

Ethnobotanical, micrographic and pharmacological features of plant-based weight-loss products sold in naturist stores in Mexico City: the need for better quality control

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ABSTRACT

The consumption of dietary supplements and herbal mixtures to promote weight loss is a common practice in the West. This study was undertaken in Mexico City, surveying stores selling “natural products” at subway stations. The aims of this paper were as follows: to compile a record of plant products marketed as slimming aids and of retailer perceptions of these products; to review the pharmacological and ethnobotanical literature on the species declared; and to create an optical micrograph of a subset of products to verify the accuracy of the list of component plant species shown on the labels. We applied the techniques of observation, semi-structured interviews and free-listing at the retail stores. Results are presented for the 75 species recorded in the 41 weight-loss products surveyed, showing which plant parts are used, the geographical distribution of the species, pharmacological effects, dosage, route of administration and method of preparation, as well as ethnobotanical information derived from fieldwork. We discuss the values assigned to the species used. Microscopic analyses revealed that many of the plant ingredients declared were absent, highlighting the need for greater quality control and safety of these herbal remedies.

Key words: Urban ethnobotany, dietary supplements, obesity

Introduction

In Mexico City, as in many other large urban conglomerations, traditional markets selling not just food, but also various plant and animal-based therapeutic items, co-exist alongside health food stores known locally as *tiendas naturistas*. These stores are centers for the sale of packaged natural products, mainly pulverized plants or their derived extracts, and are systematically located in various subway stations, where they are often presented under a relatively similar facade. They offer a similar line of products for sale, including health foods, functional foods, dietary supplements and various herbal remedies used to counteract different conditions.

Our interest is centered on products promoted as weight-loss aids (dietary supplements and herbal remedies), as obesity is currently a concern for a significant sector of society, given its widespread presence throughout the Western world, particularly in large urban centers (Pittler & Ernst 2004; Hasani Ranjbar *et al.* 2009), heavily influenced by the aesthetic standards spread by the mass media

promoting slimness as a benchmark of beauty. For this reason, various practices, such as weight-loss diets, physical exercise and alternative or complementary therapies, exist to counter the effects of obesity, as does the consumption of various products advertised as “natural” (monoherbs, mixtures prepared by a herbalist, teas, dietary supplements, etc.), the majority of which are plant based.

In a previous study on the sale of dietary products in health stores in Mexico City, 40 natural weight-loss products, composed of approximately 75 plant species, were found to be frequently marketed. The most commonly sold products were those whose ingredients included plant species of global medical importance or traditional use (Molaes *et al.* 2012).

Various factors converge in the selection of herbs and the products developed from them, such as the popular belief that herbal remedies are harmless and are more effective than are conventional medicines, the resurgence of philosophies implying a “holistic approach” toward the body and the mind, greater accessibility and the relatively low cost of these herbal products in comparison to those of

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allopathic medicine (Arenas 2007; Pochettino *et al.* 2008). In the particular case of weight-loss products, the preference for their consumption seems to be linked to dissatisfaction with the treatments offered by approved health care systems and as a practical alternative to a more natural diet and increased physical exercise (Amariles *et al.* 2006). Many of the consumers of “natural products” generally resort to self-prescription, without consulting a physician, encouraged by the advice of the salesperson, attracted by the novel packaging of the products and expecting to achieve the desired results within a short timeframe (Bianchi 2003).

Access to various products of natural origin such as these and many others regularly available in fixed or transitory markets or in the rotating markets known as *tianguis* by part of the Mexican population, as well as the health stores approached in this study, constitute a rich tradition expressing economic, social, cultural, political and religious features (Bellucci 2002; Manzanero-Medina *et al.* 2009). Martínez Moreno *et al.* (2006) consider these markets as scenarios key to social processes undertaken everywhere and continuously over time, whereas Bye & Linares (1983) consider them as reflections of the intense relationship existing between plants and populations of different socioeconomic levels. It is thus, as “one of the most striking traces of old Mexico”, that markets offer a space conducive to ethnobotanical research, by which we might understand the spatial and temporal distribution of the plants, the flow patterns, the ecological variables and the developmental shifts in the close relationship between the Mexican people and their plants (Bye & Linares 1990). Other more recent concepts define the markets as open and dynamic systems that concentrate and spread empirical knowledge on natural resources, with implications for the recovery and maintenance of popular knowledge, the preservation of plant species and their related uses (Albuquerque *et al.* 2007; Monteiro *et al.* 2010).

For their part, naturist stores—understood to be an urban and modern expression of traditional Mexican markets—are centers selling plant products that may be considered non-traditional, given that the interaction between the populace and the stores is of short duration, and the knowledge that sustains their recognition and use is not the fruit of cultural transmission through the generations nor of the sharing of practices (Ladio & Molares 2010; Hurrell *et al.* 2010, 2011a). Often, it is rather that knowledge of the products has been introduced intentionally, sometimes by means of mass media advertising. In such circumstances, consumers do not have a direct relationship with their production and manufacture, or direct experience with the places where they are sold (Hurrell *et al.* 2011a). In addition, there is very often a lack of concordance between what is indicated on the label of the bottle and its actual contents, which is usually the result of a lack of standardization, regulations and rigor in the official controls of quality, safety and efficiency (Arenas 2009). Micrographs, together with macroscopic, organoleptic and, in some cases, physico-

chemical inspections, have facilitated the identification of the plant species used in the making of the products, as well as the detection of possible contaminants, substitutes and adulterants used (WHO 1998; Rivera-Arce *et al.* 2003; Arenas 2009; Molares & Ladio 2010).

The present work consists of micrographic, ethnobotanical and pharmacological analyses of the plants composing the weight-loss products gathered from health stores located along Line 3 of the Mexico City subway system, listed and published in Molares *et al.* (2012). The many variables explored in the study cited included the wealth of products specifically recommended for weight loss, their pharmaceutical forms, their retail names, the plant composition stated, the most frequently cited plant species, their presence in traditional Mexican pharmacopoeias, similarities between the products according to their plant composition and average sales rankings in terms of explanatory variables of market preferences.

Materials and methods

The ethnobotanical work was undertaken in Mexico City in June 2010. The study was carried out at stores selling “natural products” located along subway Line 3 in the direction of Ciudad Universitaria-Indios Verdes, a 23-km stretch encompassing 22 naturist stores at 21 stations. Information was obtained via conventional ethnobotanical methodology: observation, participant observation, semi-structured interviews and free list provided by store managers and salespeople (Martin 1995; Alexiades & Sheldon 1996; Albuquerque & Lucena 2004), who were considered “trained” in the sense that they sell the products, know their properties and assist consumers, making recommendations (Pochettino *et al.* 2008). This new approach studied other features that emerged during the interviews with the salespeople: what the effects to be expected upon consuming the products are; who buys them; at what time of year sales peak; what the instructions for use are; and other information of interest. We also conducted a review of the literature on the pharmacological properties stated for the plant species declared on the labels of the bottles, particularly those related to use for weight loss purposes. The ethnomedicinal uses documented were also investigated, as were the plant parts employed and the geographical distribution of the species considered, for which the authors used the analysis of different sources of information as a basis, with these cited in Table 1.

The samples obtained were analyzed by means of conventional qualitative and quantitative analytical microscopy techniques using optical microscopy and the application of simple histochemical tests (WHO 1998). This presents the micrographs for the species present in the composition of six products marketed as weight-loss aids. The latter were selected for being the most frequently mentioned by respondents and for their greater richness in terms of plant species, whereas one of them—Neo Damiana de California

(Arenas AMx6 sample)—was incorporated because its purported slimming effect is relatively novel. The samples acquired were deposited in the Scientific Collections of the Ethnobotany and Applied Botany Laboratory at the Faculty of Natural Sciences and Museum, the National University of La Plata.

Results and discussion

Table 1 lists the 75 plant species declared on the labels of the 41 products analyzed, the pharmacological activity registered in the relevant literature, the documented ethnomedicinal uses, the part of the plant used and its geographical distribution. The products studied take the form of pharmaceutical tablets, capsules, tea bags and powders.

Plant species used in the making of the products and their pharmacological properties

Fifteen plant species possess studied slimming, appetite-suppressant or anorexigenic activity or are effective in slowing gastric drainage: *Citrus × aurantium* L. (orange group); *C. × limon* (L.) Osbeck.; *C. × aurantium* L. (grapefruit group); *Cyamopsis tetragonoloba* L. (Taub); *Cymbopogon citratus* (DC.) Stapf; *Fucus vesiculosus* L.; *Fucus* sp.; *Garcinia* spp.; *Hoodia gordonii* (Masson) Sweet ex Decne.; *Ilex paraguariensis* A. St. Hil.; *Orthosiphon stamineus* Benth.; *Paullinia cupana* Kunth; *Arthrospira maxima* (Setch. & N. L. Gardner) Geitler; *Arthrospira* sp.; and *Turnera diffusa* Willd. ex Schult. (Tab. 1). There have been no definitive studies assessing the slimming effect of *Citrus × aurantium* and “guar gum”, the resin extracted from *Cyamopsis tetragonoloba* (Martínez-Álvarez *et al.* 2006).

