-induced experimental diarrhoea with narcotic-like extracts of *Psidium guajava* leaf in rats. Journal of Ethnopharmacology 83:19-24.

MacDonald D, VanCrey K, Harrison P, Rangachari PK, Rosenfeld J, Warren C, Sorger G. 2004. Ascaridole-less infusions of *Chenopodium ambrosioides* contain a nematocide(s) that is(are) not toxic to mammalian smooth muscle. Journal of Ethnopharmacology 92(2-3):215-221.

Maffi L. 1994. A linguistic analysis of Tzeltal Maya ethnosymptomatology. University of California, Berkley. PhD thesis

Malcolm SA, Sofowora EA. 1969. Antimicrobial activity of selected Nigerian folk remedies and their constituent plants. Llpydia 32:512-517.

Mascolo N, Jain R, S.C.Jain, Capasso F. 1989. Ethnopharmacological investigation of ginger (*Zingiber officinale*). Journal of Ethnopharmacology 27:129-140.

McElroy A, Toownsend PK. 2004. Medical Anthropology in Ecological perspective. Westview Press, Boulder, CO.

Mehta D. 2007. British National Formulary. Pharmaceutical Press, London.

Mimaki Y, Watanabe K, Ando Y, Sakuma C, Sashida Y, Furuya S, Sakagami H. 2001. Flavonol glycosides and steroidal saponins from the leaves of *Cestrum nocturnum* and their cytotoxicity. Journal of Natural Products 64:17-21.

Moerman DE. 1996. An analysis of the food plants and drug plants of native North America. Journal of Ethnopharmacology 52:1-22.

Montoya-Cabrera M, Escalante-Galindo P, Meckes-Fisher M, Sánchez-Vaca G, Flores-Alvarez E, Reynoso-García M. 1996. [Fatal poisoning caused by oil of epazote, *Chenopodium graveolens*]. Gaceta Médica de México 132(4):433-437.

Morton JF. 1981. Atlas of medicinal plants of middle America, Bahamas to Yucatan. C. Thomas, Springfield, IL.

Munson PL. 1996. Principles of pharmacology. Chapman and Hall, New York.

Nagata KM. 1971. Hawaiian Medicinal Plants. Economic Botany 25:245-254.

Navarro V, Villareal M, Rojas G, Lozoya X. 1996. Antimicrobial evaluation of some plants used in Mexican traditional medicine for the treatment of infectious diseases. Journal of Ethnopharmacology 53(3):143-147.

Neiburg FG. 1988. Identidad y conflicto en la Sierra Mazateca, el caso de los ancianos de San Jose' Tenango. Instituto Nacional de Antropologia y Historia, Mexico city.

Ngokwey N. 1995. Home remedies and doctors' remedies in Feira (Brazil). Social Science and Medicine 40(8):1141-1153.

Nickel LG. 1959. Antimicrobial activity of vascular plants. Economic Botany 13:281-318.

Ojewole JA. 2005. Antinociceptive, anti-inflammatory and antidiabetic effects of *Bryophyllum pinnatum* (Crassulaceae) leaf aqueous extract. Journal of Ethnopharmacology 99(1):13-19.

Okumura J, Wakai S, Umenai T. 2002. Drug utilisation and self medication in rural communities in Vietnam. Social Science and Medicine 54:1875-1886.

Oliveira DR, Leitão GG, Santos SS, Bizzo HR, Lopes D, Alviano CS, Alviano DS, Leitão SG. 2006. Ethnopharmacological study of two *Lippia* species from Oriximiná, Brazil. Journal of Ethnopharmacology 108(1):103-108.

Ortiz de Montellano B, Browner CH. 1985. Chemical bases for medicinal plant use in Oaxaca, Mexico. Journal of Ethnopharmacology 13:57-88.

Paroli E. 1997. Farmacologia. Societa' editrice universo, Roma.

Perez-Guerrero C, Herrera M-D, Ortiz-Rafael, Alvarez de Sotomayor M, Fernandez M-A. 2001. A pharmacological study of *Cecropia obtusifolia* Bertol aqueous extract. Journal of Ethnopharmacology 76(3):279-284.

Plotkin MJ. 1994. Tales of a shaman's apprentice. Penguin Books, New York.

Prabuseenivasan S, Javakumar M, Ignacimuthu S. 2006. In vitro antibacterial activity of some plant essential oils. BMC Complementary and Alternative Medicine(6):39.

Quadros MR, Souza-Brito AR, Queiroz ML. 1999. *Petiveria alliacea* L. extract protects mice against Listeria monocytogenes infection--effects on bone marrow progenitor cells. Immunopharmacology and Immunotoxicology 21(1):109-124.

Revilla-Monsalve MC, Andrade-Cetto A, Palomino-Garibay MA, Weidenfeld H, Islas-Andrade S. 2007. Hypoglycemic effect of *Cecropia obtusifolia* Bertol aqueous extracts on type 2 diabetic patients. Journal of Ethnopharmacology 11(3):636-640.

Rodríguez-Carranza RR. 2005. Vademecum Academico de Medicamentos. McGrawHill, Facultad de medicina UNAM:Mexico D.F.

Samal PK, Dhyani PP. 2006. Gender in the management of indigenous knowledge: reflections from Indian Central Himalaya. Current Science On-Line 91(1):104-108.

Schultes RE. 1941. Economic aspects of the flora of Northeast Oaxaca. University of Harvard, Cambridge, MA.

Schultes RE, Raffauf RF. 1990. The Healing Forest: Medicinal and Toxic Plants of the Northwest Amazonia. Cioscorides Press.

Sharma JN, Srivastava KC, Gan EK. 1994. Suppressive effects of eugenol and ginger oil on arthritic rats. Pharmacology 49(5):314-318.

Singh KV. 1984. Effects of leaf extracts of some higher plants on spore germination of Ustillago maides. Fitoterapia 55(5):189-192.

SPM swiss pharmaceutical society. 2004. Index nominum.International drug directory. Medpharm .Scientific publishers, Stuttgart.

SSA – Segeretería de Salud (2004). Anexo estadisticos. Salud Mexico 2004. SSA website. <www.salud.gob.mx/unidades/evaluacion/saludmex2004/anexo.pdf> ; last accessed 15.01.08 [Electronic Citation]

SSA. 2006. Estadisticas de morbilidad estatal: Oaxaca.

Stoner BP. 1986. Understanding medical systems: traditional, modern, and syncretic health care alternatives in medically pluralistic societies. Medical Anthropology Quarterly 17(2):44-48.

Suarez UA, Ulate MG, Ciccio JF. 1997. Effects of acute and subacute administration of *Pimenta dioica* (Myrtaceae) extracts on normal and hypertensive albino rats. Revista de Biologia Tropical 44-45:39-45.

