

**CZECH UNIVERSITY OF LIFE SCIENCES PRAGUE**

**Faculty of Tropical AgriSciences**



Czech University of Life Sciences Prague

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AgriSciences**

**The use of medicinal plants in the treatment of  
selected lifestyle diseases in the population of Santa  
Marta, Colombia**

Master's Thesis

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## **Declaration**

I, Martina Hamříková, hereby declare that this thesis, submitted in partial fulfilment of requirements for the MSc. degree at the Faculty of Tropical AgriSciences of the Czech University of Life Sciences Prague, is wholly my own work unless otherwise referenced or acknowledged.

In Prague: 27.4.2017

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Martina Hamříková

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## Abstract

Colombian population is considerably threatened by lifestyle diseases. However, as the traditional medicine is still popular in Colombia, the local people do not hesitate to use medicinal plants for their treatment. Therefore, the main aim of this thesis was to find medicinal plants that are recommended by herbalist's shops to cure obesity, diabetes, hypertension and heart diseases. Data were collected in the period of September 2016 - February 2017 in 7 *herboristerías* in Santa Marta through 3 semi-structured questionnaires and open-ended interviews. First questionnaire was focused mainly on the information about the vendor, the second questionnaire was for each disease category, focusing on the appropriate medicinal plants. The third was oriented on each mentioned plant, describing plant part used and the mode of preparation and application. The study documented 53 folk taxa corresponding to 56 plant species, and belonging to 35 botanical families. Quantitative ethnobotanical indices were calculated to determine the most cited and frequently used species to treat each disease category, and to compare ailments among themselves. For diabetes the most frequently cited plants were *Anacardium occidentale*, *Moringa oleifera* and *Bauhinia* sp. For obesity it was *Marrubium vulgare*, for hypertension *Salvia palifolia* and in heart diseases category it was *Phthirusa stelis*. In general, the scale of used plants was relatively broad, as we found 30 unique species, and therefore the Informant Consensus Factor of each ailment category was low. We also documented species of plants for which future researches about biological activity could be done. This thesis contributed to the exploration of the traditional Colombian knowledge about medicinal plants.

**Keywords:** ethnobotany, traditional knowledge, herboristería, diabetes, Latin America

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## **List of abbreviations**

CIA	Central Intelligence Agency
DBP	Diastolic Blood Pressure
FAO	Food and Agriculture Organization
F <sub>IC</sub>	Informant Consensus Factor
FL	Fidelity Level
IDEAM	Institute of Hydrology, Meteorology and Environmental Studies
IDF	International Diabetes Federation
OECD	Organisation for Economic Co-operation and Development
SBP	Systolic Blood Pressure
SNSM	Sierra Nevada de Santa Marta
UR	Use-Report
WHO	World Health Organization



# 1 Introduction

## 1.1 Colombian Flora

Colombia's flora is very rich, and it is making this place unique. Also Colombian biodiversity is really extraordinary. The diversity of Tropical Andes (Santa Marta is part of it) and Tumbes-Chocó-Magdalena region was described as a biodiversity "hotspot" (Mittermeier et al., 2004; Alvear et al., 2015). Myers (2000) defined a hotspot as a biogeographic region, which has 30% or less of its original primary vegetation. In other words, it is extremely threatened, because it has lost 70% of its original natural vegetation. There are 254 flora species in the Colombian territory, which are threatened by extinction (Calderón Sáenz, 2007). Colombia's endemic vascular taxa numbers more than 15,000 species (Mittermeier et al., 2004; Hobohm, 2014).