The incorporation of stimulants promoting thermogenesis is also common among the products studied. These include ephedrine, synephrine and caffeine, or rather the presence of plant species rich in these substances, such as guarana (*Paullinia cupana*) or cola nuts (*Cola acuminata* (P. Beauv.) Schott & Endl.), all of which are contraindicated for anyone with a heart condition, hypertension or asthma (Martínez-Álvarez *et al.* 2006; Blanck *et al.* 2007; Biesemeier & Cummings 2008; Navarro & Ortega 2009). A study conducted in Italy by the Supreme Health Institute and the Italian Pharmacovigilance Agency reports numerous adverse reactions caused by the consumption of supplements based on some of these plants used as weight-loss aids (e.g., *Citrus × aurantium*, *Paullinia cupana* and *Hoodia* spp.). The majority of the reactions were cardiovascular or affected the central nervous system, the skin or the gastrointestinal tract (Vitalone *et al.* 2008; Navarro & Ortega 2009).

Fucus vesiculosus has been used as a coadjuvant in the treatment of overweight and obesity, basically due to its high iodine content. In sensitive individuals, the same iodine may cause various thyroid conditions, such as hyperthyroidism (Bisset 1994; Phaneuf *et al.* 1999). Agarwal *et al.* (2006) re-

ported a clinical case of cardiac arrhythmias and ventricular fibrillation caused by the consumption of herbal slimming medicines containing *Fucus* spp., dandelion (*Taraxacum officinale* Webb) and boldo (*Peumus boldus* Molina). Such products may also be toxic due to the heavy metals concentrated in their thallus (Arenas 2007; 2009; 2010). Furthermore, *Arthrospira* spp.—due to its phenylalanine content—may reduce appetite, although in 1981 the United States Food and Drug Administration declared it ineffective in promoting weight loss (Martínez-Álvarez *et al.* 2006). Adulteration, substitution or contamination with other cyanobacteria is also common, which is particularly dangerous due to the existence of toxigenic species (Arenas 2003).

Yerba mate (*Ilex paraguariensis*), in addition to its traditional consumption in the form of mate (tea) in South America, is also sold in Argentina as a weight-loss aid combined with other plants, such as *Turnera diffusa* and *Paullinia cupana*. Although clinical tests have not demonstrated its activity, some studies have yielded encouraging results in terms of weight loss, due to its appetite-modulating effect, which prolongs gastric drainage (Navarro & Ortega 2009). Opinions vary regarding the efficiency of *Garcinia gummi-gutta* L. (Roxb.) as a weight-loss aid, as some authors maintain that the effect of hydroxycitric acid present in this plant species would be effective in weight loss, whereas others have found that effect to be less than significant in comparison with that of a placebo (Heymsfield *et al.* 1998; Navarro & Ortega 2009). The lack of clinical studies of *Hoodia gordonii* in humans precludes any support for its activity (Pittler & Ernst 2004; Navarro & Ortega 2009). *Orthosiphon stamineus* is actually a diuretic, hence its use in cases of obesity associated with other pathologies. There are no conclusive tests assessing its effectiveness in humans (Moro & Basile 2000; Navarro & Ortega 2009). In general terms, there has been insufficient investigation to encourage the consumption of plants to promote weight loss, except that of *Garcinia gummi-gutta* and yerba mate, which nevertheless still require further investigation (Pittler & Ernst 2004; Pittler *et al.* 2005). However, there are 20 plant species that have a diuretic effect: *Achillea millefolium* L.; *Alisma plantago-aquatica* L.; *Arctostaphylos uva-ursi* (L.) Spreng.; *Brassica oleracea* L.; *C. × aurantiifolia* (Christm.) Sw.; *C. × limon*; *C. × aurantium* (pomelo group); *Cymbopogon citratus*; *Cynara cardunculus* L.; *Equisetum arvense* L.; *Erythraea stricta* Schtdl.; *Foeniculum vulgare* Mill.; *Hibiscus sabdariffa* L.; *Ilex paraguariensis*; *Orthosiphon stamineus*; *Peumus boldus*; *Plantago psyllium* L.; *Smilax aristolochiifolia* Mill.; *S. campestris* Griseb.; and *Taraxacum officinale*—17 taxa that function as laxatives: *Cyamopsis tetragonoloba*; *Cymbopogon citratus*; *Foeniculum vulgare*; *Fucus vesiculosus*; *Fucus* sp.; *Hibiscus sabdariffa*; *Linum usitatissimum* L.; *Malus pumila* Mill.; *Malva sylvestris* L.; *Malva* sp.; *Oryza sativa* L.; *Plantago psyllium*; *Prunus domestica* L.; *Rhamnus purshiana* DC.; *Senna alexandrina* Mill.; *Tamarindus indica* L.; and *Triticum aestivum* L.—16 taxa that are antihyperglycemic agents:

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Table 1. Plant species and their common names declared on the labels of weight-loss products sold in health stores along Line 3 of the Mexico City subway: properties, parts used and geographic distribution.

Species (English common name)	Family	Commercial product	Pharmacological activity	Ethnomedicinal uses	Part used	Geographic distribution
<i>Achillea millefolium</i> L. (Yarrow)	Asteraceae	Menosgrass, Demogress plus, Demogress, L-Carnachof Mix	Anti-inflammatory, painkiller, digestive, antimicrobial, CNS ⁺ depressant, diuretic (Alonso 2004)	Diaphoretic, emmenagogue, anti-asthmatic, antihemorrhoidal, gastrointestinal diseases, diuretic, anti-inflammatory, antispasmodic, infections in the upper respiratory tracts, asthenia, fever, gout, kidney stones, hyperthermia, urinary infections, dysmenorrhea, dyspepsia, healing, slimming, carminative, antidiarrheal (Roig 1988; Lorenzi & Abreu Matos 2002; Alonso 2004; Hurrell <i>et al.</i> 2011b)	All of the flowering plant	North Africa, Europe, Asia
<i>Agave</i> spp. (Agave)	Asparagaceae	Reduc Line	<i>A. sisalana</i> (sisal): antisyphilitic, immunomodulator, stimulant of the intestine and uterine musculature, antiseptic, emmenagogue, hypertensive, hair tonic, diaphoretic, dysentery, constipation (Debnath <i>et al.</i> 2010)	Dysentery, ulcers, heart pain, lung pain, blows to the body, increases blood (Aguilar <i>et al.</i> 1994)	Stalks, sap, roots	Central America
<i>Alisma plantago-aquatica</i> L. (Alisma)	Alismataceae	Demogress plus, Demogress, L-Carnachof Mix	Astringent, diuretic, depurative, antihepatotoxic, antihypercholesterolemic (Bezanger-Beauquesne <i>et al.</i> 1990)	Urinary conditions (Mösbach 1992)	Rhizome	Europe, Asia, North America
<i>Aloe barbadensis</i> Miller. (Aloe vera)	Xanthorrhoeaceae	Demogress plus, Demogress, L-Carnachof Mix	Dermatologic, antimicrobial, digestive, respiratory, immunostimulant, painkiller, anti-inflammatory, antipyretic, antidiabetic (Alonso 2004)	Erysipelas, toothache, burns, wounds, inflammation, pimples, diabetes, healing, fever, muscular inflammation, cough, cancer, asthma, gastritis, decongestant, bronchodilator, eye injuries, laxative, insect repellent (Aguilar <i>et al.</i> 1994; Alonso 2004)	Leaves, sap, flowers, root	The island of Socotra (northeast Africa)
<i>Aloe ferox</i> Miller (Cape aloe, bitter aloe, red aloe, tap aloe)	Xanthorrhoeaceae	Demogress plus, Demogress, L-Carnachof Mix	Treatment of hepatomegaly, jaundice, liver abscesses, tumors, constipation, loss of appetite, indigestion, flatulence and skin diseases; anti-inflammatory, painkiller and digestive tonic (Ayurvedavaridhi & Ayurvedavaridhi 2008)	Venereal diseases, chronic conjunctivitis, to stimulate hair growth (Alonso 2004)	Pulp of the leaves	Africa
<i>Amphipterygium adstringens</i> (Schltdl.) Schiede ex Standl. (Cuachalalate)	Anacardiaceae	Escoba	Antitumoral, antihypercholesterolemic, anti-gastric ulcers (Online Library of Traditional Mexican Medicine 2011; Rosas-Acevedo <i>et al.</i> 2011)	Gastric ulcers, wounds, hemorrhages (Aguilar <i>et al.</i> 1994)	Bark	Mexico

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Table 1. Continuation.