Thomas E, Vandebroek I. 2006. Guia de plantas medicinales de los Yucares y Trinitarios del territorio indigena parque nacional Isiboro-Secure, Bolivia. Sirena, Santa Cruz , Bolivia.

Tona L, Kambu K, Ngimbi N, Mesia K, Penge O, Lusakibanza M, Cimanga K, De Bruyne T, Apers S, Totte J, Pieters L, Vlietinck A. 2000. Antiamoebic and spasmolytic activities of extracts from some antidiarrhoeal traditional preparations used in Kinshasa, Congo. Phytomedicine 7(1):31-38.

Trotter RT, Logan MH. 1986. Informant consensus: a new approach for identifying potentially effective medicinal plants. In: Plants in indigenous diet and medicine. Etkin N, editor, Gordon and Breach (Redgrave), New York.

UNAM. 2007. Dicionario de especialidades farmaceuticas. Facultad de medicina UNAM. <http://www.facmed.unam.mx/bmnd/dirijo.php?bib_vv=6> , last accessed 10-10-2007. [Electronic Citation]

Van der Geest S. 1987. Self-care and the informal sale of drugs in South Cameroon. Social Science and Medicine 25(3):293-305.

Van Than C, Murav'eva DA. 1990. *Cestrum nocturnum* in Vietnamese flora as a source of steroid saponins. Farmatsiya 39(2):25-27.

Waldstein A. 2006. Mexican migrant ethnopharmacology: Pharmacopeia, classification of medicines and explanations of efficacy. Journal of Ethnopharmacology 108:299-310.

Walton,J., Barondess,J.A., Lock,S. (1994). *The Oxford medical companion.* Oxford, New York, Tokyo: Oxford University Press.

Wasson RG. 1957. Seeking the magic mushroom. *Life,* **13(5):** 100-120.

Weimann C, Heinrich M. 1997. Indigenous medicinal plants in Mexico: the example of Nahua (Sierra de Zongolica). Botanica acta 110(1).

White B. 2007. Ginger: an overview. American Academy of Family Physicians 75:1689-1691.

WHO. 1978. Primary health care: a joint report. WHO, Geneva.

WHO. 2007. Who model list of essential medicines. WHO. <http://www.who.int/medicines/publications/EML15.pdf> , last acces 15.01.08 [Electronic Citation]

Whyte RS, Van der Geest S. 1988. The context of medicines in developing countries. Van der Geest S, Whyte RS, editors, Kluwer Academic Publishers, Dordrecht/Boston/London.

Williams LAD, Gardner MT, Fletcher CK, Naravane A, Gibbs N., Fleshhacker R. 1997. Immunomodulatory activities of Petiveria Alliaceae L. Phytotherapy Research 11:251-253.

Wong W. 1976. Some folk medicinal plants from Trinidad. Economic Botany 30(2):103-142.

Yasunaka K, Abe F, Nagayama A, Okabe H, Lozada-Perez L, Lopez-Villafranco E, Muñiz EE, Aguilar A, Reyes-Chilpa R. 2005. Antibacterial activity of crude extracts from Mexican medicinal plants and purified coumarins and xanthones. Journal of Ethnopharmacology 97(2):293-299.

Young JC, Garro LY. 1982. Variation in the choice of treatment in two Mexican communities. Social Science and Medicine 16(16):1463-1465.

Young H, Luo Y, Chen H., Hsieh W., Liao J., Peng W. 2005. Analgesic and anti-inflammatory activities of [6]-gingerol. Journal of Ethnopharmacology 96:207-210.

Young JC. 1978. Illness categories and action strategies in a Tarascan town. American Ethnologist 5:81-97.

DIAGNOSIS	No of CASES	Incidence (%)
Acute Respiratory infections (IRAS)	845	16.3
Dental cavities	540	10.4
Intestinal amoebiasis	278	5.4
Back pain	180	3.5
Gastritis	130	3.4
Anaemia	80	1.5
Trichomoniasis	80	1.5
Dermatophytosis (fungal infection of the skin)	70	1.4
Traumas	64	1.2
Others	59	1.1
Candidiasis	27	0.5
Acute diarrhoeic diseases	20	0.4
Reumatoid arthritis and other arthropathy	11	0.2
Arterial hypertension	9	0.2
Ascaris	6	0.1
Malnutrition	5	0.1
Diabetes	3	0.1
Tubercoulosis	3	0.1
Scabies	1	0.0

TABLE 1. Cases of visits of the IMSS health clinic in Cañada de Mamey from 2000 to 2004 by diagnosis (4 communities: total population 1035). Incidence was calculated as percentage of cases per year

Local name (Mazatec, Spanish)	Latin name	Use reports during freelisting	Average Rank	Smith's Index	Use reports during open interview	Main uses	Levels of eviedence for local use	Evidences supporting local uses	Voucher
Ndia-sa', Huele de noche	*Cestrum nocturnum* L. (Solanaceae)	18	3.1	0.43	19	The foam-forming leaves are crushed in cold water in order to form a medical bath to treat fever.	?	High levels of saponins have been extracted from the leaves (Mimaki et al., 2001; Van Than, 1990).	142[M]
Ya-tze',Guaya ba	*Psidium guajava* L. (Myrtaceae)	18	3.9	0.37	18	A tea made with the leaves or the bark is used to treat diarrhoea, mucoid diarrhoea, stomach ache and vomiting.	1,2,3,4	SUD (Berlin and Berlin 1996). in vivo antimicrobial activity of extract (Cáceres et al. 1993); extract showed in vivo inhibition of experimental induced diarrhoea (Lutterodt 1992); clinical study showed antispasmodic effect of a phytodrug of P.guajava leaves in the treatment of diarrhoea (Lozoya et al. 2002)	-
Tu-bo	*Zingiber officinale* Roscoe (Zingiberaceae)	19	4.4	0.37	13	A beverage made by crushing or boiling the rhizome is used to treat diarrhoea, stomach ache, vomiting, and nausea. The tea is also used to treat common cold and cough.	1,2,3	SUD (Morton 1981).in vitro the extracs show antibacterial activity (Mascolo et al. 1989) and inhibition of prostaglandin release (Mascolo et al. 1989); in vivo the extract (Mascolo et al. 1989) and gingerol (Young et al. 2005) showed anti-inflammatory and antipyretic activity;	-
Kajma-cha, Guaco	*Aristolochia odoratissima* L. (Aristolochiaceae)	15	3.3	0.33	9	The decoction of the stem is used orally to treat stomach ache and belly cramps	1	SUD (Morton 1981)	330d[M]
Ya-to-no, Arnica	*Pimenta dioica* (L.) Merr. (Myrtaceae)	7	4.0	0.15	3	A tea made with the leaves is used to treat mucoid diarrhoea, back pain and body aches.	1,3	SUD (Morton 1981). in vivo the extracts caused a depression of CNS, analgesic and hypothermic effects (Suarez et al. 1997) ; eugenol has showed in vivo anti-inflammatory effects (Sharma et al.1994)	284[S]
Xka-scion-ko, Flor de	*Tagetes erecta* L.					The leaves are crushed and rubbed in cold water in order to form a medical		SUD (Frei et al. 1998; Arvigo et al. 1998). the extract showed anti-inflammatory and analgesic activity in the treatment of halux abducto valgus	