Colombia can pride in its nature, because its vegetal treasure forms about 12% of the world. There are 927 different species of mosses, 1,400 species of ferns, 1,515 species of lichen and 840 species of hepatics (Rangel-Ch, 1995; Ministry of Environment and Sustainable Development, 2012). During recent years, several botanical researches also revealed many newly discovered species, especially in the areas of Sierra Nevada de Santa Marta, such as *Deprea nubicola* N.W.Sawyer (Solanaceae; Sawyer, 2007), *Matisia racemifera* Fern.Alonso (Malvaceae; Fernández-Alonso, 2002), *Podandrogyne laplanadae* Cochrane (Cleomaceae; Cochrane, 2016), *Passiflora splendida* M. Bonilla, C. Aguirre & C. Caetano (Passifloraceae; Morales et al., 2016) or *Serpocaulon tayronae* D.Sanín (Polypodiaceae; Sanín, 2015). Nevertheless, one of the most numerous group still belongs to the family Orchideaceae, where the species number varies between 3,200 and 3,848 (Yepes-Rapelo et al., 2015).

### 1.1.1 Colombian medicinal plants

Colombia can be considered as a heaven of medicinal plants. In the world there are about 350,000 - 500,000 plants species. 35,000 - 50,000 of them occur just in Colombia. Peasants and indigenous tribes believe that about 5.000 of them have medicinal properties (Fonnegra and Jiménez, 2007; Bueno et al., 2011). Also the investigations show that there are many plants and crops with medical effects in Colombia. Some are more known than others, and some are less popular. Constantly bigger popularity acquire for example

*Moringa oleifera* Lam., which is not native to Colombia, and thanks to its anti-cancer, anti-inflammatory, anti-aging (and much more) properties replaces other Colombian medicinal plants (Castillo-Lopez et al., 2016). *Euphorbia cotinifolia* L., *Euphorbia tirucalli* L. (Euphorbiaceae) and other few plants of *Euphorbia* genus found in Colombia proved antiviral and antiherpetic activity (Betancur-Galvis et al. 2002). Other plants, such as *Brownea rosademonte* Bergius (Leguminosae, subf. Ceasalpinioideae), *Tabebuia rosea* (Bertol.) DC. (Bignoniaceae), *Sida acuta* Burm.f. (Malvaceae) or *Pseudoelephantopus spicatus* (Juss. Ex Aubl.) Rohl ex Gleason (Asteraceae) have neutralizing properties of the haemorrhagic effect of *Bothrops atrox* venom (Otero et al., 2000). Antimycobacterial properties were found for example in *Allium sativum* L. (Amaryllidaceae), *Senna obliqua* (G. Don) H.S. Irwin & Barneby (Leguminosae), *Lantana hispida* Kunth (Verbenaceae) or *Leucas volkensis* Gürke (Lamiaceae; Graham et al., 2004; Jiménez-Arellanes et al., 2007; Bueno et al., 2011), whereas *Renalmia alpinia* (Rottb.) Maas (Zingiberaceae) displays antinociceptive and analgesic effects (Gómez-Betancur et al., 2015). Cogui tribe, that are indigenous people inhabiting the mountain range of Sierra Nevada de Santa Marta, claims credit especially to *Stevia lucida* Lag. (Asteraceae), *Ladenbergia moritziana* Klotzsch (Rubiaceae), *Erechtites hieracifolia* (L.) Raf. (Asteraceae) or *Aniba* sp. (Lauraceae), as each of them has more medicinal properties (Carbonó-Delahoz and Dib-Diazgranados, 2013). In the comparison of 3 ecoregions (Andes, Amazon, Chocó) in four South American countries (Bolivia, Colombia, Ecuador, Peru), it was Colombia who prevailed in the number of medicinal palms (56 useful species with 278 medicinal uses). Some of the important and most useful medicinal palms found in Colombia are *Cocos nucifera* L., *Oenocarpus bataua* Mart. or *Manicaria saccifera* Gaertn. (Paniagua-Zambrana et al., 2015).

According to scientific researches, medicinal plants used in Colombia by locals are usually in majority belonging to Lamiaceae, Asteraceae, Apiaceae, Fabaceae, Solanaceae, Rutaceae or Rubiaceae (Toscano Gonzales, 2006; Gómez-Estrada et al., 2011; Carbonó-Delahoz and Dib-Diazgranados, 2013).