Species (English common name)	Family	Commercial product	Pharmacological activity	Ethnomedicinal uses	Part used	Geographic distribution
<i>Ananas comosus</i> (L.) Merr. (Pineapple)	Bromeliaceae	Demogross, 24 Horas Redu Sí Express, Caps-inn plus (fase 3)	Anti-inflammatory, treatment of cellulite, edema and hemorrhoids (Moro & Basile 2000; Navarro & Ortega 2009)	Digestive, emollient, diuretic, antiseptic, antitumoral, purgative, emmenagogue, deworming agent, carminative, anti-inflammatory, for infections of the respiratory tract and the skin, neurasthenia, dyspepsia, arthritis, slimming, pancreatic insufficiency (Lorenzi & Abreu Matos 2002; Villar <i>et al.</i> 2003; Hurrell <i>et al.</i> 2010)	Fruit, juice, leaves	Central America, Brazil, Paraguay
<i>Arctostaphylos uva-ursi</i> (L.) Spreng. (Kinnikinnick, pinemat manzanita)	Ericaceae	Adelgasol EEUU Maxislim	Astringent, diuretic, antiseptic (Vanaclocha & Cañigueral 2003; Alonso 2004)	Diuretic, urinary antiseptic, digestive, healing (Alonso 2004)	Leaves	Northern Hemisphere
<i>Arthrospira maxima</i> (Setch. & N. L. Gardner) Geitler (Espirulina)	<i>Pseudoanabaenaceae</i>	Spirulina Hawaiana	Hepatoprotective, obesity treatment, antihypertensive, diabetes mellitus, dyslipidemia, non-alcoholic fatty liver disease, antioxidant, antihyperlipidemic, reduces the risk of cancer, improves states of malnutrition, antimicrobial, promotes immune system response (Miranda <i>et al.</i> 1998; Blé-Castillo <i>et al.</i> 2002; Torres-Durán <i>et al.</i> 2007; Ferreira Hermosillo <i>et al.</i> 2010, 2011)	Slimming, reduces cholesterol, stimulates the elimination of kidney toxins, prevents cancer, anti-aging, anti-arthritis (Arenas 2009)	Trichomes	Cosmopolitan freshwater
<i>Arthrospira</i> sp. (possibly <i>A. platensis</i>) (Espirulina)	<i>Pseudoanabaenaceae</i>	Peso Exacto, Spirulina Hawaiana, Reduc Line	Inhibits HIV replication, nutritional, immunostimulant, experimental oncology, antiviral and antibacterial, slimming, anti-anemic, anti-xerophthalmic, topical application on dermatitis, seborrhea and eczema, antihypercholesterolemic, cardiovascular protector; diabetic neuropathies (Blé-Castillo <i>et al.</i> 2002; Arenas 2009)	Coadjuvant in dieting, slimming, reduces cholesterol, stimulates the elimination of toxins from the kidneys, prevents cancer, anti-aging, anti-arthritis (Arenas 2009)	Trichomes	Cosmopolitan freshwater
<i>Aspalathus linearis</i> (N.L.Burm.) R.Dahlgren (Rooibos, Red tea)	Lamiaceae	Demogross Plus	Antioxidant (von Gadow <i>et al.</i> 1997)	Relieves infantile colic, allergies, asthma, dermatological conditions (Joubert <i>et al.</i> 2008)	Leaves	South Africa
<i>Berberis</i> spp. (Quassia)	Berberidaceae	T-Lirol Kilos		Appetite suppressant (bile flow inhibitor); treatment of colic, inflammations, rheumatism (Aguilar <i>et al.</i> 1994)	Stem, whole plant	Europe, western Asia
<i>Brassica oleracea</i> L. var. <i>gemmifera</i> (DC.) Zenker (Brussels sprouts)	Brassicaceae	24 Horas Redu Sí Express	Antioxidant (Kurilich <i>et al.</i> 1999)	Antioxidant, antitumoral, anti-anemic, diuretic, depurative (Hurrell <i>et al.</i> 2009)	Axillary buds	Italy, Belgium, northern France

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Table 1. Continuation.

Species (English common name)	Family	Commercial product	Pharmacological activity	Ethnomedicinal uses	Part used	Geographic distribution
<i>Brassica oleracea</i> L. (Broccoli)	Brassicaceae	24 Horas Redu Si Express	Antioxidant, antitumoral, antibacterial, diuretic (Hurrell <i>et al.</i> 2009)	Purgative (Alonso 2004)	Fresh plant leaves	The European Mediterranean
<i>Camellia sinensis</i> (L.) Kuntze (Green tea, white tea)	Theaceae	Sbelttix, Peso Exacto, Hoodia Slim, Curvelle, Té Verde, Demogross Plus	Green tea: Antihypercholesterolemic, antioxidant, antimicrobial, stimulant, antihyperlipidemic, prevents tooth decay, anticarcinogenic, antiulcer, antidiarrheal (Lorenzi & Abreu Matos 2002; Vanaclocha & Cañigual 2003); white tea: antihypercholesterolemic, antioxidant, antitumoral, antimicrobial, stimulant, antihyperlipidemic (Vanaclocha & Cañigual 2003)	Green tea: stimulant, treats skin conditions, relieves inflammation, allergies, conjunctivitis, diuretic, tonic, antihypercholesterolemic, antimigraine (Lorenzi & Abreu Matos 2002; Alonso 2004); white tea: conjunctivitis, diuretic, tonic, antihypercholesterolemic, antimigraine (Alonso 2004)	Leaves	Southeast Asia, China, India
<i>Carica papaya</i> L. (Papaya)	Caricaceae	Caps-inn rosa (fase 1), Caps-inn azul (fase 2)	Anthelmintic, reduces heart rate, painkiller, antimicrobial, antihypertensive, CNS depressant (Lorenzi & Abreu Matos 2002; Alonso 2004)	Diuretic, laxative, asthma, diabetes, deworming agent, removes corns and warts, the green fruit is thought to induce abortion, emmenagogue, antipyretic, digestive, anti-fever, osteoarthritis, edemas, respiratory conditions, soothing, antioxidant (Lorenzi & Abreu Matos 2002; Alonso 2004; Hurrell <i>et al.</i> 2010)	Leaves, fruit and seeds	Probably originated in Central America, widespread across tropical regions
<i>Centella asiatica</i> (L.) Urb. (Centella)	Apiaceae	Adelgasol EEUU Maxislim	Anti-inflammatory, antimicrobial, to treat hypertrophic and keloid scars, antithrombotic, antioxidant, anti-ulcer, neuroprotectant, antitumoral (Hurrell <i>et al.</i> 2011b; Pieroni 2011)	Activates blood flow, anti-inflammatory, healing, depurative, diuretic, digestive, slimming aid, treatment for cellulite (Lorenzi & Abreu Matos 2002; Pieroni 2011)	The part above ground	Southeast Asia, India
<i>Cinnamomum verum</i> J. Presl. (Cinnamon)	Lauraceae	Alcachofa	Antimicrobial and digestive (Alonso 2004)	Antiflatulent, emmenagogue, fever reducer, painkiller, antidiarrheal, antitussive, treatment for tuberculosis and rheumatism (Alonso 2004)	Bark	Tropical Asia
<i>Citrus × aurantium</i> L. (pomelo group) (Bitter orange)	Rutaceae	Adelgasol EEUU Maxislim, Adelga Sin Dieta, Raíz De Nopal, 24 Horas Redu Si Express, Hiperlina Fruit	Diuretic, remineralizing agent, slimming aid (Botanical-online 2011)	Slimming aid, fat burner	Root	East Indies, Polynesia
<i>Citrus × aurantiifolia</i> (Christm.) Sw. (Lime)	Rutaceae	T-Lirol Kilos, Caps-inn Plus (fase 3), 24 Horas Redu Si express, Demogross, L-Carnachof Mix, Capslim plus	Diuretic, antimycotic, antibacterial (Germosén-Robineau 1996)	Catarrh, sudorific, alkaline dyspepsia, catarrhal angina; nerves, gastritis, kidneys, colic, eye pain, dysentery, bad breath, kidney stones (Roig 1988; Aguilar <i>et al.</i> 1994)	Juice, bark, essence	Southern Asia, the Himalayas

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Table 1. Continuation.