TABLE 2- continued

Local name (Mazatec; Spanish)	Latin name	Use reports during freelisting	Average Rank	Smith's Index	Use reports during open interviews	Main uses	Levels of eviedence for local use	Evidences supporting local uses	Voucher
Xka-scion-ko, Flor de los muertos	*Tagetes erecta* L. (Asteraceae)	9	4.0	0.14	10	The leaves are crushed and rubbed in cold water in order to form a medical bath to treat fever.	1	SUD (Frei et al. 1998; Arvigo et al. 1998). the extract showed anti-inflammatory and analgesic activity in the treatment of halux abducto valgus (Khan 1999)	220[S]
Xka-najno', Tabaco	*Nicotiana tabacum* L. (Solanaceae)	7	5.1	0.12	5	Ground tobacco leaves mixed with aguardiente are used as a body ointment to treat body aches. The ground leaves are carried to traditional healers who use them to treat witchcraft.	1	SUD (Kamen-Kaye 1975:54; Morton 1981:796; Thomas and Vanderbroek 2006)	13[M]
Xka-ya-to-chu	*Ricinus communis* L. (Euphorbiaceae)	7	4.3	0.12	9	The leaves are applied on the body especially on the head to treat fever and headache	1	SUD (Nagata 1971:252; Germosén-Robineau, 1996)	-
Yo-ma', Aguacatillo	*Persea americana* Mill. (Lauraceae)	7	5.0	0.11	4	The tea made with leaves is used to treat body aches and sprains. Warm leaves can also be applied externally to sprains and fractured bones.	1,2,3	SUD (Wong 1976). The extract showed in vivo anti-inflammatory and analgesic activity (adeyemi et al. 2002). Avocado phytochemicals were found to prevent the inhibition of the production of matrix molecules in osteoarthritis osteoblasts and chondrocytes and it was suggested that these compounds could promote cartilage repair (Henrotin et al. 2006)	256b[M]

Table 2- Continued

TABLE 2- continued

Local name (*Mazatec*, *Spanish*)	Latin name	Use reports during freelisting	Average Rank	Smith's Index	Use reports during open interviews	Main uses	Levels of eviedence for local use	Evidences supporting local uses	Voucher
Ndia-o, *Epazote*	*Chenopodium ambrosioides* L. (Chenopodiaceae)	7	7.3	0.10	4	The tea made with leaves is used to treat grastrointestinal parasites infections.	1,2,3	SUD (Morton 1981). The species contains Ascaridol an antihelmintic compound. Extract shows in vitro nematocidal activity (MacDonald et al. 2004) and in vivo antihelmintic effects (Fernan-Nuez 1927)	-
To-nu-tze-cho-si	*Aristolochia pentandra* Jacq. (Aristolochiaceae)	8	6.4	0.09	5	A beverage made by crushing or boiling the root is used to treat diarrhoea and vomiting.	?		287c[M]
Xka-gijkon-se'	*Valeriana scandens* L. (Valerianaceae)	5	3.6	0.09	5	The leaves are crushed and rubbed in cold water in order to form a medical bath to treat fever.	?		74[M]
Nacha-ni, *Mamey*	*Pouteria sapota* (Jacq.) H.E. Moore & Stearn (Sapotaceae)	4	4.8	0.08	9	A tea made by boiling the bark is used to treat diarrhoea and mucoid diarrhoea.	?		-
Ya-mango, *Mango*	*Mangifera indica* L. (Anacardiaceae)	3	3.3	0.07	2	A tea made by boiling the bark is used to treat diarrhoea.	1,2	SUD (Tona et al. 2000). The exctract showed in vitro antiamoebic and antispasmolytic activities (Tona et al. 2000)	-
Tcha-jo	*Sida rhombifolia* L. (Malvaceae)	4	3.8	0.07	2	Crushed leaves are applied on wounds. The leaves are also rubbed in water to be used as shampoo against hair loss.	2	the extract showed anti-bacterial activity in vitro (Islam et al. 2003)	88[S]

TABLE 2 - CONTINUED

Local name (Mazatec; Spanish)	Latin name	Use reports during freelisting	Average Rank	Smith's Index	Use reports during open interviews	Main uses	Levels of eviedence for local use	Evidences supporting local uses	Voucher
Ya-kon, Cedro	*Cedrela odorata* L. (Meliaceae)	4	6.3	0.06	3	A tea made by boiling the bark is used to treat diarrhoea and mucoid diarrhoea.	?		257a[M]
Xka-ntao	*Artemisia spp*. (Asteraceae)	3	4.3	0.05	6	A te made by boiling the leaves is used to treat stomach ache.	1,2	SUD (Morton, 1981;Weinman and Heinrich, 1996). The extract showed antimicrobial properties in vitro (Navarro et al., 1996; Heinrich 1992b)	-
Ya-ndi-cho	not determined	3	4.3	0.05	0	The sap is applied topically to heal toothache and other body aches	?		-
Ya-in	*Bursera simaruba* (L.) Sarg. (Burseraceae)	3	4.7	0.05	5	A tea made by boiling the bark is used to treat diarrhoea and mucoid diarrhoea	1,2	SUD (Yasunaka et al. 2005). The extract showed antibacterial activity in vitro (Yasunaka et al. 2005; Camporese 2003)	137[S]
Scio-xka	*Mentha spp.* (Lamiaceae)	3	5.7	0.04	9	Leaves are applied locally to treat earache. The tea made by boiling the leaves is used to treat cough.	1,3	SUD (Kufer et al. 2005). The extracts showed analgesic and anti-inflammatory properties in vivo (Atta and Alkofahi 1998)	246[S]
Xu-na-ke	*Piper umbellatum* L. (Piperaceae)	2	4.0	0.04	3	Leaves are boiled to obtain a steam bath used against body pains. The water where the leaves were boiled is poured on wounds as disinfectant	1	SUD (Burkill 1996)	219a[M]