## 1.2 Traditional medicine in Colombia

Nature has always been part of the medicine. Now, medicinal plants play a crucial role in the traditional health care, just as it was in the past. (Schippmann et al., 2002;

Guido et al., 2015). Traditional medicine occupies a very important part of developing countries, where about 80% of the population rely on traditional resources for their health care. It is also typical for Colombian society. (Gómez-Estrada et al., 2011; Cadena-González et al., 2013). In Colombia, 40% of the whole population tend to traditional medicine (WHO, 2002). It is also known, that medicinal plant knowledge is not characteristic only to indigenous people, but also to a wide part of society (Mathez-Stiefel and Vandebroek, 2011). Even in political field, there was an effort to integrate traditional medicine (Guido et al., 2015).

The traditional medicine in Colombia have not disappeared yet mainly because of homeopaths, herbalists and many local people and peasants, which managed to preserve their knowledge (Fonnegra and Jiménez, 2007). As mentioned, there are a few ethnobotanical studies done. They are focused mainly on the medicinal plants in Colombia. One of those studies point out the knowledge of traditional healers. The investigators recorded 101 species, which are used in the traditional medicine in Antioquía and Chocó to cure snakebites (Otero et al., 2000). Already the investigation already showed how extensive the knowledge of local healers is. An ethnobotanical research done by Carbonó-Delahoz and Dib-Diazgranados (2013) described that the Cogui from Sierra Nevada de Santa Marta (SNSM) tribe use 189 different medicinal plant species to treat various illnesses, such as flu, herpes, skin rashes, etc. or to struggle with many kinds of pain and other health problems. The majority of those plants is recollected in the wild. However, the Cogui tribe always first tries to move the illnesses away by group ceremonies. Other investigation which confirms that local people heal themselves by the use of medicinal plants discovered that there are 84 species used by the communities of the Sidewalk San Isidrio, Colombia. It also points that the wisdom about traditional medicine is handed down from generation to generation, and it is always the healer or mother's family head, who maintain the knowledge (Toscano Gonzales, 2006).

### **1.3 Previous ethnobotanical studies in Colombia**

It is known, that Colombia is a country with a lack of literature reporting (Cámara-Leret et al., 2014). Already in eighties, Gyllenhaal et al. (1986) were on the grounds of a fast environmental changes pointing out a need of investigations in the development of new drugs from Colombia's plants. Unfortunately, Colombia is still a

country, where it is possible to obtain more information by fieldwork than from the publications (Cámara-Leret et al., 2014). According to Albuquerque et al. (2013), Colombia belongs among the Latin America's countries with lesser number of published papers in ethnobiology researches. Between 1963 - 2012, there were only 11 papers with ethnobotanical researches published on Scopus ([www.scopus.com](http://www.scopus.com)), or on Web of Science ([www.isiknowledge.com](http://www.isiknowledge.com)). Brazil with 289 papers, Mexico with 153 papers and Peru with 61 published papers are the countries which take the lead. Nevertheless, the ethnobiological researches and publishing has in Colombia rather increasing character last years. Even Paniagua-Zambrana et al. (2015) cited that in the three ecoregions (Andes, Amazon, Chocó) in four countries (Bolivia, Colombia, Ecuador, Peru), it is Chocó of Colombia which has increasing number of new records related to medicinal use of palms.

## **1.4 Investigated diseases**

Chronic diseases, such as diabetes, cancer, hypertension, cardiovascular disease, and heart disease, have always a few things in common; they last a long time, they can be prevented in timely manner and it takes them decades to get “well”-formed (WHO, 2005; Lewanczuk, 2008).

Instituto Colombiano de Bienestar Familiar (2006) marks lifestyle diseases in Colombia as one of the greatest causes of death.