Species (English common name)	Family	Commercial product	Pharmacological activity	Ethnomedicinal uses	Part used	Geographic distribution
<i>Citrus × aurantium</i> L. (orange group) (Orange)	Rutaceae	Demogross, Demogross plus, L-Carnachof Mix, Hoodia slim	Antihemorrhagic, antibacterial and antimycotic essential oil, coadjuvant in the treatment of obesity (Germosén-Robineau 1996; Navarro & Ortega 2009)	Flu, diabetes, hot flushes, weight gain, strengthening bones, postpartum bathing; sudorific, catarrh, stimulant, antispasmodic (Roig 1988; Aguilar <i>et al.</i> 1994)	Juice, bark, essential oil	Asia
<i>Citrus × limon</i> (L.) Osbeck. (Lemon)	Rutaceae	Peso Exacto, Caps-inn plus (fase 3), Capslim plus	Antiscorbutic, antimigraine, digestive, depurative, antibacterial, diuretic, in obesity treatments (Botanical-online 2011)	Stomach ache, nerves, diarrhea, vomiting, dysentery, appetite (Aguilar <i>et al.</i> 1994)	Leaves, flowers, fruit	Southeast Asia
<i>Cordia ecalyculata</i> Vell. (Cha de bugre)	Boraginaceae	Sbelttix	Anticarcinogenic, antiviral, cardiogenic (Raintree Nutrition 2011)	Appetite suppressant, antitussive, fever reducer, stimulant, diuretic, cardiac tonic, slimming aid, treatment of cellulite (Lorenzi & Abreu Matos 2002; Raintree Nutrition 2011)	Leaves, fruit, bark	Brazil, Paraguay, Argentina
<i>Crataegus mexicana</i> Moc. & Sessé ex DC. (Tejocote, manzanita, tejocotera, Mexican hawthorn)	Rosaceae	Caps-inn rosa (fase 1), Caps-inn azul (fase 2), Caps-inn plus (fase 3), Capslim plus	Cardiovascular system, respiratory tract, genitourinary tract, antioxidant (Botanical-online 2011)	Cough, dysentery, diabetes, diuretic, "cool/refreshing to the stomach" (Aguilar <i>et al.</i> 1994)	Fruit, root, leaves, flowers	Mexico
<i>Cyamopsis tetragonoloba</i> (L.) Taub. (Guar)	Fabaceae	L-Carnachof Mix	Gentle laxative, demulcent, appetite suppressant (Vanaclocha & Cañigueral 2003.)	Antihyperglycemic, antihypercholesterolemic (Trease & Evans 1989)	Endosperm of the seeds	India
<i>Cymbopogon citratus</i> (DC.) Stapf (Lemon grass)	Poaceae	Dispan Doble	Weight-loss diets, diuretic, laxative, gentle spasmolytic, antimicrobial, tranquilizer, carminative, antidiarrheal, antihypertensive, fever reducer, expectorant, antifungal, anti-inflammatory, cardioprotective, antioxidant, antitussive, oral candidiasis in patients with HIV or AIDS, immunostimulant (Lorenzi & Abreu Matos 2002; Hurrell <i>et al.</i> 2011b; Natura Net 2011)	Postpartum treatment (Hurrell <i>et al.</i> 2011b)	Leaves	Tropical regions
<i>Cynara cardunculus</i> L. (Artichoke)	Asteraceae	Menosgrass, N-Duretty Plus, Plus 44, Caps-inn azul (fase 2), Caps-inn rosa (fase 1), 24 Horas Redu Sí Express, Demogross, Escoba, L-Carnachof Mix, Siluety Control, Lipoquim	Eupeptic, regulator of liver and bladder function, diuretic, antihyperlipidemic, hepatoprotective, detoxifying (Alonso 2004)	Digestive, diuretic, detoxifying, antidiabetic, gallbladder activator, liver protector, reduces cholesterol, improves kidney function, eliminates gallstones (Aguilar <i>et al.</i> 1994; Lorenzi & Abreu Matos 2002; Alonso 2004)	Dry leaves and root	Northern Africa, the European Mediterranean

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Table 1. Continuation.

Species (English common name)	Family	Commercial product	Pharmacological activity	Ethnomedicinal uses	Part used	Geographic distribution
<i>Ehretia tinifolia</i> L. (Bastard cherry, cherry ehretia)	Boraginaceae	Peso Exacto, Caps-inn Plus (fase 3), Capslim Plus		Healing for nerves, kidney pain, fright, rheumatism and hypertension; protection against heatstroke and windburn (Sanabria 1986; Aguilar <i>et al.</i> 1994; Online Library of Traditional Mexican Medicine 2011)		Mexico
<i>Equisetum arvense</i> L. (Field horsetail, common horsetail)	Equisetaceae	Plus 44, Dispan Doble	Diuretic, hemostatic, promotes healthy bone and joints (Bezanger-Beauquesne <i>et al.</i> 1990; Alonso 2004)	Diuretic, anemia, urinary infections, stomach aches, astringent, gonorrhoea, diarrhoea, mending broken bones, laxative (Aguilar <i>et al.</i> 1994; Lorenzi & Abreu Matos 2002; NaturaNet 2011)	Part above ground	Europe
<i>Equisetum</i> sp. (Horsetail)	Equisetaceae	Plus 44		Flushes the kidneys (Aguilar <i>et al.</i> 1994)	Part above ground	Europe
<i>Erythraea stricta</i> Schltld. (Tlanchalagua)	Gentianaceae	Demogross	Eupeptic, stimulates digestive, hepatobiliary and pancreatic secretions, carminative, diuretic, antihyperglycemic, antiseptic, antipyretic, antitussive, healing agent (Vanaclocha & Cañigueral 2003)	Aperitif, digestive, depurative, sudorific, anti-flu, fever reducer, painkiller, anti-inflammatory, antihypertensive (Moesbach 1955; San Martín 1983; Houghton & Manby 1985; Citarella 1995)	Flowering tops	Mexico
<i>Erythraea tetramera</i> Schiede (Tlanchalagua)	Gentianaceae	Escoba	Antioxidant (Camacho <i>et al.</i> 2011)	Bile, neurosis, diuretic, against inflammations of the stomach, slimming aid (Vida y salud Natural 2012)	Bark	Mexico
<i>Flourensia cernua</i> DC. (Tarbush)	Asteraceae	Dispan Doble	Mycobactericidal (Molina-Salinas <i>et al.</i> 2011)	Stomach aches, diarrhoea, dysentery, purgative, expectorant, rheumatic (Mata <i>et al.</i> 2003)	Leaves	Southern United States to Argentina and Chile
<i>Foeniculum vulgare</i> Mill. (Fennel)	Apiaceae	Siluetu control	Anticarcinogenic, menstrual conditions, galactagogue, digestive, antimicrobial, anti-inflammatory, expectorant, carminative, purgative, diuretic (Lorenzi & Abreu Matos 2002; Alonso 2004; Raintree Nutrition 2011)	Diuretic, rheumatism, kidney stones, cystitis, digestive, carminative, otitis, conjunctivitis, appetite suppressant (Alonso 2004; Raintree Nutrition 2011)	Fruit	Southern Europe, central Europe, the Mediterranean, Asia Minor
<i>Fucus</i> sp. (Fucus)	Fucaceae (Phaeophyta)	Adelgasol EEUU Maxislím	Laxative, treatment for tuberculosis of the cervical lymph nodes, slimming aid, anti-hypothyroidism (Arenas 2009)	Treatment for tuberculosis of the cervical lymph nodes, slimming aid, laxative, depurative, for avoiding goiters, emmenagogue (Arenas 2009)	Thallus	Cold oceans, Northern Hemisphere
<i>Fucus vesiculosus</i> L. (Fucus)	Fucaceae (Phaeophyta)	Sbelttix, Neo Kelp	Laxative, treatment for tuberculosis of the cervical lymph nodes, antiemetic, slimming aid, lymphatic conditions, antihypercholesterolemic, antitumoral, antihypothyroid (Arenas 2009)	Treatment for tuberculosis of the cervical lymph nodes, slimming aid, laxative, depurative, for avoiding goiters, emmenagogue (Arenas 2009)	Thallus	Cold oceans, Northern Hemisphere

Continues

Table 1. Continuation.

Species (English common name)	Family	Commercial product	Pharmacological activity	Ethnomedicinal uses	Part used	Geographic distribution
<i>Fuirena</i> sp. (Zacate)	Cyperaceae	Caps-inn Plus (fase 3), Capslim Plus		Stomach cramps, abdominal pain (Aguilar <i>et al.</i> 1994)	Underground parts	East Africa, a species endemic to Mexico
<i>Garcinia</i> spp. (<i>G. gummi-gutta</i> L. (Roxb.) and <i>G. indica</i> (Thouars) Choisy) (<i>Garcinia</i>)	Clusiaceae	Adelgasol EEUU Maxislím, Siluety control	Antihyperlipidemic, appetite suppressant, aphrodisiac, suppresses ovulation, antipyretic, anti-inflammatory, painkiller, antiviral, hepatoprotective, CNS stimulant, antioxidant, antidepressant, antidiabetic, antithrombotic (Asika <i>et al.</i> 2011)	Gum-resin: emetic and cathartic; fruit rind: astringent	Dry fruit rind and gum-resin	Asia, southern Africa, Polynesia
<i>Gardenia</i> sp. (Zichi)	Rubiaceae	Sbelttix	<i>G. gummifera</i> : gastrointestinal diseases, antiseptic, carminative, expectorant, stimulant, deworming agent, insect repellent, throat pain, spasms (Herbal Cure India 2011)	Obesity treatment (Herbal cure India 2011)	Resin	India
<i>Ginkgo biloba</i> L. (Ginkgo)	Ginkgoaceae	Q-grass	Peripheral and cerebral circulation, antioxidant, antibacterial, vertigo (Bezanger-Beauquesne <i>et al.</i> 1990; Lorenzi & Abreu Matos 2002; ANMAT 2011)	Astringent, controls allergic reactions, circulation stimulant, antifungal, antibacterial, anti-asthmatic, antitussive (Lorenzi & Abreu Matos 2002)	Leaves	China, Japan
<i>Glycine max</i> (L.) Merr. (Soya)	Fabaceae	Hoodia slim	Anti-estrogenic, hormone replacement therapy for menopausal women, antitumoral, antihyperglycemic, antihypercholesterolemic, anti-osteoarthritis, phytocosmetic, coadjuvant in osteoporosis processes, prostatic hypertrophy (Alonso 2004)	Improves vision, controls diabetes, protects against osteoporosis (Alonso 2004)	Seeds	Asia
<i>Hibiscus sabdariffa</i> L. (Roselle)	Malvaceae	Hiperlina fruit, Fulmina Grasas	Antioxidant, antihypertensive, cardioprotective, laxative and diuretic, anticarcinogenic, antibacterial, chemoprotective (Dickel <i>et al.</i> 2007; Lin <i>et al.</i> 2007; Olaleye 2007; Sáyago-Ayerdi & Goñi 2010)	Diuretic, emollient, stomach conditions, antiscorbutic, fever reducer, mucosal protective agent (Aguilar <i>et al.</i> 1994; Lorenzi & Abreu Matos 2002)	Floral calyces	Africa
<i>Hoodia gordonii</i> (Masson) Sweet ex Decne. (Hoodia)	Apocynaceae	Hoodia slim	Anorexigenic (Navarro <i>et al.</i> 2009)	Appetite suppressant (van Heerden 2008)	As a whole	Southern Africa
<i>Hypericum silenoides</i> Juss. (Tlanchalagua)	Hypericaceae	Demogras plus, Demogras, Menosgrass, Tlanchalagua, Raíz de Nopal		Ulcers, stomach ache, diarrhea (Aguilar <i>et al.</i> 1994)	Stems and leaves	Mexico, northern Argentina

Continues

Table 1. Continuation.

