WHAT HAPPENS WHEN ONE CANNOT AFFORD THE PHARMACY BILLS? COMPARATIVE STUDY OF MEDICINAL PLANT CONSUMPTION IN LATIN AMERICA

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Summary

In spite of a considerable rise in food production and despite recent spectacular scientific and technological achievements, poverty is growing at an alarming pace. Globalization has contributed to further increase the gap between rich and poor, globalizing inequalities and tensions, the less wealthy lacking access to the most basic needs such as food, shelter and healthcare. What happens when one has no medical assistance and cannot afford chemical remedies sold in the pharmacy? That's what the Portuguese Tropical Research Institute has been field researching in Latin America since 1998, starting with a remote Brazilian city and ending up with the wide Mexican urban agglomerate. The paper addresses the issue of medicinal plant consumption in 4 Latin American cities, as a comparative study, in the context of ethno-botany and pharmacology.

Key Words: Medicinal plant consumption

Scope and Methods

Herbal remedies have always contributed to improve therapeutic knowledge and even though modern pharmacopoeia is nowadays based on chemicals, traditional natural medicinal practices were never completely abandoned for there was a vast proportion of the world population that had no access to healthcare and medical scientific and technological advances. That's the case with Latin American less wealthy residents which drove us to seek for strategies used by the elderly and the poor, in selected urban centers, devised to cope with disease and pain, whenever the household income was not reasonably enough to look for specialized medical treatment and modern pharmaceutical trade inexistent or unaffordable.

The sample research was conducted by the author with local help in case of Spanish speaking countries for the specificities of language and culture had to be wisely addressed. Survey extracted from the city of Belen, located in lower Brazilian Amazon, back in 1998 came first. The query was part of an urban and peri-urban agriculture investigation, under green cities framework, and the main objective was to search for food security provided to the destitute by home gardens. The surprise was medicinal herbs came second as crops in home gardens and peri-urban plots all over the metropolis (following fruit culture), and the magnificence of domestic herbal remedies I registered patiently when exploring house by house, home gardens and cultivated plots, particularly when elder persons were in charge of the front- and backyards. The catalog was so rich, both in ancestral Amazon traditions as in European and African prescriptions for nearly any possible body affection or affliction that it led to further studies in Brazil, Presidente Prudente in S. Paulo state having been researched in 1999, with similar results (1) (2).

During 2002-2003 a joint Portuguese-Chilean team continued the trend in Santiago, enriching the number of plant species consumed in South America and the herbal medicines, particularly those based in Indian healing traditions. Plant therapy, healers, medical doctors and *machis* (shamans) became part of the interviewing process routine driving us to the conclusion that the main herb, roots, fruit, tubers providers were the urban markets and not the farmed front- and backyards. The next step was thus to redirect the fieldwork selecting the next urban centers to survey in order to get a fair idea of this geographical space preferences in terms of plant species, therapeutics and prescriptions. Again I emphasize that the driving question was how do the less wealthy treat disease and pain when they cannot afford or access modern medical care?

Table 1 summarizes cities selected in Latin America - Mexico City, Lima, Santiago and Belen – and characterizes the methodological process, consisting of six stages:

i) National and local statistics examination, in order to seek for answers in terms of vegetable cultivation and food trade per metropolitan area;

ii) Inquiries to urban gardeners and peri-urban medicinal herb growers, except for Lima because of climatic considerations;

iii) Survey to medicinal herb traders with plant acquisition and herbal remedies inventory;

iv) Interviews to selected actors, like merchants, gardeners, nurses, doctors and Indian healers in a quest for long-established plant therapy and ancestral curative practices;

v) Botanical identification of specimens gathered during the inquiries and interviews.

vi) Ranking of plant species common to all four urban centers and medicinal recommendations;

vii) Prescriptions and therapeutics comparison in 4 specific diseases: cancer, arthritis, diabetes and eye diseases.