### **1.4.1 Diabetes**

Diabetes, officially diabetes mellitus, is a group of metabolic diseases, which are characterized by hyperglycemia, and damage of the metabolism of saccharides. There are two main types of diabetes that are distinguished; type 1 diabetes and type 2 diabetes. Both types come into existence via lack or no insulin (hormone made by pancreas) presence (Mann, 2002; Caballero, 2005).

Type 1 diabetes is characterised by the complete absence of endogenous insulin production as a result of autoimmune and permanent destruction of pancreatic  $\beta$ -cells. It is present in 5 - 10% of people who suffer from diabetes, and affected persons who are

dependent on lifelong exogenous insulin application. Type 2 diabetes is present in 90 - 95% of diabetes cases, and it is known as adult-onset diabetes or non-insulin-dependent diabetes. It means that the pancreas cannot produce enough insulin or the insulin produced does not serve well (American Diabetes Association, 2008).

Although each type is caused by different actions, both are accompanied by similar symptoms, such as weight loss, polyuria, blurred vision and polydipsia. People with type 2 diabetes have often dyslipidemia (low HDL-cholesterol and high triglycerides), obesity and elevated blood pressure (Campbell and Campbell, 2006; American Diabetes Association, 2008; IDF, 2015a).

Instituto Colombiano de Bienestar Familiar (2006) speaks about 5.7% of diagnostic cases of diabetes mellitus in adults (18 - 64 years) between 2004 and 2005. According to WHO (2015a), in 2012 there were 3% of deaths caused by diabetes mellitus in Colombia. It killed 6,100 people. Therefore, diabetes was incorporated among “*Top 10 causes of death*”. However, newer data obtained from International Diabetes Federation (IDF, 2015b) for the year 2015 shows that there were 3,048,700 adults (20 - 79 years) with proved diabetes in Colombia, but 1,220,300 more people (20 - 79 years) had the diabetes undiagnosed. This increases the cases of death to 19,802.1 deaths related to diabetes in 2015.

#### **1.4.2 Obesity**

Obesity, which is very closely-related to chronic diseases, can be present in more than 20 chronic diseases, including diabetes and hypertension (STOP Obesity Alliance, 2012). It is often connected to the wealth, and it is determined by body mass index (BMI). Usually, the standards mark BMI greater than 25 as overweight, and in the case of obesity BMI exceeds the value 30 (Campbell and Campbell, 2006). Nowadays, obesity is a very widespread world disease. It is linked to the high risk of many chronic diseases (e.g. diabetes, dyslipidemia, hypertension, cardiovascular diseases and cancer). This disease still has growing tendency and many developed countries fight against obesity through special programs (Wang and Lobstein, 2006).

Obesity is a worldwide problem. It is reported that there are more deaths caused by overweight than by underweight (WHO, 2016). Weight problems are for Colombia more

characteristic every year. The investigation done by Instituto Colombiano de Bienestar Familiar (2006) shows that there were 3.1% children at the ages of 0 - 4 with excess weight between 2004 and 2005. The percentage increased up to 4.3% of children with excess weight that are 5 - 9 years old. In groups of children between 10 and 17 years, 10.3% of them evidenced excess weight (girls are affected more than boys; 12.3:8.1%). It was also proved that in Colombia the maternal education has positive relationship with child overweight, so the children of mothers with higher education level are being overweight (Muthuri et al., 2016). Obese children tend to eat more saturated fats and less fresh fruits and vegetables (Ledesma-Ríos et al., 2016). Finally, there is also a very important problem related to excess weight in adults between 18 - 64 years. This number rises up to 46% (women 49.6%, men 39.9%). 33% of men and 31.1% of women in Colombia suffer from overweight, and obesity affects 16.6% of women and 8.8%. All age groups have confirmed that weight problems are more typical for urban zones than for rural zones (Instituto Colombiano de Bienestar Familiar, 2006).