TABLE 2- continued

TABLE 2- continued

Mazatec name	Latin name	Use reports during freelisting	Average Rank	Smith's Index	use reports during open interviews	Main uses	Levels of eviedence for local use	Evidences supporting local uses	Voucher
Xka-ya-ndi	*Petiveria alliacea* L. (Phytolacaceae)	2	2.5	0.04	0	A tea made by boiling the leaves is used as prevention to sickness.	1,3	SUD (Leonti 2002;)the extract showed in vivo protective effects on cells of the immune system (Quadros et al 1999) and immunomodulatory effects (Williams 1997)	84[M]
To-san, Limon	*Citrus aurantifolia* (Christm.) Swingle,*Citrus limon* L. (Brum) (Rutaceae)	2	6.5	0.04	7	Lemon juice is drunk to treat diarrhoea and cough.	1,2	SUD (Morton 1981). Species from the genus Citrus have well known antimicrobial properties (de Castillo et al. 2000; Prabuseenivasan et al. 2006).	-
To-nzu, Cebolla	*Allium cepa* L. (Alliaceae)	2	6.5	0.04	2	An heated split bulb is applied on sprains and the juice on teeth to heal toothache	1,2	SUD (Samal and Dhyani 2006). The extracts showed in-vitro anti-bacterial activity (Kim 1997; Elnima et al. 1983)	-
Ya-to-ia', Guarumbo	*Cecropia obtusifolia* Bertol. (Cecropiaceae)	2	6.5	0.03	1	The tea made with the leaves is used internallly to treat diabetes and externally to heal skin eruptions.	1, 3,4	SUD (Morton 1981).The extract showed hypoglicemic activity in rats (Andrade-Cetto and Weidenfeld 2001) and in patients (Revilla-Monsalve 2007);acqueos extract showed in vivo topical and systemic anti-inflammatory effect (Perez-Guerrero 2001)	314a[M]
Xka-najno'-le-scia', Tabaco amargo	*Neurolaena macrocephala* Sch. Bip. Ex Hemsl. (Asteraceae)	3	7.0	0.03	16	A tea made by boiling the leaves is used to treat diabetes and fever.	?	Sesquiterpene lactones have been isolated from this species (Passreiter et al, 1999).	178[M]

Local name (*Mazatec*, Spanish)	Latin name	Use reports during freelisting	Average Rank	Smith's Index	Use reports during open interviews	Main uses	Levels of eviedence for local use	Evidences supporting local uses	Voucher
<u>Ya-ni</u>	*Croton draco* Schltdl. & Cham. (Euphorbiaceae)	2	6.0	0.03	2	A tea made by boiling the bark is used to treat mucoid diarrhoea.	?	The same use of an affine species, Croton lechleri, has been supported by in vitro and in vivo studies (Jones 2003).	205b[M]
<u>Xak-ninda'</u>	*Pedilanthus tithymaloides* (L.) Poit. (Euphorbiaceae)	3	7.0	0.03	6	The leaves are applied externally to treat cough and inflammed throat.	1, 3	SUD (Morton 1981). A tincture from this species showed in vivo anti-inflammatory activity (Abreu et al. 2006)	274[M]
<u>Xka-ya-luxa</u>, *Naranja*	*Citrus sinensis* (L.) Osbeck (Rutaceae)	3	8.7	0.03	1	A tea prepared by boiling the leaves is used to treat cough	1, 2, 3	SUD (Morton 1981). Species from the genus citrus have antimicrobial activity. Vitamin C promotes mucosal tissue integrity. Citrus flavonoids showed in vivo anti-inflammatory and analgesic activity (Galati et al. 1994; Emim et al 1994).	-
<u>Scio-xka</u>	*Lippia alba* (Mill.) N.E. Br. (Verbenaceae)	2	7.5	0.03	2	A drop of the juice obtained from the leaves is applied inside the ear to treat earache.	1,2,3	the extract showed analgesic activity in vitro (Oliveira et al 2006) and in vivo (Costa et la. 1989)	73[M]
<u>Ya-naxu-tzonga</u>	*Ageratum corymbosum* Zuccagni (Asteraceae)	2	6.5	0.03	4	All the plant is boiled to obtain a steam bath used against body pains and fever.	?	A related species A. conyzoides is used similarly as anti-rheumatic and febrifuge (Gupta 1995)	19[M]
<u>Xka-ya-ne</u>	*Verbesina turbacensis* Kunth (Asteraceae)	2	7.0	0.02	3	The leaves are boiled and applied externally to open wounds.	?		285c[M]

Mazatec name	Latin name	Use reports during freelisting	Average Rank	Smith's Index	Use reports during open interviews	Main uses	Levels of eviedence for local use	Evidences supporting local uses	Voucher
Xka-ya-cho-ti	*Lycopersicon esculentum* Mill. (Solanaceae)	2	6.5	0.02	2	The warm leaves are applied on the throat to treat common cold and cough.	1,3	SUD (Morton 1981). The extract showed analgesic activity in vivo (Amin et al. 1984)	-
Ya-to-twa	*Tournefortia glabra* L. (Boraginaceae)	2	6.5	0.02	5	The leaves are applied on the body especially on the head to treat fever.	?		159b[M]
Xka-ngia'	*Kalanchoe pinnata* (Lam.) Pers. (Bryophyllum pinnatum) (Crassulaceae)	2	9.5	0.01	4	The leaves are applied on the body especially on the head to treat fever. The ground leaves are also applied on open wounds in order to heal them.	1,2,3	SUD (Morton 1981). The extract showed in vitro anti-microbial activity (Akinpelu 2000)and in vivo anti-inflammatory and antinociceptive properties (Ojewole 2005)	29[M]
Ya-naxo-nindo'	*Odontonema callistachyum* (Schltldl. & Cham.) Kuntze (Acanthaceae)	2	7.5	0.01	1	The ground leaves and the stem are applied on open wounds in order to heal them.	1	SUD (Leonti 2001)	35[M]
Xka-listo	*Trimezia steyermarkii* R.C. Foster (Iridaceae)	3	7.3	0.01	5	A bevarage prepared by grounding the bulb in water is used as purgative and antiparasite.	?		54[M]

Mazatec name	Latin name	Use reports during freelisting	Average Rank	Smith's Index	Use reports during open interviews	Main uses	Levels of eviedence for local use	Evidences supporting local uses	Voucher
Xka-limo'	*Cymbopogon citratus* (DC.) Stapf. (Poaceae)	2	7.5	0.01	4	A tea prepared by boiling the leaves is used to treat cough.	1,2,3	SUD (Alcorn 1984). the essential oil showed antibacterial activity in vitro (Cimanga et al. 2002) and analgesics in vivo (Lorenzetti 1991); in vivo the species extract showed analgesic activity (costa et al. 1989)	-
Xka-nindo'	*Pilea microphylla* (L.) Liebm. (Urticaceae)	2	9.0	0.01	7	The leaves are crushed in cold water in order to form a medical bath to treat measles.	?	The use of this species to treat skin eruptions has been documented elsewhere (Morton 1981)	164[M]