Table 1 – Medicinal Plant Consumption Sample Research in Latin America

Selected urban centers	City rank	Population (in millions)	Location and Environment	Medicinal plant cultivation and trade Surveys	Interviews to marketing and healing agents (N°)	Number of plant species recorded
Mexico City	**National capital**	**17**	**Mexican high plateau**	**100**	**23**	**60**
Lima	**National capital**	**8**	**Peruvian Coastal Desert**	**34**	**38**	**60**
Santiago	**National capital**	**6**	**Chilean plateau**	**132**	**25**	**70**
Belen	**Pará State capital**	**2**	**Brazilian Amazonia**	**570**	**15**	**140**
Total		**33**		**836**	**101**	**330**

Surveys & Interviews: 1998-2006

Results

Medicinal plant consumption was quite impressive among the lower income groups in Mexico and Brazil, but less important in Chile and Peru, where ethnicity is either ignored or ostracized, a good reason to seek for help in conventional pharmacies. Because it is frequently impossible to have access to expensive healthcare, two strategies were found evident both in Peru and Chile: first the pharmaceutical products, homeopathic and chemicals, are sold inside gross and neighbourhood markets (Chile) or nearby (Peru), sometimes mixed with traditional fresh and dried herbal medicines; second, pills are traded per unit (Peru) or in small portions (Chile), the patient freely deciding the quantity and the period of time the medicine should be administered. Auto medication was therefore widely observed to be common practice, with the assistance of traders quite often a mix of non-graduated pharmaceuticals and healers. Nevertheless, herbal medicines consumption is still quite considerable within the elders and migrants from Andean provinces in Peru, the Quechuas relying on their roots and herbs from Central Peruvian regions and Aymaras on their own, from Arequipa and Puno origins (Southern Peru). Interesting is to register that in Chile middle and lower income classes put their faith in Peruvian herbal remedies, Cat's Claw (*Uncaria tomentosa*) on top, a miracle bark, sometimes despising highly recommended ones of their own (Chilean Boldu tree leaves having more adepts in Brazil and Mexico), whereas in Peru Fennel (*Foeniculum vulgare* Miller), Chamomile (*Matricaria Chamomilla* L.) or Great Plantain (*Plantago major* L.) are believed to be Peruvian.

In Mexico City the research was much easier to organise, because there is a market solely for herbal medicines trade – *Sonora* – and two types of traders:

1. The informal merchants, mostly females, which usually are also micro-farmers that travel from two to three hours distant Mexico state, Puebla and Morelos pueblos, as well as from peri-urban surroundings, twice or three times per week, in order to sell their fresh produce

at the entrance and around the market, from 5 a. m. to 10 o'clock. After that time, loyalties between "*informales*" and a quite severe (outlaw and repressive) solidarity chain system obliges them to either sell the remainder to the established retailers inside the market or then travel further to *La Merced* or *Jamaica* markets, leaving the ground to informal faster return dealers (clothing, shoes, etc.), the ones who can afford to oversleep and start working later in the morning, allowed to trade at better times for regular urban costumers. So even among the poor and inside marketing businesses, inequalities are hard to cope with… According to Mexican statistics only 3 in 10 women are formally employed in the biggest Latin American city. The remainder are housewives, service providers and street traders. Informal retailers, mostly being self-employed and earning about 1 US dollar per hour, in Mexico City metropolis, amounts to 31.8% of active residents (3). Depending on the plant cycle and species availability in the market each herb package or bouquet of fresh specimens rang from 5 to 50 cents.

2. Formal market retailers, inside Sonora, La Merced, Jamaica Flower Market and elsewhere, sell sometimes exclusively dried herbal remedies, others mixed dried and fresh species together with homeopathic prescriptions, *sahumerios* and business protection flower bouquets, sought daily by all sorts of merchants and business people, middle class and small entrepreneurs. Mexico City is no different in this particular deal against *mal ojo* (*mau olhado* in Brazil), plant species such as the Herb of Grace (*Ruta graveolens* L.) being usually present, in vases or bunch of herbs in Mexico as other Latin American countries. Because trade and medicinal plant cultivation is mostly a family business, prescriptions are easy to get, ancestral healing procedures among Indians and *mestizos* as herbal remedies being marked by gender (females) and ethnicity (Aztecs, Nahuas and Zapotec Indians).