The data obtained from Kasper et al. (2014) shows that the prevalence of obesity in men and women (18 - 64 years) in Colombia was 13.9% in 2005. In 2010, the prevalence rised to 16.4%. More women suffer from obesity than men do, and people that are affected the most were in the age ranges of 45-54 and 55-64 years.

Nevertheless, WHO (2015b) published information that in 2010 there were 19% (23.6% female, 14.2% male) of obese people (+18 years old) in Colombia, and in 2014 the percentage increased to 21% (25.7% female, 16.1% male). Therefore the obesity poses a big threat to the Colombian population.

### **1.4.3 Hypertension**

Hypertension, often known as high blood pressure, comes with a major risk of stroke and heart disease (Ross, 2010). The National High Blood Pressure Education Program (2004) defines that there are four categories of blood pressure for adults, according to the values of systolic blood pressure (SBP) and diastolic blood pressure (DBP). SBP values are regarded as: normal blood pressure is inferior to 120 mmHg (DBP < 80 mmHg), prehypertension oscillates between 120 - 139 mmHg (DBP 80 - 89),

stage 1 hypertension is between 140 - 159 (DBP 90 - 99), and stage 2 hypertension is determined as a value exceeding 160 mmHg (DBP  $\geq$  100).

Investigation made by Instituto Colombiano de Bienestar Familiar (2006) demonstrates that raised blood pressure was confirmed in 9.3% of adults (18 - 64 years) in Colombia. The prevalence (17.4%) was noted in people at the age of 50 and 64. In 2008, raised blood pressure represented a risk factor in 27.4% adults (WHO, 2014). Finally, World Health Rankings (2014) speaks about the death rate of 14.47 per each 100,000 Colombians.

#### **1.4.4 Heart diseases**

Heart diseases (or heart problems) can be understood as a variation of complications that are associated with any disease of the heart, usually with diseases of the heart muscle, heart attacks, heart failures or strokes (Steyn and Fourie, 2007). This research worked under the broad name “*Heart diseases*” in order to give vendors more space to describe, what their and their clients’ understanding is. Plants that were sold for heart diseases were specially prescribed to heal palpitations, angina pectoris, for post heart attack treatment, and for heart and circulation cleansing.

Unfortunately, Colombia is much affected by heart diseases. Cardiovascular diseases are the major cause of mortality in Colombia, where the death rate is 152 deaths per each 100,000 people (Delgado et al., 2015). WHO (2015a) claims that in 2012, the leading cause of death (14.4%) was ischaemic heart disease. This disease killed 29.1 thousand people. According to WHO (2014), 28% of deaths in Colombia were caused by cardiovascular diseases in 2012.

## 2 Objectives

This thesis aimed to explore the herbalist's shops in the city of Santa Marta and determine the medicinal plants, which were recommended and sold there by the *herboristerías* for treating selected lifestyle diseases, i.e. diabetes, obesity, hypertension and heart diseases, as well as to preserve the precious knowledge of local herbalists.

Thus, the concrete objectives of this work were: (1) to make a list of medicinal plants that were recommended and sold at the herbalist's shops in Santa Marta to treat diabetes, heart diseases, hypertension and obesity (2) to find the most cited and most frequently used plant species in each disease category (3) to compare the consensus on herbalists' knowledge of medicinal plants (4) to compare the relation between years of experience and knowledge of medicinal plants (5) to verify the taxonomic identity of plants sold.



### **3 Materials and Methods**

#### **3.1 Background research**

A literature review was executed using an electronic search of scientific papers and abstracts. Used databases for literature screening were Web of Knowledge, Scopus, Google Scholar and ResearchGate. We used older nomenclature that was used before a new Angiosperm Phylogeny Group system (APG system).