Species (English common name)	Family	Commercial product	Pharmacological activity	Ethnomedicinal uses	Part used	Geographic distribution
<i>Ilex paraguariensis</i> A. St.-Hil. (Yerba mate)	Aquifoliaceae	Sbelttix	Anti-inflammatory, antioxidant, antispasmodic, bile stimulant, vasodilator, CNS stimulant, thermogenic anti-obesity, diuretic, delays gastric drainage (Lorenzi & Abreu Matos 2002; Alonso 2004; Dickel <i>et al.</i> 2007; Raintree Nutrition 2011)	Antiallergic, antidepressant, appetite suppressant, cardiogenic, blood purifier, CNS stimulant, digestive, antihypertensive, purgative, wounds and ulcers, muscular and mental fatigue, diuretic (Lorenzi & Abreu Matos 2002; Dickel <i>et al.</i> 2007; Raintree Nutrition 2011)	Leaves	South America
<i>Linum usitatissimum</i> L. (Flax)	Linaceae	Demogross plus, Demogross, Lina Slim, Menosgrass, Hiperlina fruit, L-Carnachof Mix, Plus 44, Caps-inn rosa (fase 1), Caps-inn azul (fase 2), Raíz de Nopal	Laxative, suitable for diabetic diets, anti-inflammatory through topical use, antihypercholesterolemic, antihyperlipidemic, reduces platelet aggregation (Lewis & Elvin-Lewis 2003)	Constipation, gastritis, respiratory, urinary and hyperlipidemic conditions (Alonso 2004)	Dried ripe seeds	Asia
<i>Malus pumila</i> Mill. (Apple)	Rosaceae	Menosgrass, Peso Exacto	Antioxidant, antitumoral, astringent, digestive, laxative, emollient, antiseptic, strengthens teeth and gums, antacid, antibacterial, anthelmintic, fever reducer (Hurrell <i>et al.</i> 2010)	For coughs (Estomba <i>et al.</i> 2005)	Flower, fruit, bark and leaves	Southwest China
<i>Malva</i> sp. (Mallow)	Malvaceae	Dieters drink, U-44, Caps-inn plus (fase 3)	Respiratory infections, antihyperglycemic, laxative (Alonso 2004)	Anti-inflammatory, laxative, antihyperglycemic (Alonso 2004)	Flowers and leaves	Europe, northern Asia, Africa
<i>Malva sylvestris</i> L. (Mallow)	Malvaceae	Escoba, Capslim plus	Respiratory infections, antihyperglycemic, laxative, antioxidant, antimicrobial (Alonso 2004; Hurrell <i>et al.</i> 2011b)	Anti-inflammatory, laxative, antihyperglycemic, burns and insect bites, astringent, chronic bronchitis, cough, asthma, colitis and intestinal constipations, topical use for skin conditions (Lorenzi & Abreu Matos 2002)	Leaves, flowers and fruit	Europe, northern Asia, Africa
<i>Marrubium vulgare</i> L. (White horehound, common horehound)	Lamiaceae	Menosgrass, Demogross plus, Plus 44, Demogross, L-Carnachof Mix, Caps-inn azul (fase 2), Caps-inn rosa (fase 1)	Digestive, painkiller, anti-inflammatory, antimicrobial (Bradley 2010)	Antiseptic, expectorant, to reduce swelling and relieve spasms, diuretic, fever reducer, antitussive, antispasmodic, digestive, orexigenic, eupeptic, bronchial asthma, diabetes, cardiac arrhythmias, arterial hypertension, depurative, hepatic, slimming (Lorenzi & Abreu Matos 2002; Alonso 2004; Hurrell <i>et al.</i> 2011b)	Dried flowering tops	Northern Africa, Asia, central Europe, southern Europe
<i>Matricaria recutita</i> L. (Chamomile)	Asteraceae	Fulmina Grasas	Tonic, digestive, sedative, carminative, appetite stimulant, trichomonacide, anti-inflammatory, immunostimulant, emollient, antispasmodic, antibacterial, deworming agent, soothing effect (Lorenzi & Abreu Matos 2002; Alonso 2004; Hurrell <i>et al.</i> 2008)	Diuretic, digestive, anti-inflammatory, antiseptic (Alonso 2004)	Flower heads	Eurasia

Continues

Table 1. Continuation.

Species (English common name)	Family	Commercial product	Pharmacological activity	Ethnomedicinal uses	Part used	Geographic distribution
<i>Opuntia</i> spp. and <i>Nopalea</i> spp.** (Nopal, prickly pear cactus)	Cactaceae	Hiperlina fruit, Reduc line, Demogross	Ovarian cancer preventive agent, antioxidant, anti-inflammatory, antihyperglycemic, antihyperlipidemic (Supino <i>et al.</i> 1996; Park <i>et al.</i> 2001; De Palo <i>et al.</i> 2002; Galati <i>et al.</i> 2003; Cicero <i>et al.</i> 2004; Tesoriere <i>et al.</i> 2004)	Ulcers, diabetes, swelling, erysipelas, headaches, otitis, antidiarrheal, whooping cough and bronchitis, hepatoprotective, wounds, insect bites, cutaneous irritations, rheumatic pain, herpes, gastritis (Aguilar <i>et al.</i> 1994; Alonso 2004)	Flower, fruit and stalks	The Americas
<i>Opuntia streptacantha</i> Lem. (Nopal xoconoxtle)	Cactaceae	Q-grass, Menosgrass, Demogross plus	Antihyperglycemic, antioxidant (Ibañez-Camacho <i>et al.</i> 1983; Kuti 2004)	Diabetes, stomach and liver problems, fatigue, bruising (Aguilar <i>et al.</i> 1994; Baptist Health System 2011)	Fruit, cladodes, flowers	Mexico
<i>Orthosiphon stamineus</i> Benth. (Java Tea)	Lamiaceae	L-Carnachof Mix	Treatment of obesity associated with other pathologies, diuretic, urinary antiseptic; experimental: antihypercholesterolemic, spasmolytic, cholagogue; antihypertensive, vasodilator (Moro & Basile 2000; Alonso 2004; Adam <i>et al.</i> 2009; Basheer & Majid 2011)	Slimming, gout, rheumatism, urinary antiseptic, cholagogue, antidiabetic, bladder stones, hypertension (Alonso 2004)	Leaves	Southeast Asia, northern Australia
<i>Oryza sativa</i> L. (Rice)	Poaceae	Curvelle	Antidiarrheal, demulcent, anti-inflammatory, fever reducer, painkiller, facilitates the drainage of boils and abscesses; brown rice: laxative fiber and antihyperlipidemic (Vanaclocha & Cañigueral 2003)	Diarrhea, pushing in child birth (Aguilar <i>et al.</i> 1994)	Seeds	Eastern India
<i>Paullinia cupana</i> Kunth (Guarana)	Sapindaceae	Menosgrass, Demogross plus, Demogross, L-Carnachof Mix	CNS stimulant, relaxes bronchi and muscles, anti-platelet aggregation agent, fever reducer, antidiarrheal, slimming (Lorenzi & Abreu Matos 2002; Alonso 2004)	Astringent, against fatigue, to help prevent premature aging, slimming, detoxifies the blood, flatulence, dyspepsia, arteriosclerosis, adaptogen, dysentery, cardiogenic, fever reducer, antimigraine, diuretic, general stimulant and aphrodisiac (Lorenzi & Abreu Matos 2002; Alonso 2004)	Ground seeds	Tropical regions of the Americas
<i>Peumus boldus</i> Molina (Boldo)	Monimiaceae	24 Horas Redu Sí Express	Regulator of liver and bladder function, antimicrobial, antidiabetic, cholagogue, diuretic (Alonso 2004; Hurrell <i>et al.</i> 2011b)	Digestive, cholagogue, sedative, anthelmintic, in poultices for rheumatic pain; gonorrhoea and urinary tract stones (Alonso 2004)	Leaves	South American Andes
<i>Plantago psyllium</i> L. (Psyllium)	Plantaginaceae	24 Horas Redu Sí Express	Mass-forming laxative, demulcent, antihyperglycemic, antihyperlipidemic, anti-inflammatory, gentle diuretic (Alonso 2004)	Bulk-forming laxative (Alonso 2004)	Seed hulls	Europe
<i>Prunus amygdalus</i> Stokes (Almond)	Rosaceae	Natural diet, Diet Siluety	Anti-stress, antioxidant, immunostimulant, antihypercholesterolemic, antihyperglycemic, aphrodisiac, hepatoprotective, prebiotic potential (Hari Jagannadha Rao 2012)	Pectoral, emollient, antitumoral (Hurrell <i>et al.</i> 2010)	Oil, fruit	Southwest Asia

Continues

Table 1. Continuation.