TABLE 2 Medicinal plants as elicited through freelisting (FL) by 33 informants (19 males; 14 females; mean-age=47.1 years)
Use reports during freelisting: number of informants that reported the species during freelisting on medicinal plants.
Use reports during open interviews: number of informants that reported the species during open interviews.
Average rank: average rank of the species during freelisting;
SMITH'S index: Smith's index of salience which is a measure of salience that takes into account both the frequency, and the order with which items are listed (Borgatti 1996)
Main uses: short description of main uses according to use reported in UR1 and UR2
Levels of evidence for efficacy of local uses: evidences supporting local uses were searched in literature. 1=same use in different cultures, 2=*in vitro* evidence, 3=*in vivo* evidence, 4=clinical evidence. SUD=same use documented elsewhere.
Voucher: number of voucher specimens Giovannini# deposited at MEXU(M) or at School of Pharmacy (S) herbarium.

TABLE 3

Chemically Defined Medicines (CDMs)	Frequency	Percentage	Average rank	SMITH'S Index	Active principle (INN)	Type	Main use	Formulated medicine	Efficacious	Safe	WHO
NEO-MELUBRINA®	28	65	2.4	0.50	Metamizole sodium	Agc/Apy/spa	Fv, Ha, BC, Ba	c/t, inj	**x**		
TERRAMICINA®	20	47	4.0	0.29	Oxytetracycline	Abio	Di, MD	c/t, inj	?	**x**	
666®	18	42	4.7	0.25	Acetylsalicylic acid, Paracetamol, Caffeine, Chlorphenamine	Agc/Apy/afl, Sti, Hist	Fv, Co, Ba	c/t	**x**	**x**	
MEJORAL®	16	37	3.7	0.24	Paracetamol	Agc/Apy	Fv, Co, Ha	c/t	**x**	**x**	**x**
ALKA-SELTZER®	16	37	3.6	0.24	Acetylsalicylic acid, Sodium bicarbonate, Citric acid	Antiacid and Agc/Apy/afl	Fv, Ha, **Sa , Vo, Ag**	c/t	**x**	**x**	**x**
ASPIRINA®	13	30	3.5	0.21	Acetylsalicylic acid	Agc/Apy/afl	Fv, Ha, Co	c/t	**x**	**x**	**x**
PENICILLINA	9	21	3.7	0.13	Penicillins (generic)	Abio	Fv, Wn, **In**	inj	-	-	-
PRODOLINA®	9	21	3.3	0.12	Metamizole sodium	Agc/Apy/spa	Ta, BC	c/t, inj	**x**		
PENPROCILINA®	7	16	4.7	0.10	Benzylpenicillin	Abio	Fv	inj	?	**x**	**x**
VINO	6	14	2.8	0.09	Iron and vit. B supplement	Vit, Min	Vit	syr	**x**	**x**	
XL-3®	6	14	3.7	0.09	Paracetamol, Phenylephrine chlorhydrate, Chlorphenamine maleate	Agc/Apy, Dec and Hist	Fv, Co	c/t	**x**	**x**	
VICKS-VAPORUB®	6	14	3.7	0.08	Camphor, Menthol, Eucalyptol	Cou/Agc	Co	cr	**x**	**x**	
AMPICILLINA®	5	12	4.4	0.08	Ampicillin	Abio	**Co., In, Ba, Fv, Vit, Br**	inj	?	**x**	**x**
RESPICIL®	7	16	4.3	0.08	Procaine benzyilpenicillin, Metamizole sodium, (Streptomycin?)	Abio, An, Agc/Apy/spa	Fv	inj	?		
TRIBEDOCE®	3	7	1.3	0.07	Cyanocobalamin, Pyridoxine, Thiamine	Vit	Vit	inj	**x**	**x**	

TABLE 3 - CONTINUED

Chemically Defined Medicines (CDMs)	Frequency	Percentage	Average rank	SMITH'S Index	Active principle (INN)	Type		Main use	Formulated medicine	Efficacious	Safe	WHO
TIAMINAL®	2	5	1.5	0.04	Cyanocobalamin,Thiamine, Chlorhydrate lidocaine	Vit, An	**Vit**	inj	**x**	**x**		
TESALON®	4	9	4.3	0.04	Benzonatate	Cou	Cg	c/t	**x**	**x**		
BALSAMO	3	7	2.7	0.04	unknown	-	**BC**	cr	?	-	-	
DESENFRIOL®	5	12	5.0	0.04	Chlorphenamine maleate, Pseudoephedrine sulfate, Paracetamol	Hist, Agc/Apy, nasal Dec	Co	c/t	**x**	**x**		
DRAMAMINE®	2	5	3.0	0.04	Dimenhydrinate	Hist (anti-vomiting)	**Vo**	c/t	**x**	**x**		
CONMEL®	3	7	6.0	0.03	Metamizole sodium	Agc/Apy/Spa	**Ha, Ta**	c/t	**x**			
VOMISIN®	2	5	3.0	0.03	Dimenhydrinate	Hist	**Vo**	c/t	**x**	**x**		
CAFI-ASPIRINA®	2	5	4.0	0.03	Acetylsalicylic acid, Caffeine	Agc/Apy/afl, Sti	**Fv, Ha, Bn, BP**	c/t	**x**	**x**	**x**	
BICARBONATO	2	5	5.5	0.03	Sodium bicarbonate	Antiacid	**Ag**	pow	**x**	**x**		
AVAPENA®	2	5	3.0	0.03	Chloropyramine hydrochloride	Hist	**Ro**	inj	?	**x**		
PEPTO-BISMOL®	2	5	8.0	0.03	Bismuth subsalicylate	Mot	**Di,**	syr	**x**	**x**		
MAGNOPYROL®	2	5	4.0	0.03	Metamizole magnesium	Agc/Apy/spa	**Sa, Ba**	c/t	**x**			
VESATICIL®	2	5	3.5	0.02	undetermined	-	**Wn, Sa, Sw**	?	-	-	-	
LASSANTE	2	5	7.5	0.02	undetermined	-	**Pu**	-	-	-	-	
TEMPRA®	2	5	5.5	0.02	Paracetamol	Agcs/Apys	**Fv, Co, Ta**	c/t	**x**	**x**	**x**	