In Belen, located in lower Amazonian Brazil, there is one main market for fresh medicinal herb trade, where the native species are combined with all sorts of natural medicines, love potions and syrups, usually produced in local family businesses. *Ver-o-Peso* (Weight Market) stands along the bay, just next to the fluvial port where farmers from the surrounding islands provide weekly the leaves traded, and very close to the city center, which lends the daily fair a quite exotic, tourist friendly look. The trustworthiness residents have in plant therapy is remarkable and perceptible the vast amount of species consumed in Brazil, the majority being rainforest natives and others from several parts of the country, notwithstanding a good proportion of alter South American medicinal biodiversity, followed by European and African influences, related to the Portuguese presence, and the migration of peoples from the North-Eastern Brazilian states, some claiming to be black slaves descendants.

Cultivation of medicinal plant species is adamant in the outskirts of Santiago, Mexico City as in Belen home gardens and results from field research surely deepen matter under discussion for front and backyards are remarkably biodiverse, medicinal plant species being so numerous, recommendations and therapeutics so impressive that it is necessary to narrow focus and make a synthesis effort. Table 2 presents the top ranking species consumed in the 4 selected urban centres, resulting from combined cultivation and market surveys. In fact, the surprising outcome is mostly everybody looks for the same remedy: a reliable infusion for pain (analgesic), a digestive tea ready for use after each meal, and a sedative that can help to cope with stress, an urban affliction worldwide. The common name is sometimes the same even when Botany tells you the family, gender and species aren't. Not surprisingly in Mexico and Brazil where faith in herbal remedies was unshaken by globalization the preferred plant species are endemic, but in biased Peru and Chile the herbs prescribed are European and largely recommended by conventional medicine.

Table 2 - Top Ranking Medicinal Herbs Consumed in Latin American Selected Cities

City	Common name (in English)	Botanical name (FAMILY)	Recommended Uses	Pharmacological activities
Mexico City	Toronjil (Fake Lemmon Balm)	*Agastache mexicana* Kunth (LABIATAE)	Sedative, anti-stress and digestive	Antispasmodic activity registered in the flowers. Mild sedative effects in the whole plant species, both white and rosy varieties (*morado*) (4).
Lima	Manzanilla (Chamomile)	*Matricaria Chamomilla* L *M. Recutita* L (COMPOSITAE)	Anti-inflammatory, antispasmodic, sedative and digestive (int.) Conjunctivitis (ext.)	Anti-inflammatory activity has been widely reported, antispasmodic, antibacterial and anti-fungal effects proved. It is anti-septic, sedative and febrifuge (5) (6)
Santiago	Melisa or Toronjil (Lemmon Balm)	*Melissa officinalis* L. (LABIATAE)	Sedative and antispasmodic, digestive	Antibacterial, anti-fungi and antispasmodic activities recorded. Digestive and anti-septic. Mild sedative, good antiviral effects over herpes simplex. (5) (6)
Belen	Erva-Cidreira (Fake Lemmon Balm)	*Lippia alba* HBK. (VERBENACEAE)	Stomachic, analgesic, digestive and sedative	Unknown

Survey: 1998-2006

Herbal medicines are usually prescriptions of individual plant species and thus Table 3 summarises uses from all 4 countries, per botanically identified plant. The majority of the prescriptions gathered in Brazil are domestic traditional applications; in Chile, Peru and Mexico, market traders and Indian healers were the main sources. Recommendations for kidneys, *prostatitis*, prostate cancer and, in general, diuretic plant species or plant portions were found in frequently combined manner (infusions and *jarabes*), most especially in the Andean countries. In Peru, the common leaf in such prescriptions is Annatto tree – *Achiote* (*Bixa orellana* L.) or *Urucum* (Brazil) – an up to 9-meter tall species, South American native and historically connected to the Indians. In matter of fact, when Columbus discovered America (1492) he thought to have got to India (as is common knowledge) and so he named natives as “Indians”. But when the Portuguese discovered Brazil, India’s maritime path (via Southern Africa and the Indian Ocean) had been already achieved by Vasco da Gama fleet (1498) and therefore, in 1500 the indigenous peoples from Bahia shores encountered, their skin covered with a red coloured seed extract, were named “red skinned”.