Species (English common name)	Family	Commercial product	Pharmacological activity	Ethnomedicinal uses	Part used	Geographic distribution
<i>Prunus domestica</i> L. (Plum)	Rosaceae	N-Duretty Plus, Fulmina Grasas	Vitamin, demulcent, laxative, astringent, topical healing, hemorrhagic diarrhea, spasmolytic, choleric, hypertensive, painkiller, antihypothermic, antispasmodic, anticonvulsant (Vanaclocha & Cañigueral 2003, Alonso 2004)	Nutritional, digestive, refrigerant, hepatic stimulant, stomach ache, bile, CNS stimulant, diarrhea, nasal hemorrhages, laxative, diuretic, bladder antispasmodic, skin conditions, antioxidant, antitumoral, fever reducer (Lorenzi & Abreu Matos 2002; Alonso 2004; Hurrell <i>et al.</i> 2010)	Flowers, fruit and, in rare instances, bark and leaves	Southeast Europe, southwest Asia
<i>Rhamnus purshiana</i> DC. (Cascara buckthorn)	Rhamnaceae	Plus 44	Laxative, oncology, experimental antihypercholesterolemic (Alonso 2004)	Laxative at high doses, stomach remedy at low doses (Alonso 2004)	Dried bark	North American Pacific coast
<i>Salix humboldtiana</i> Willd. (Pencil willow)	Salicaceae	Peso Exacto, Adelgasol EEUU Maxislím	Painkiller, anti-inflammatory, sedative, anti-platelet, antipyretic, for stomach problems, antibacterial (Botanical-online 2011; Hurrell <i>et al.</i> 2011b)	Fever, headaches, arthralgias, tonic, rheumatoid arthritis, for gastric acid, hysteria, menstrual pain, insomnia; antirheumatic, digestive, astringent, antidiarrheal, sedative (Alonso 2004; Hurrell <i>et al.</i> 2011b)	Bark of the stems and branches, male catkins and leaves	Europe, Asia, North America
<i>Senna alexandrina</i> Mill. (Senna)	Fabaceae	Dieters Drink, U-44, Linaslim, Raíz de Nopal, Body slim, 24 Horas Redu Sí Express, Hiperlina Fruit, Lipo Delgadil Plus	Laxative, antimicrobial (Alonso 2004)	Laxative, expectorant, antibacterial (treatment for gonorrhoea), antithermic, cholagogue, deworming agent, anti-gout, antirheumatic, antihemorrhoidal (Alonso 2004; Hurrell <i>et al.</i> 2011b)	Leaflets and fruit	Southern Arabian Peninsula, the Punjab region, Somalia
<i>Silybum marianum</i> (L.) Gaertn. (Milk thistle)	Asteraceae	L-Carnachof Mix	Hepatoprotective, antioxidant, antihyperlipidemic, antihyperglycemic, anti-inflammatory, antiallergic, antitumoral, patients with HIV/AIDS (Alonso 2004, Hurrell <i>et al.</i> 2011b)	Urinary, bile and uterine problems, bladder, cirrhosis, hepatitis, toxicity, digestive, antiallergic, anti-asthmatic, fever reducer, antihemorrhoidal, arterial hypertension, cardiotoxic (Lorenzi & Abreu Matos 2002; Alonso 2004)	Dried ripe fruits	Southern Europe, northern Africa
<i>Smilax aristolochifolia</i> Mill. (Mexican Zarzaparrilla)	Smilacaceae	Menosgrass, Demogress plus, Dispan Doble, Demogress, L-Carnachof Mix	Diuretic, antimicrobial (Alonso 2004)	Blood purifier, syphilis, diabetes, stomach infections, dysentery, catarrh (Aguilar <i>et al.</i> 1994)	Root	From Mexico to Brazil and the Antilles
<i>Smilax campestris</i> Griseb. (Zarzaparrilla)	Smilacaceae	Demogress plus	Syphilis, diuretic, antimicrobial, anti-inflammatory, anti-asthmatic, spasmolytic, antiallergic, antioxidant, antirheumatic, antipruritic (Lorenzi & Abreu Matos 2002; Alonso 2004; Hurrell <i>et al.</i> 2011b)	Blood purifier, syphilis, diabetes, stomach infections, dysentery, catarrh, sexual impotence, rheumatism, skin conditions, strengthener, diuretic, diaphoretic, arthritis, gout (Aguilar <i>et al.</i> 1994; Lorenzi & Abreu Matos 2002; Alonso 2004)	Root	From Mexico to Brazil, including Central America and the Antilles
<i>Solanum</i> sp. (Solanum)	Solanaceae	Plus 44				

Continues

Table 1. Continuation.

Species (English common name)	Family	Commercial product	Pharmacological activity	Ethnomedicinal uses	Part used	Geographic distribution
<i>Tamarindus indica</i> L. (Tamarind)	Fabaceae	24 Horas Redu Si Express, Fulmina Grasas	Laxative, fever reducer, antiscorbutic, antioxidant, antimicrobial (Hurrell <i>et al.</i> 2008)	Laxative, fever, fright, pimples, satiety inducer, indigestion, diuretic, refreshing, measles, flu, kidney stones (Aguilar <i>et al.</i> 1994; Lorenzi & Abreu Matos 2002)	Fruit and leaves	Tropical regions of Africa (dry savannas)
<i>Taraxacum officinale</i> Webb (Dandelion)	Asteraceae	Demogross Plus, Hiperlina Fruit, L-Carnachof Mix	Cholagogue, hepatoprotective, diuretic, antitumoral, antihyperglycemic, anti-inflammatory, dermatological, depurative, antihypertensive (Alonso 2004; Hurrell <i>et al.</i> 2009)	Diabetes, diuretic, loss of appetite, skin conditions, laxative, cholagogue, gallstones, dyspepsia, rheumatism, slimming, antithermic (Lorenzi & Abreu Matos 2002; Alonso 2004)	Root and leaves	Europe, Asia
<i>Thevetia peruviana</i> (Pers.) K. Schum (Yellow oleander)	Apocynaceae	Caps-inn Plus (fase 3)	Toxic (González <i>et al.</i> 2003)	Eye pain (Aguilar <i>et al.</i> 1994)	Seeds	Tropical regions of the Americas
<i>Tilia</i> spp. (Linden)	Malvaceae	Fulmina Grasas		<i>T. mexicana</i> var. <i>occidentalis</i> Schldl.: menstrual colic, nerves (Aguilar <i>et al.</i> 1994).	Leaves and flowers	Temperate Northern Hemisphere
<i>Trigonella foenum-graecum</i> L. (Fenugreek)	Fabaceae	Hiperlina Fruit, Raíz de Nopal, Escoba	Antihyperglycemic, antihyperlipidemic, antimicrobial, painkiller, antipyretic, anti-inflammatory, antitumoral, hepatoprotective (Alonso 2004; Hurrell <i>et al.</i> 2008)	Diabetes, dyspepsia, fever reducer, stimulates lactation, stomach remedy, pectoral, antiseptic, aphrodisiac (Alonso 2004; Hurrell <i>et al.</i> 2008)	Dry seeds	Europe, southern Asia
<i>Triticum aestivum</i> L. (Wheat)	Poaceae	Hiperlina Fruit, Diet Siluety	Antihyperlipidemic, anti-abortive, to treat male sterility, arteriosclerosis, urinary incontinence, healing, anticarcinogenic, laxative (Bezanger-Beauquesne <i>et al.</i> 1990)	Emollient, erythema, headache, controlling cholesterol and constipation, slimming (Tiwari 2008; Botanical-online 2011)	Bran	The Middle East the Mediterranean
<i>Turnera diffusa</i> Willd. ex Schult. (Damiana)	Passifloraceae	Plus 44, Neo Damiana de California	Appetite suppressant, induces weight loss (Lewis & Elvin-Lewis 2003)	Aphrodisiac, stomach aches, tonic, diuretic, stimulant (Roig 1988; Aguilar 1994)	Leaf, stems and flowering tops (Roig 1988)	Greater Antilles, Bahamas, Virgin Islands, tropical regions of the Americas
<i>Zingiber officinale</i> Roscoe (Ginger)	Zingiberaceae	Peso exacto	Antiviral, painkiller, antipyretic, antispasmodic, digestive, carminative, antimicrobial, immunoprotective agent (Germosén-Robineau 1996; Lorenzi & Abreu Matos 2002; Alonso 2004)	Asthma, bronchitis, menorrhagia, tonic, digestive, expectorant, anti-inflammatory, antihyperlipidemic, aphrodisiac, inhibits appetite, antihyperglycemic, antiemetic, antirheumatic (Roig 1988; Lorenzi & Abreu Matos 2002; Alonso 2004)	Rhizomes	The Old World, tropical regions of Asia

*CNS – central nervous system.