Chemically Defined Medicines (CDMs)	Frequency	Percentage	Average rank	SMITH'S Index	Active principle (INN)	Type	Main use	Formulated medicine	Efficacious	Safe	WHO
DOLO-NEUROBION®	2	5	7.0	0.02	Diclofenac, thiamine, cyanocobalamin, Pyridoxine	Afl/Agcs/Apy , Vit	**Ba, Vit, Bn, BP**	inj	**x**	**x**	
BEDOYECTA-TRI®	2	5	5.0	0.02	Thiamine, Cyanocobalamin, Pyridoxine	Vit	**Vit**	inj	**x**	**x**	
SUERO	2	5	5.5	0.01	Glucose, Sodium chloride, Potassium chloride	Rehydratation salts	**Vit, Di**	pow	**x**	**x**	**x**
MICOTEX®	2	5	9.5	0.01	Undecylenic acid, Zinc undecylenate, hydroxytetrachloride, aluminium zirconium glycine.	Antimicotic	**Hi**	cr	**x**	?	
VITAMINA	2	5	5.0	0.01	Vit (generally)	-	**Vit**	-	**x**	**x**	-
MERTIOLATE®	2	5	10.0	0.01	Mercurochrome	Antiseptic	**Wn**	tin	**x**		

TABLE 3. Chemically defined medicines as elicited through freelisting (FL) with 43 informants (25 males; 18 females; mean-age=45.8 years).
CDM:chemically defined medicine;
Frequency: frequency of mention during freelisting (FL);
Percentage=percetange of informants that mentioned the item;
Average rank: average rank of the item during FL;
SMITH'S index: Smith's index of salience(Borgatti, 1996);
Active principle (INN): Active principles (International Nonpropietary Names) as found in literature (SPM, 2004; Mehta, 2007; Rodríguez-Carranza, 2005; Unam, 2007)
Type: **Agc**=analgesic , **Apy**=Antipyretic, **Afl**=anti-inflammatory, **Spa**=spasmolitic, **Abio**=antibiotic, **Vit**=Vitamins, **Hist**=antihistaminic, **Min**=minerals, **Cou**= cough suppressant, **Sti**=stimulant, **An**=anaestetics, **Dec**=decongestant, **Mot**=antimotility agent
Efficacious: efficacy of the medicine for local uses: **x**= yes , **?**=unknown; Efficacy was assessed looking at the pharmacological activity of the active ingredients in the literature (Munson, 1996; Rang et al., 2003; Smith and Reynard, 1992; Paroli, 1997).
SAFE: **x**=yes, **?**=unknown. ;
WHO=WHO list of essential medicine (WHO, 2007), codes: **x**=all the ingredients are on the WHO list for the same use category;
Main uses: bold when consensus is low (less than 3 reports for the same use)**Ba**=Body ache, **BB**=broken bones, **BC**=Belly cramps, **BN**=pain of the bones, **BP**=hypertension, **Br**=Bruises golpes torcedura, **Cg**=Cough, **Co**:Common cold, **Cp**=constipation; **Db**=Diabetes, **Di**=Diarrhoea, **Ea**=Ear ache, **Fv**=fever, **Ha**=Headache, **HI**=itching, **MD**=Mucoid diarrhoea, **Na**=Nausea, **Pa**=Panacea, **Pw**=Parasitic, worms, **PU**=Purgative, **Ro**=Erysipela, **Sa**=Stomach ache, **SE**=Skin eruptions, **SN**=Swollen neck glands, **Sp**=Back pain, , **Ta**=Toothache, **Sw**=Swelling, **Vit**=Vitamins, **Vo**=Vomiting, **Wn**=Wounds.

Formulated medicine: form of administration, **cr**=cream, **inj**=injection, **c/t**=capsules or tablets, **syr**=syroup, **pow**=powder, **tin**=tincture;
Registered trademarks (®) are indicated in the text according to our literature search. The trademark symbol is omitted when the name of the CDMs elicited was clearly the name of an active principle or the generic name for a class of medicines.

TABLE 4

ILLNESS: Mazatec	ILLNESS: Spanish	ILLNESS: English	Frequency	Percentage	Average rank	Smith's index	Medicinal plants Use reports during Freelisting	Medicinal plants Use reports during open interviews	CDM use reports during freelisting
CHIJIN-NDAE	*CALENTURA*	FEVER	18	78	3.1	0.66	Cestrum nocturnum (15), Ageratum corymbosum (1), Aristolochia pentandra(1), Eupatorium morifolium(1), Pimenta dioica(1), Ricinus communis(6), Tagetes erecta(8), Tournefortia glabra(2), Valeriana scandens(3), Vitis tilifolia(1)	Ageratum corymbosum (1), Allium sativum (1), Asclepia curassavica (2), Begonia manicata (1), Begonia nelumbifolia (1), Brugmansia candida (1), Citrus limon (1), Cestrum nocturnum (16), Coffea arabica (1), Cymbopogus citratus (1), Eupatorium morifolium (3), Kalonchoe pinnata (2), Neurolaena macrocephala (3), Pilea microphylla (1), Ricinus communis (6), Tagetes erecta (8), Theobroma cacao (2), Tournefortia glabra (3), Valeriana scandens (1), Vitis tilifolia (1).	666® (13), Alka-seltzer® (6), Ampicillina (1), Aspirina® (3), Cafi-aspirina® (1), Mejorales® (13), Neo-melubrina® (13), Penicillina® (5), Penprocillina® (7), Prodolina® (1), Respicil® (4), Tempra® (1), Tesalon® (1), XL-3® (3)
CHIJIN-TZE	*GRIPA*	COMMON COLD	16	70	5.5	0.49	Licopersicon esculentum(1), Pedilanthus tithymaloides (1), Zingiber officinale(2)	Allium sativum (1), Cestrum nocturnum (2), Citrus limon (1), Lippia alba (1), Neurolaena macrocephala (1), Nicotiana tabacum (1), Plantago sp., Zingiber officinale (1).	666® (3), Alka-seltzer® (1), Ampicillina (1), Aspirina® (4), Contac® (1), Desenfriol® (4), Mejorales® (6), Neo-melubrina® (1), Penicillina® (1), Respicil® (1), Tempra® (1), Vicks-Vaporub® (6), XL-3® (3)
CHIJIN-FAJA	*DIARREA*	DIARRHOEA	14	61	5.1	0.44	Aristolochia pentandra(3), Cedrela odorata (4), Citrus limon(1), Croton draco(1), Pimenta dioica(1), Pouteria sapota(3), Psidium guajava(13), Zingiber officinale(14)	Aristolochia odoratissima (1), Bursera simarruba (1), Byrsonima crassifolia (2), Chenopodium ambrosiodes (1), Cissampelos sp. (1), Litsea Gluacescens (1), Mangifera indica (2), Matricaria recutita (2), Mentha sp. (1), Neurolaena macrocephala (1), Oryza sativa (1), Pouteria sapota (5), Psidium guajava (13), Zingiber officinale (7)	Neo-melubrina® (1), Pepto-bismol® (2), Suero-Oral® (1), Terramicina® (14)