Bixa orellana has been recovered recently by Cosmetics and is used in solar protection aerosols and crèmes. Curiously it was not recorded in use for medicinal purposes in Belen, even though it was the 10th vegetable cropped in home gardens (7). Brazilians use *Urucum* as spice these days, as Mexicans have been doing for generations (8), but Peruvians combine *Achiote* with endemic medicinal species such as *Huamampinta* (*Chuquiraga huamanpinta* Hieron), *Manayupa* (*Desmonium molliculum* (HBK) DC.) and, in case of prostate cancer, also with Cat's Claw (*Uña de Gato*). "*Why am I working at 88 and so healthy?* Asked me an old museum "guard" in Lima. *Every single day I take an infusion of 1 small spoon* of *Achiote and 1 spoon of Huamampinta. In my age males are dead or then have to go to the toilet all the time. Not me! Pharmacy? No! Doctor? I never go to the doctor!* Pharmacological tests on Annatto tree (*Bixa orellana)* leaves prove he is right. It contains C25 H30 O4 and has anti-septic and diuretic activities (5). As for Huamampinta I found no convincing literature. Annatto tree leaves have a quite wide usage in Peru but not in Chile. A rare case was its recommendation in an infusion against human immunodeficiency virus (HIV), which was singular in this research. In all 4 countries the answer to the question: *what can one use to cure Acquired Immunodeficiency Syndrome (AIDS)?* Was quite similar: *You can't use anything!* Why it has no possible cure? *Because the viral disease treatment was a lab induced disease. Only chemicals might solve it!*

Regarding the plant therapeutic recommendations in case of four specific diseases researched in Latin America, cancer has been already mentioned, Aloe (*Aloe vera* Burm) being one of the universal herbal medicines used. Named Zábila in Mexico and Peru, and Babosa in Brazil, the succulent Liliaceous is native to Mediterranean Regions and Atlantic Islands, and grows in most cropped plots visited, being the ninth occurrence in Belen's home gardens and the eighth in Santiago peri-urban plots. Common treatment is extracted leaf juice taken orally to treat any type of cancer. In Peru the juice is also recommended in conjunctivitis and for recovery from cataracts surgery. This drives us to another affliction, eye diseases, the most surprising record being *Pirarucu* (*Bryophyllum calicinum* Salisb.) leaf extract application to the eyes in case of glaucoma in Belen, and Chicalote (*Argemone mexicana* L.) latex to cure cataracts, an old Aztec remedy still in use in Mexico City. If Aloe has been chemically tested, as well as Cat's Claw (see Table 3), with highly positive and promising results, that is not the case with Chicalote and Pirarucu. Ross has found analgesic activity in fresh leaf pulp of Aloe in addition to anti-burn, anti-fungi and anti-inflammatory effects (9). Antiviral and antibacterial activities were proved but anti-tumour properties remain elusive, which doesn't happen with Peruvian Cat's Claw (5).

Arthritis and rheumatic afflictions in general come up with a good collection of herbal remedies, Rosemary being one of the prescriptions found in the 4 urban centres, both in markets and in front- and backyards. In Mexico City rosemary is the top cropped species in 500 m2 plots explored over Popocatepetl volcano slopes, in Mexico state, about two hours distant from Sonora Medicinal Herb Market. Native to Southern Europe it is an evergreen bush that Spanish colonisation was successful in disseminating all over Latin America. It ranks seven in Peru, where it has external application in frictions, and internal as diuretic, sedative, anti-diabetic and digestive. In Mexico City main recommendation is to take a plant infusion orally to ease severe headaches. In Belen rosemary is part of about 15 to 20 aromatic species that compose good smelly baths taken for the Solstice feasts (June saints), both for the body and the soul, notwithstanding the bad fluids cleaning purpose (10) (11). It has been proved that *Rosmarinus officinalis* is good stimulant for stomach secretions. Camphor, present in proportions ranging from 15 to 25%, is natural stimulant both for blood and nervous systems. Analgesic, antispasmodic, antibacterial, antiviral and anti-inflammatory effects were recorded (4) (5) In Chile, skin cancer anti-tumour activity was registered in the whole plant and remains the standard recommendation within peri-urban farmers in Southern Santiago together with its external usage in hair treatment (6).