**The two taxa are taken together because they share a common name and uses. It has thus far not been possible to identify the species. The name “prickly pear” cactus is mentioned on the label for the product called Demogross, as though it were the scientific name for Nopal Penca.

Erythraea stricta; *Garcinia* spp.; *Glycine max* (L.) Merr.; *Linum usitatissimum*; *Malva sylvestris*; *Malva* sp.; *Opuntia streptacantha* Lem.; *Opuntia* spp./*Nopalea* spp.; *Peumus boldus*; *Plantago psyllium*; *Prunus amygdalus* Stokes; *Silybum marianum* (L.) Gaertn.; *Arthrospira maxima*; *Arthrospira* sp.; *Taraxacum officinale*; and *Trigonella foenum-graecum* L. —19 taxa that are antihyperlipidemic agents (including

antihypercholesterolemic agents): *Alisma plantago*; *Amphipterygium adstringens* (Schldl.) Schiede ex Standl.; *Camellia sinensis* (L.) Kuntze; *Cynara cardunculus*; *Fucus vesiculosus*; *Garcinia* spp.; *Glycine max*; *Linum usitatissimum*; *Opuntia* spp./*Nopalea* spp.; *Orthosiphon stamineus*; *Oryza sativa*; *Plantago psyllium*; *Prunus amygdalus*; *Rhamnus purshiana*; *Silybum marianum*; *Arthrospira maxima*; *Arthrospira* sp.;

Table 2. Microscopic analysis of the plant species contained in a sample of weight-loss products sold in health stores on Line 3 of the Mexico City subway.

Product	Declared ingredientes*	Content found (botanical species): diagnostic structures studied	Undeclared content found	
Neodamiana de California	Damiana de california (Turnera diffusa willd.)	<i>Turnera diffusa</i> Willd. ex Schult.: Abundant verrucous bristles		
		Spiral vessels		
		Simple starch grains		
		Paracytic stomata		
		Fibers		
		Long tectorial hairs		
		Scarring at the base of the hair follicle		
		Cells with yellowish content		
		Boldo		
		Diente de león	<i>Taraxacum officinale</i> Webb: Skin cells with very long, septate hairs	
Fenogreco	<i>Trigonella foenum-graecum</i> L.: Seeds: simple starches, with an elongated hilum. Epidermal cells tapered to a point			
Hojas de Sen	<i>Senna alexandrina</i> Mill.: Paracytic stomata, epidermis with short, unicellular hairs, veins with calcium oxalate crystals and drusen			
Hiperlina Fruit	Nopal	Absent		
	Malva	<i>Malva</i> sp.: very long, verrucous hairs	Seeds from 3 different species	
	Salvado de trigo	<i>Triticum aestivum</i> L.: Very long unicellular hairs, strangled cells, starch grains		
	Tlanchalahua	Absent		
	Toronja	Absent		
	Linaza Canadiense	<i>Linum usitatissimum</i> L.: Seed: sclerenchyma, cells with orangey content, mucilage.		
	Jamaica (Hibiscus sp.)	Absent		
	Salvado	<i>Triticum aestivum</i> L.: septate and verrucous hairs, loose raphides, stomata.		
	Linaza	Absent		
	Alcachofa (Synara acolymus)	<i>Cynara cardunculus</i> L.: short, unicellular hairs with triangular epidermal cells forming the base of the hair. Crystalliferous fibers.	Undetermined leaf, presence of long hyphae	
Escoba	Fenogreco (<i>Trigonella foenum-graecum</i>)	<i>Trigonella foenum-graecum</i> L.: Seeds: simple starches, with elongated hilum. Epidermal cells taper to a point.		
	Malva (<i>Malva silvestris</i>)	Absent		
	Cuachalate (<i>Amphipterygium adstringens</i>)	<i>Amphipterygium adstringens</i> (Schltdl.): Schiede ex Standl.: Reddish external bark		
	Tlanchalagua (<i>erythraea tetrámera</i>)	Absent		
	Aloe vera L (<i>Aloe ferox</i> , <i>A. barbadensis</i>)	Absent		
	Tlan chalagua (<i>Erytreaca stricta</i> L.)	Absent		
	Naranja (<i>Citrus sinensis</i>)	<i>Citrus × aurantium</i> L.: bark: calcium oxalate crystals and cells with orangey, oily content.		
	Lino (<i>Linum usitatissimum</i>)	Absent		
	Manrubio (<i>Manrubium vulgare</i>)	Absent		
	Demogras	Alisma (<i>Alisma plantago</i> , L.)	Absent	
Lima (<i>Citrus limetta</i> , Risso)		Absent		
Milenrama (<i>Achillea miliefolium</i>)		Absent		
Cocolmeca (<i>Smilax pseudo china</i>)		<i>Smilax</i> sp.: Grouped starch grains		
Nopal penca (Prickly pear cactus)		<i>Opuntia</i> spp./ <i>Nopalea</i> spp.: air-filled parenchyma		
Bromelina (<i>Ananas comosus</i>)		<i>Ananas comosus</i> (L.) Merr.: External epidermis from the perianth tube		

Continues

Table 2. Continuation.

Product	Declared ingredientes*	Content found (botanical species): diagnostic structures studied	Undeclared content found
Dispan Doble	Nopal deshidratado	Stalks: Aerenchyma	
	Phitolaca	Absent	
	Zendo**	<i>Equisetum</i> sp.: Stems with siliceous protuberances, paracytic stomata with cellulose. <i>Arctostaphylos uva-ursi</i> (L.) Spreng.: epidermis with large, rectangular cells, large stomata, short, septate crystals with orangey content.	
	Cocolmeca	<i>Smilax</i> sp.: roots and rhizomes. Grouped starches, cells with thickened bark, stony cells and cells with orangey content	
	Aloe vera (<i>Aloe ferox</i>)	Absent	
	Guaraná (<i>Paullinia cupana</i> Kunth)	Absent	
	Naranja (<i>Citrus aurantium</i>)	Absent	
	Lino (<i>Linum usitatissimum</i> L.)	<i>Linum usitatissimum</i> L.: Epidermis, endosperm with grains of aleurone, fibers and cells with content	
	Marrubio (<i>Marrubium vulgare</i> L.)	<i>Marrubium</i> sp.: epidermis with starred and septate hairs	
	Llantén acuático (<i>Alisma plantago</i>)	Absent	
L-Carnachof Mix	Lima (<i>Citrus limonum</i>) Risso	Absent	Undetermined leaves: epidermis with stomata in striated rows
	Milenrama (<i>Achillea millefolium</i> L.)	Absent	
	Cocolmeca (<i>Smilax cordifolia</i>)	<i>Smilax</i> sp.: grouped starch grains	
	Nopal (<i>Opuntia ficus-indica</i> Miller)	Absent	
	Goma guar (<i>Cyamopsis tetragonoloba</i> Taub)	Absent	
	Alcachofa (<i>Cynara scolymus</i> L.)	Absent	
	Cardo mariano (<i>Sylibum marianum</i> Gaertner)	Absent	
	Diente de león (<i>Leontodon taraxacum</i> L.)	Absent	

*The names of the “ingredients” have been reproduced from the product labels. Therefore, in many cases, scientific names and their respective authorities are erroneous.
 **Composed of *Andropogon citratus*, *Arctostaphylos uva-ursi*, *Equisetum arvense* and *Flourensia cernua*.

Trigonella foenum-graecum; and *Triticum aestivum*—and 30 taxa with a combined effect in the form of two or more effects related to weight loss (Tab. 1). Nevertheless, for the majority of the species mentioned, there have been no scientific studies providing evidence of a link to the effective treatment of obesity (Martínez-Álvarez *et al.* 2006).

Opinions on green tea, black tea and the variety known as Oolong tea (*Camellia sinensis*) are divided between those who espouse their effectiveness as slimming aids due to their high content of catechins (Opala *et al.* 2006) and those who maintain that the number of studies indicating such effectiveness remains insufficient. Opinions also differ regarding the metabolite responsible, whether it is the catechins, the caffeine or the synergy between the two (Kovacs & Mela 2006).

Cynara cardunculus (artichoke), *Hibiscus sabdariffa* (roselle) and *Ilex paraguariensis* (yerba mate) may be beneficial in the treatment of hyperlipidemia (Dickel *et al.* 2007). Artichokes have a purifying effect, as well as reducing cholesterol and contributing to weight loss (Navarro & Ortega 2009). Other ingredients, such as cinnamon (*Cinnamomum verum* J. Presl.), whose known pharmacological properties have nothing to do with

slimming, would only be adding flavor to the product. However, the presence of *Marrubium vulgare* L.—used as an orexigenic—would have an effect which is exactly the opposite of that expected, given that it is considered to be a good appetite stimulant (aperitif), because it promotes the secretion of saliva, the production of gastric juices and all of the digestive processes (Bradley 2010).