TABLE 4- CONTINUED

ILLNESS: Mazatec	ILLNESS: Spanish	ILLNESS: English	Frequency	Percentage	Average rank	Smith's index	Medicinal plants Use reports during Freelisting	Medicinal plants Use reports during open interviews	CDM use reports during freelisting
CHIJIN-KINE-KWA'	*DOLOR-DE-CABEZA*	HEADACHE	16	70	5.8	0.44	Ricinus communis(1)	Cinnamonum verum (1), Begonia sp. (1), Cestrum nocturnum (1), Eupatorium morifolium (2), Kalonchoe pinnata (1), Pilea microphylla (1), Ricinus communis (4), Valeriana scandens (1).	666® (1), Alka-seltzer® (3), Aralen® (1), Aspirina® (9), Cafi-aspirina® (1), Comen® (2), Mejorales® (3), Neo-melubrina® (7), Prodolina® (2), XL-3® (1)
CHIJIN-KINE-NZUA	*DOLOR-DE-ESTOMAGO*	STOMACH ACHE	11	48	6.3	0.32	Aristolochia pentandra(1), Aristolochia odoratissima(7), Artemisia sp(1), Chenopodium ambrosiodes (1), Nicotiana tabacum (6), Vitis tilifolia(1), Zingiber officinale(1)	Aristolochia odoratissima (2), Artemisia sp. (3), Byrsonima crassifolia (1), Cinnamonum verum (1), Citrus limon (1), Citrus sinensis (1), Litsea Gluacescens (1), Mangifera indica (2), Matricaria recutita (2), Pimenta dioica (1), Pouteria sapota (2), Psidium guajava (4), Ruta sp. (1), Zingiber officinale (3)	666® (1),Alka-seltzer® (2), Butilhioscina® (1), Magnopirot® (1), Neo-melubrina® (2), Vesatisil ® (1)
CHAN	*CALAMBRE*	BELLY CRAMPS	11	48	5.9	0.29	Aloe vera (1), Aristolochia odoratissima (4)	Abelmoschus moschatus (1), Aloe vera (1), Aristolochia odoratissima (8), Nicotiana tabacum (2), Zingiber officinale (1).	Balsamo® (2), Essencia® (1), Irgapirina® (1), Neo-melubrina® (7), Prodolina® (4)
CHIJIN-XI	*DIABETES*	DIABETES	10	43	4.9	0.28	Cecropia obtusifolia (1), Neurolaena macrocephala (2), Verbesina turbacensis (1)	Aloe vera (1), Cochlospermum vitifolium (1), Neurolaena macrocephala (10), Verbena carolina (1)	
CHIJIN-TISI	*TUBERCOLOSIS*	TUBERCOLOSIS	10	43	6	0.23		Cestrum nocturnum (1)	
CHIJIN-VIJSO	*VOMITO*	VOMITING	8	35	7.3	0.22	Aristolochia pentandra(4), Artemisia sp(1), Cissampelos tropaefolia(1), Persea sp.(2), Zingiber officinale(2)	Aristolochia odoratissima (1), Aristolochia pentandra (4), Byrsonima crassifolia (1), Matricaria recutita (1), Pouteria sapota (1), Psidium guyava (3), Zingiber officinale (3).	Alka-seltzer® (2), Buscapina® (1), Dramamine® (2), Picot® (1), Vomisin® (2)
KINE-YA-NINDA'	*DOLOR-DE-HUESO*	PAIN OF THE BONES	5	22	6.4	0.16	Allium cepa(1), Nicotiana tabacum (1), Pimenta dioica(1), Tournefortia glabra(1)	Allium sativum (1), Aristolochia odoratissima (1), Cestrum nocturnum (1), Ocimum sp. (1), Rosmarinus officinalis (1), Ruta sp. (1)	Cafi-aspirina® (2), dolor-neurobion® (1), Makno-Atlantis® (1), Neo-melubrina® (1), Prodolina® (1)

TABLE 4- CONTINUED

ILLNESS: Mazatec	ILLNESS: Spanish	ILLNESS: English	Frequency	Percentage	Average rank	Smith's index	Medicinal plants Use reports during Freelisting	Medicinal plants Use reports during open interviews	CDM use reports during freelisting
CHIJIN-VITOJYA'	*HINCHASON*	SWELLING	6	26	13	0.15		Piper umbellatum (1)	Vesatisil® (1), Vino de hierro® (1)
CHIJIN-KINE-TO	*DESINTERIA*	DYSENTERY	6	26	8.3	0.12	Bursera sp(2), Cedrela odorata(1), Citrus limon(1), Pimenta dioica(1), Pouteria sapota(2), Psidium guajava(4)	Bursera simaruba (4), Cedrela odorata (2), Citrus limon (2), Croton draco (2), Litsea glaucescens (1), Matricaria recutita (1), Nicotiana tabacum (1), Persea americana (1), Pimenta dioica (2), Pouteria sapota (6), Psidium guajava (10), Solenostenum scutellarioides (1), Zingiber officinale (2)	Balsamo® (1), Metronidazol® (1), Paracetamol® (1), Terramicina® (5)
CHIJIN-SCI	*ATAQUE*	EPILEPSY	4	17	8.3	0.11			
CHIJIN-FI	*TOS-FERINA*	WHOOPING COUGH	5	22	6.6	0.11		Cestrum nocturnum (1), Tagetes erecta (1)	
NINDO-SARAMPILLO	*SARAMPION*	MEASLES	6	26	9.2	0.11	Pilea microphylla(2)	Begonia sp. (1), Bixa orellana (1), Cestrum nocturnum (1), Pilea microphylla (6), Vitis tilifolia (1)	
KINE-SKUA	*MAL-DE-OJO*		4	17	7	0.10		Vitis tilifolia (2)	Aspirina® (1), Palmin® (1)
	DOLOR-DE-ESPALDA	BACK PAIN	3	13	4.7	0.09	Pimenta dioica(2)		
	CANCER	CANCER	3	13	11	0.09			
NINDO-SKO-TZUI		CHICKENPOX	6	26	10	0.09	Kalanchoe sp.(1)	Begonia sp. (1), Bixa orellana (1), Cestrum nocturnum (1), Pilea microphylla (6), Vitis tilifolia (1), Cestrum nocturnum (4), Citrus limon (1), Peperomia rotundifolia (1), Peperomia nigropunctata (1), Litsea glaucescens (1), Valeriana scandens (2)	
KINE SCIA NIA	*DOLOR-DE-OIDO*	EARACHE	4	17	9.3	0.09	Lippia alba(3)	Allium cepa (1), Mentha sp. (5)	
KA-SKJA	*CEGUERA*	BLINDNESS	5	22	14	0.08			
CHIJIN-KINE-NI-GNUA'	*DOLOR-DE-MUELA*	TOOTHACHE	5	22	17	0.08	Allium cepa(1)	Allium cepa (1), Brugmansia x candida (1)	Alka-seltzer® (1), Balsamo® (1), Comen® (2), Prodolina® (3), Tempra® (1)