Table 3 – Medicinal Plants Common to the Researched Latin American Home Gardens and Urban Markets

Common Names per country (English)	Trade and (production) ranking	**Botanical Names**	**Botanical description and origin**	**Medicinal uses and therapeutics**	**Pharmacological activities**
Boldo (Mex.) Boldo (Peru) Boldo (Chile) Boldo do Chile (Br) (**Boldu tree**)	3 17 9 2 (12)	*Peumus boldus* (Mol.) Lyons	MONIMIACEAE tree originated in Chile, about 8 meters tall, with scented leaves, white or yellow flowers and juicy fruits.	Hot water extract of dried leaves is taken orally against liver colic and for bile's protection in all four cities.	Anti-septic activity, diuretic and digestive effects, *boldina* has proved liver benefits (5). Anti-spasmodic, sedative effects registered. Anti-inflammatory and anti-pyretic activities recorded (6)
Té Limon (Mex.) Yerbaluisa (Peru) Capim Santo (Br.) (**Lemmon Grass**)	4 2 (2)	*Cymbopogon Citratus* (DC.) Stapf	GRAMINEAE perennial leaf, about 1 meter long and 1 cm wide. The origin is unclear but one can find it in all tropical countries, from Asia to America.	Hot water extract of dried leaves is taken orally against flu (Mex.) Leaves infusion & decoctions are taken orally for sedative purposes, as analgesic and diuretic (Peru) Fresh entire plant in hot water extract is taken orally as anti-spasmodic, tranquilliser, and analgesic (Bra.)	Weak analgesic activity but high antibacterial. Anti-filarial and anti-fungi effects, plus anti-inflammatory and antispasmodic activities. Good for indigestion (9).
Hierbabuena (Mex) Menta-mate or Hierba Buena (Peru) Menta (Chile) Hortelã-pimenta (B) (**Peppermint and Mint**)	5 15 11 (1) (10)	*Mentha x piperita* L. *Mentha spicata* L. *Mentha viridis* L.	LAMIACEAE gender with 25 species. Perennial European herbs grown all over the world.	Stomach pain infusions (Mex.) External application of leaves in skin cancer (Peru). Stomachic and analgesic (Ch.) Used as spice in fish dishes, the fresh leaves are taken orally in digestive infusions (Br.) *Spicata* species is heart regulator (Brazil and Peru)	Anti-septic and antispasmodic activities registered in *spicata* and *piperita* species (5). *Piperita* has 40% mint giving it special scent and flavour. Recognised antispasmodic activity (6). Antifungal and antibacterial activities in *viridis* (4).
Cedrón (Mex.) Cedrón (Peru) Cedrón (Chile) Carmelitana (Br.) (**Lemmon Verbena**)	9 8 (2)	*Lippia citriodora* Kunth (HBK)	VERBENACEAE bush grows up to 3 meters, it is aromatic, with white or lilac flowers, probably from South America (Peru and Chile)	Hot water extract of dried leaves is taken orally for indigestion (Mex. and Peru). Fresh leaves are taken as strong tranquillizer infusion (Bra) Digestive and mild sedative infusion, offered in restaurants (Chile)	Proved antispasmodic and anti-septic effects whilst no toxicity was registered (5). Sedative effect proved (6). Antispasmodic activity, antibacterial and antibiotic effects found (tuberculosis) (12) Active diuretic activity recorded (13).
Aguacate (Mex.) Palto, Palta (Peru) Palto, Palta (Ch.) Abacateiro (Bra.) **(Avocado)**	(3) 23 (5)	*Persea Americana* Mill.	LAURACEAE American tree, about 15 meters high, the leaves are elliptical, up to 20 cm long and over 15 cm broad. Green fruits are peer shaped and come in various sizes.	Decoction of leaves is taken orally as diuretic and anti-diarrhoeal (Mex.) Seeds and bark are powered and ministered against diarrhoea (Peru). Fresh leaves taken orally against cough and cold and used in anti- bugs garden mixtures (Chile). Hot water extract of fresh leaves is taken orally as anti-syphilitic and diuretic (B)	The fresh fruit has allergenic and anti-fungi activities. The oil had anti-microbes effect (5). Antibacterial, antiviral and anti-fungi activities found in the fruit and leaves oil (6). Water extract of dried leaves had anti-hypertensive and diuretic activities (9)
Uña de gato (Mex.) Uña de gato (Peru) Uña de gato (Chile) Unha de gato (Bra.) (**Cat's Claw**)	6 4 4	*Uncaria tomentosa* (Willd) De Candolle	RUBIACEAE liana, can grow up to 30 meters, with green yellowish leaves, 17 cm long and 9 cm wide, oval shaped. Native of the Peruvian Jungle can be found in Lower Amazon regions.	Anti-rheumatic and and anti-tumour uses in hot water bark extracts recorded both in Peru and Chile as the common procedures. Decoction of leaves is preferred in Belen, Brazil	Anti-inflammatory and anti-oxide activities (5). DNA synthesis inhibition in tumour cells (6). Anti-tumour-activity, proved anti-cancer and antiviral effects (12). Anti-pyretic and anti-tumour effects and immuno-stimulant activity proved (14)