Opuntia streptacantha is reported as an antihyperglycemic agent, explaining why it may be effective in cases of obesity associated with other conditions such as diabetes (Basurto Santos *et al.* 2006). *Thevetia peruviana* (Pers.) K. Schum., known as “yellow oleander”, is one of the plant species mentioned in the composition of Caps-inn plus (fase 3) and Capslim (both fanciful names for the respective products) but is toxic because it contains glycosides that are cardiotoxic. For this reason, the Mexican Federal Commission for Health Oversight ordered its recall from the market (El Universal 2009).

Despite the lack of certainty regarding the pharmacological activity of many of the species considered, together with the antagonistic or adverse effects which may be caused by these products, as well as their or contraindications, they remain a valid alternative for many consumers (Pillitteri *et al.* 2008).

The use of attractive images of muscled or slim individuals is well received by the overweight or obese, who are vulnerable to advertisements of quick solutions and who sometimes ignore or fail to perceive the potential risks that consumption of these products entail (Molares *et al.* 2012). Of all such products, approximately 80% are mixtures of between 2 and 14 ingredients. It has been shown that consuming three or more species in combination increases the risk of undesirable antagonist effects and of the inhibition of the desired effects (Nascimento *et al.* 2005).

Plant species employed in the making of the products and their ethnomedicinal properties

The majority (99%) of the species used in slimming products are plants with existing ethnobotanical records, referring to a large variety of medicinal uses (Tab. 1). Of those, 28% have been recorded as weight-loss aids or appetite suppressants. Another group of species have been registered as possible coadjuvants to the treatment of obesity, as diuretics (17%), laxatives (13%), antihyperglycemic agents (13%) and antihyperlipidemic agents (5%), or as products with combined effects (21%). For 15%, there are no ethnobotanical references linking them directly or indirectly with the treatment of overweight.

Similarly, ten of the species mentioned as weight-loss aids through ethnobotanical contributions have been confirmed as such in pharmacological studies, 49 species were investigated and proved to have therapeutic effects coadjuvant to the treatment of obesity and 15 did not have studies of this type related to the uses considered. However, 9 of the 15 species to have been pharmacologically investigated have been revealed in ethnobotanical studies to be slimming aids (*Citrus × aurantium*; *Fucus* sp.; *F. vesiculosus*; *Hoodia gordonii*; *Ilex paraguariensis*; *Orthosiphon stamineus*; *Paullinia cupana*, *Arthrospira maxima*, *Arthrospira* sp. (Tab. 1).

Microscopic analysis of the species present in a sample of the commercial products

Table 2 presents the results of the microscopic observation, the diagnostic characters found for each of the species listed on the labels as well as the structures or the characters of species not listed on the labels. Generally we found adulterations in the study sample. Also fungal filaments were detected on leaves in the product called Escoba (Arenas AMx1 sample) indicating the deteriorated state of the ingredients. The presence of fungi is often due to storage under conditions of humidity that is higher than that recommended, and its proliferation, as well as that of other microorganisms, may lead to decomposition of the main active plant ingredients and to the generation of substances that, upon ingestion, may lead to toxicity (Nascimento *et al.* 2005). In addition, for all of the products analyzed, there was a lack of concordance between the composition declared

and that actually observed, only 35-58% of the species mentioned on the labels actually being present in the products.

Salesperson recommendations and point of view

The salespeople—employees or sales managers—are mostly women aged between 25 and 45. Although most have no more than 3 or 4 years of experience, there were some salespeople with much more (up to 30 years of) experience. Some also stated that they had used the products themselves, and that it was based on their own experience that they were able to recommend the products to customers.

The knowledge possessed by some young salespeople stems from their own interest in informing themselves, which led them to glean such information from the Internet. They also claim to have learned from the accompanying reading material provided by the suppliers. One respondent with a long history in the business claimed to have taken a kind of training course offered by the company and later learned both from customers and from various text-based sources.

In general terms, the respondents cite the harmless nature of the products, stressing that the ingredients are natural (“They don’t do any harm because they’re herbs”, as they claim for Hoodia Slim), unlike chemicals, an assertion which apparently seems aimed at reassuring customers, while simultaneously justifying their prolonged use. Salespeople recommend, for example, that the product be used for 30 days, followed by a period off and then another 30 days of use (e.g., Demograss plus, Caps-inn rosa (fase 1)), 30 days of use (e.g., Alcachofa capsules, clarifying that, in this case, “this does include chemicals”, and Adelgasol EEUU Maxislim), another 60 days of use (e.g., Menosgrass), or another 45 days of use (e.g., Demograss, for which “the slimming result is due to various reasons: because it looks after the liver, gets rid of worms and solves digestive problems”). The product known as L-Carnachof Mix also comes with the recommendation to take a 15-day period off before re-starting the treatment, as “that provides the most complete effect”. The latter is one of the newest products on the market, and it is said that “it has no laxative effect or other effect on the stomach”, “now it’s all about artichokes”, “now it has artichokes because they burn fat and protect the liver”; another feature is that it is not particularly sought out by men because it is accompanied by a reducing gel for topical use to be applied by massage. In terms of dosage, recommendations vary, from, for example, 1-2 capsules or tablets taken in the morning or evening, and sometimes requiring fasting, 2 doses before each meal or 2 doses three times a day (e.g., Neo Kelp).

In terms of the recommendations made by the salespeople, they repeat the warning concerning laxatives, given that according to the respondents, these “make a person feel bad the next day”. This is possibly due to the message

widely disseminated in the mass media regarding the harmful consequences of weight loss by sudden dehydration as a consequence of the use of laxatives.

One respondent indicated that “when a consumer experiences secondary effects such as diarrhea and dehydration, they are due to personal intolerance of certain species such as senna, although these effects are required to a certain extent given that the excess fat is eliminated by means of the feces and in the urine”. For example, in the case of the Raíz de Nopal tablets containing senna and grapefruit, it states among the ingredients: “Grapefruit burns fat. It also has senna leaves for constipation”. Salespeople also sometimes ask customers for personal information in order to suggest the most suitable option, by means of questions such as “How many pounds do you want to lose?”, just as they also advise them on the correct way to weigh themselves.

Confusion was also detected regarding certain botanical features on the part of some of the respondents, such as “Espirulina (*Arthrospira* spp.) is no use on its own because it's like yeast. It's *Espirulina* plus seaweed that works . . . there's no *Espirulina* left in Mexico anymore!”, which was a response on the source of the raw material. In this case the respondent interviewed specified a difference between *Espirulina* and *Espirulina* seaweed. Probably what she meant is that *Espirulina* has nutritional properties similar to those of yeast. Instead, what you need to lose weight is *Espirulina* seaweed (better known with this compound name since its appearance on the market). Regarding the absence of *Arthrospira* nowadays referred to by the respondent, this may be related to the production plant called Sosa Texcoco which was a company who flourished in the 1960s to have since disappeared (Basurto Peña 2009).

In terms of the characteristics of the typical customers buying these products, the respondents claimed that they are both men and women, except in the case of products including lotions or soaps, which are more favored by women. However, information offered by the respondents such as “Tlanchalagua is running very low because it's very popular” may be interpreted as a diagnosis of its environmental availability as well as that of other species which have been exploited for commercial gains, and for which studies investigating these issues will be useful to assess the state of conservation of the diversity of the species used.

Conclusions

The majority of the plants used in the making of products designed as weight-loss aids lack sufficient studies to arrive at conclusive data, with the added aggravating factor of the counter-indications listing the possible adverse effects. Artichoke, *Cynara cardunculus*, may contribute to weight loss and prickly pear cactus pad, *Opuntia streptacantha*, may be effective in obesity linked to diabetes. *Thevetia peruviana*, known as “yellow oleander” continues to form part of the composition of weight-loss products,

despite the Mexican health authorities' ordering of its recall due to its toxic nature. However, certain traditionally used plant species linked to the treatment of overweight and related conditions—whether pharmacologically assessed or not—have been incorporated into industrial products, forming part of the channels of commerce of health stores, becoming visible again to various sectors of the urban population (Hurrell *et al.* 2011a). This process would definitively attribute more weight to certain ethnobotanical properties than others, influencing and transforming features of their holistic use in the majority of cases (Miles 1998; Molares *et al.* 2012).

The microscopic analysis carried out allowed us to determine that many of the plant ingredients stated on the labels were absent from the products, that the products contained adulterants and that inappropriate methods of storage were employed, underscoring the urgent need for better quality and safety control of these herbal remedies.

From our analysis of the recommendations provided by the salespeople, we can conclude that it would be desirable for them to receive systematized academic training. In a survey carried out by the Wisconsin School of Medicine, 83% of the consumers surveyed reported not having consulted their family doctor on the consumption of “natural products”, and, in the majority of cases, such products were acquired through personal choice. This set of circumstances reveals the primary role that the salespeople play in advising on the selection of herbal remedies (Pfeffer & Kaufer-Horwitz 2001; Arenas 2010).

Despite the negative features encountered, current lifestyles, prevailing aesthetic standards and a lack of time for activities such as physical exercise and sports are likely responsible for public adherence to these new habits of accessing non-traditional therapeutic resources, which may be acquired in health stores found when “passing by” and strategically located on the route that potential consumers are obliged to follow. Meanwhile, traditional markets continue to exist, perhaps oriented toward a more conservative population loyal to its roots.

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