TABLE 4 - CONTINUED

ILLNESS: Mazatec	ILLNESS: Spanish	ILLNESS: English	Frequency	Percentage	Average rank	Smith's index	Medicinal plants Use reports during Freelisting	Medicinal plants Use reports during open interviews	CDM use reports during freelisting
CHIJIN-NIO	*MAREO*	NAUSEA	3	13	3.7	0.08			Difenidol® (1)
TSJE'	*HERIDA*	WOUND	5	22	12	0.07	Odontonema callistachyum(2), Persea sp.(1), Sida rhombifolia(2), Verbesina turbacensis(1), Piper umbellatum (1)	Ageratum corymbosum (1), Kalonchoe pinnata (1), Odontonema callistachyum (1), Piper umbellatum (1), Sida rhombifolia (1), Verbesina turbacensis (1)	Mertiolate® (2), Penicillina (4), Penprocillina® (1), Respicil® (1), Tepzcouhuite® (1), Vesatisil® (1)
CHIN-TE	*TOS*	COUGH	2	9	5.5	0.06	Citrus sinensis(3), Cymbopogon citratus(1), Mentha sp(2), Pedilanthus sp.(2), Psidium guajava(1), Tagetes erecta(1)	Allium sativum (1), Cinnamonum verum (1), Citrus limon (2), Cymbopogum citratus (2), Lippia myriocephala (1), Lycopersicon esculentum (1), Mentha sp. (1), Neurolaena macrocephala (1), Pedilantus tithymaloides (1), Rosa sp (1), Tagetes erecta (1), Zingiber officinale (4)	Penicillina® (1), Penprocillina® (1), Respicil® (1), Tesalon® (3)
KINE-YA	*DOLOR-DE-CUERPO*	BODY ACHES	2	9	4	0.05	Aloe vera (1), Aristolochia odoratissima(4), Pimenta dioica(1)	Ageratum corymbosum (2), Hyptis mutabilis (1), Cestrum nocturnum (1), Lippia myriocephala (1), Piper umbellatum (1)	666® (3), Alka-seltzer® (1), Ampicillina® (1), Anaxen® (1), dolor-neurobion® (1), Magnopirot® (1), Maknoatlantis® (1), Mejorales® (2), Metildopa® (1), Neo-melubrina® (4), Penicillina® (1), XL-3® (1)
KINE-KA-YA-NZIA	*DOLOR-DE-CINTURA*		3	13	18	0.05			

ILLNESS: Mazatec	ILLNESS: Spanish	ILLNESS: English	Frequency	Percentage	Average rank	Smith's index	Medicinal plants Use reports during Freelisting	Medicinal plants Use reports during open interviews	CDM use reports during freelisting
NDA-SE	*AGRURA*		2	9	15	0.04	Artemisia sp (1)	Aloe vera (1), Begonia sp. (1)	Alka-seltzer® (1), Bicarbonato® (1), Melo-plus® (1), Peptobismol® (1), Sal de uva® (1)
TEJE	*COMESON*	ITCHING	3	13	13	0.04		Neurolaena macrocephala (1)	Ketokonazol® (1), Micotex® (3), pomada de penicillina (1)

TABLE 4. Comparison of herbal medicine and patent medicines by illnesses as elicited during freelisting (FL) with 23 respondents (14 males; 9 females; mean age = 46 years)
Frequency: frequency of mention during freelisting (FL);
Percentage: percetange of informants that mentioned the item (illness);
Average rank: average rank of the item during FL;
SMITH'S index: Smith's index of salience;
Medicinal plants use reports during freelisting: Species reported to treat the illness, in parenthesis number of reports.
Medicinal plants use reports during open interview: Species reported to treat the illness, in parenthesis number of reports.
CDM use reports during freelisting: Chemically defined medicines reported to treat the illness, in parenthesis number of reports.

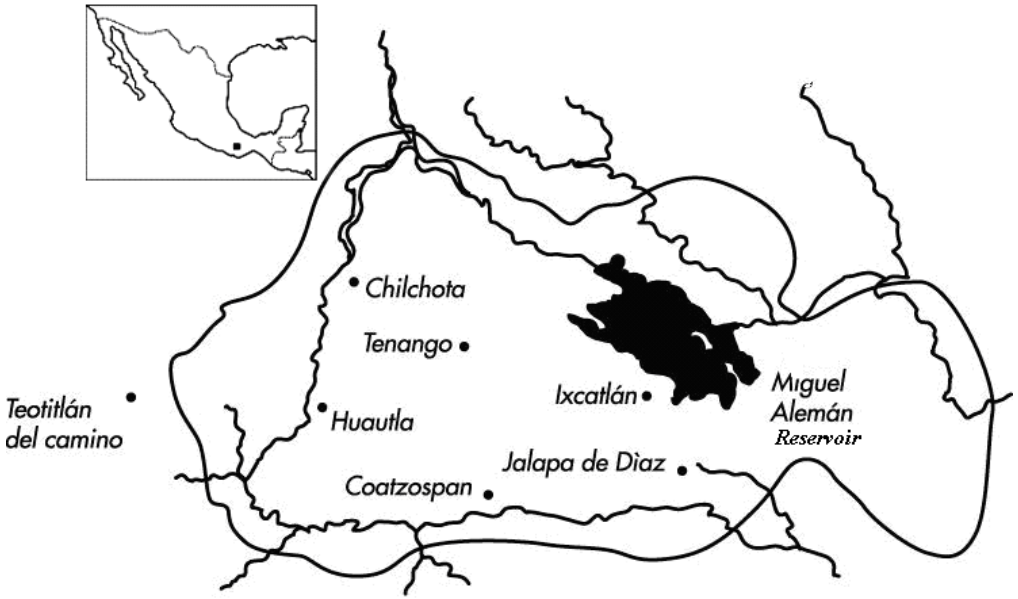

FIGURE 1. Map of the Sierra Mazateca region. The line around the region delimits the borders of the Sierra Mazateca. Modified after (Cabrera et al., 2001).

LIST OF ABBREVIATIONS USED IN THE TEXT:

CDM: Chemically Defined Medicines
GI: Gastrointestinal
IMSS: Instituto Mexicano del Seguro Social
NSAID: Non-Steroidal-Anti-Inflammatory-Drugs
ORT: Oral Rehydratation Therapy
PG: Peter Giovannini
WHO: World Health Organization
®: Registered trademark.