Surveys: 1998-2006

Last but not least, I sought for herbal remedies to help regularise sugar in diabetes patients. The most ancient prescription has been used for millennia by Aymara Indians, spread from Northern Chile, to Southern Peru, Bolivia and Northern Argentina (15). They use *Llareta* or *Yareta* (*Azorella compacta* Phil.) an Umbelliferae endemic to the Andean high plateau that only grows up to 4,000 meters above the ocean, as is the case with the more widely known aphrodisiac Peruvian *Maca* (*Lepidum peruvianum* Chacon). Chemical and Pharmacological studies have proved it has anti-parasite activity, namely against Chagas disease, common in parts of Brazil. Llareta has also been proved to have good anti-tuberculosis effect (6). The Indians use the flowers in hot water extracts to be taken orally and daily by patients. The species is utilised solely in Chile though.

Discussion

Nature has always provided a source of drugs for innumerable ailments. Herbal remedies based on one plant species can be steadily collected in domestic Latin American therapeutics and Amerindian ancestral medicines, and their effectiveness tested positively in a good number of cases, because in the last decade there have been advances in research on the natural products possessing anti-diabetes, anti-arthritis and anti-tumour activity. Concerning eye diseases I found weaker pharmacological evidence, particularly in South American native species.

As a Geographer it would be impossible for me to test the recommended treatments and deepen plant species chemistry. The option is to review literature devoted to Pharmaceutical research in order to obtain information that may validate or not the presumptions of cure. Of course Placebo effect is present in all clinical trials and thus what might not work in the lab might be in some measure beneficial for some patients. The remaining question is therefore to discover plant or plant portions toxicity, in order to establish whether the natural remedy might be at least innocuous. With a few clearly established exceptions, (where studies found were either unreliable or inexistent) plant species reported in the paper were proved to have low toxicity.

The aim of the current study is not (and could never be) to make specific plant recommendations for diseases, disorders and infections, but simply to report how the less wealthy peoples cope with pain and illness when they cannot access modern medicine and medicines. The field research was conducted in four Latin American metropolises, selection targeting places rich in endemic plant species, fertile in cultural traditions and healing practices. The originality of the study emerges from its comparative character, in a rather homogeneous geopolitical space, characterised by strong indigenous presence and considerable shamanism prevalence, even in our times.

Results show that people are aware of natural remedies limitations in serious sicknesses, even the ones possessing quite low educational level. That’s because vaccination campaigns, national healthcare systems are adamant. Of course the option for natural medicines and therapies is in most instances an option, not a necessity. We found that a good number of Europeans and North Americans travel to Andean whereabouts convinced that coca (*Erythroxylon coca* L.) or Ayahuasca (*Banisteriopsis caapi* Spruce ex Griseb Morton) hallucinogenic species are a panacea for all possible ailments. Nevertheless the locals know that they aren’t. Yet folklore keeps the business and money never stops pouring.

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