#### **3.2 Study area**

The ethnobotanical data were recorded in *herboristerías* in the city of Santa Marta, which is the capital of the Department of Magdalena (Figure 1). It is situated in 11°14'31" of northern latitude and 74°12'19" of western longitude, close to the mountain range of Sierra Nevada de Santa Marta (SNSM) which is surrounded by the Caribbean Coast (Tschanz et al., 1974; Alvear et al., 2015).

For Santa Marta is typical warm dry climate, where the annual temperature average is 27.3°C (min 22 - 25°C, max 32 - 34°C), and the annual precipitation average is 501 mm. The months of rain are from May to October (September and October are the months with the highest precipitations). The relative humidity is lowest in May, and it increases until October, where it reaches up to 79% (IDEAM, 2014).

The mountain range of SNSM represents Tropical Andes biodiversity hotspot, which is a home for many medicinal plants (Mittermeier et al., 2004; Carbonó-Delahoz and Dib-Diazgranados, 2013; Alvear et al., 2015).



**Figure 1.** Location of the Department of Magdalena (Gobernación de Magdalena, 2010)

### 3.3 Data collection

Data collection was carried out from the period of September 2016 until February 2017. The investigation took place in the 7 most important *herboristerías* in Santa Marta. First herbalist's shop was selected from Lilia Margarita Ramirez Salazar's (2006) own experience, because her thesis was oriented on the similar topic. Other herbal pharmacies were chosen according to the popularity, recommendation and suggestions among local people and healers, based on the snowball method described by Tongco (2007). Therefore we obtained shops with the longest tradition and/or the highest popularity.

The study was aimed to local *herboristerías*, because it is essential to preserve the knowledge of wise and experienced people before it vanishes (Cotton, 1996; Cámara-Leret et al., 2014). The investigation was executed with the participation of 7 informants, all of them were Colombians, where 6 respondents were women and 1 respondent was man. The age range was from 38 to 85 years (mean age was 58 years). Four herbalist's shops were founded as family businesses, where the owner (and founder) was responsible for running the shop, receiving clients, and few family members were

helping him. In the other 3 shops there was only one herbalist (an administrator), who was responsible for recommending and selling medicinal plants. Those 3 administrators were working in shops that belonged to the same owner. However, each of them had his own knowledge about medicinal plants. In that time, all respondents, except one, were attending to people and working with medicinal plants at least 15 years (the exception was a herbalist working only 7 months). The longest recorded experience was 56 years.

To confirm the importance of ethics, as Martin (2004) recommends, the herbalists were familiarized with the purpose of this research before starting the interviews. Later, respondents answered verbally and not in written form, in order to feel more comfortable and make the dialogue friendlier. For obtaining the clearest answers, each respondent was visited several times. Thus they were not pressured for time.

Considering Albuquerque's and Hanazaki's (2009) suggestions, the research data was obtained through the semi-structured questionnaires and personal open-ended interviews with the vendors, both taken in the Spanish language.

Four life-threatening and very common Colombian diseases were chosen for the purpose of this investigation; diabetes, obesity, hypertension and heart diseases. Heart diseases cover palpitation, angina pectoris, treatment after heart attack and heart and circulation cleansing.

Questionnaires were divided into 3 parts. First part was focused on the main information about the vendor (name, age), including information about his curative skills and experience (how did he acquire his knowledge, how many years is he working with medicinal plants and is recommending them). Moreover, herbalists were also asked about their clients (if clients require a different plant than the recommended one, if vendors try to convince their clients to buy the recommended plant above the client's demand, if clients are coming back). The second part was divided into four parts, where each part was focused on one of selected lifestyle diseases (diabetes, obesity, hypertension, heart diseases). Those ailments were inquired separately. First, the seller was asked about plants that he recommends and sells to his clients. We also asked about plants that, according to his experience, give the best results and which one is the most commonly sold. The information about his clients' outline (average sex and age, how much clients buy plants for the particular disease per week, if vendor could verify the effectivity of his

treatment) was interviewed too, in connection with the selected disease. The last part was focused on the mentioned plant only, containing ethnobotanical information (name, plant part used, form of product, preparation, mode of application including detailed administration, and the quantity sold nowadays and in the past).

At *herboristerías* it was usually only possible to buy dried plant material (Appendix I, Appendix II, Appendix III, Appendix IV) with only few exceptions. Therefore fresh plant material that we were not familiar with, or were not sure of its identity, was collected in Santa Marta at Mercado Público (Appendix V), street plant vendors, and at Plaza de Paloquemao in Bogota. Some specimens (mainly whole dried plant material) were obtained directly via herbalist's shops. Each plant was directly provided by digital photographic documentation (Appendix VI, Appendix VII), and afterwards, in the case of fresh material, it was dried in Herbarium UTMC of the Universidad del Magdalena. Subsequently, some plant material was identified with a help of 'A field guide to the families and genera of woody plants of Northwest South America', verified by Eduino Carbonó MSc. and some species identification was made directly by himself.

### **3.4 Herboristerías**

*Herboristería* is a Spanish word for a shop, where medicinal plants and herbs are sold (Figure 2). It is a place where especially natural products can be bought, whether fresh, dry or prepared (capsules, syrups, drops, creams, candles etc.). In the case of dry (majority) or fresh plant material, it is possible to buy only certain plant parts, for example leaf, bark, root, rhizome, seed, stem, flower or fruit. In such an herbalist's shop is a specialized person who is responsible for recommending his clients how to treat any certain diseases with medicinal plants. These herbalists also sells those medicinal products.



**Figure 2.** Mrs. Nancy Rodriguez at her *herboristería* “Botanica Renacer”

### **3.4.1 Tienda Botánica “Los Arrayanes”**

This herbalist’s shop is situated at Avenida Ferrocarril, #6 - 47. It was established by Mrs. Edilia Becerra (85 years old). Her daughter Pilar Dominguez assists her in the shop. Mrs. Becerra has been working with medicinal plants and recommending them for 40 years. She acquired her knowledge by reading books and studying. Her wisdom has been transmitted down from generation to generation. She suffers from hypertension, but is treating herself with her medicinal plants. Therefore, she can now eat whatever she wants without making her condition worse. The name *Arrayán* is the vernacular name for a tree, which is used for medicinal purposes.

### **3.4.2 Droguería y Herboristería “La Contra #3”**

The owner of this herbalist’s pharmacy is Enirida Pineda. Mrs. Gloria Rusinque (56 years old), who works here, is only the administrator. However, she is the person who is in charge of recommending medicinal plants to her clients. Mrs. Rusinque gained her knowledge by studying and reading specialized books. She has worked in this branch for

16 years. Her clients do not want to continue taking pills and they are looking for alternatives. This shop is located in the address Avenida Ferrocarril, #11 - 40.

### **3.4.3 Droguería y Herboristería “La Contra #2”**

In this ‘La Contra’ Mrs. Judith Roncallo (72 years) works with her daughter Enirida Pineda. She has a second daughter that does not work here, but does help her sometimes, as they always have a lot of clients. This place was founded by her late husband, who knew many medicinal plants for the treatment of many diseases. He gained his familiarity with plants and furthered his knowledge empirically. He transmitted all his wisdom to his wife Judith. Moreover, Mrs. Roncallo has spent time reading even more about medicinal plants, and her clients also share with her their experience with natural medicine. She has worked with medicinal plants for 56 years and said that when this store was first started, it had been focused on allopathic medicine. Her shop is located in the calle 14, #9 - 81.

### **3.4.4 Droguería y Herboristería “La Contra #4”**

*Herboristería*, which is situated in the carrera 5, #22 - 38, is administrated by Mrs. Ana Rojas (42 years old). This shop is also owned by Mrs. Enirida Pineda, but it is Mrs. Rojas who takes care of the clients and offers them her knowledge. She always recommends the best plant to solve her clients’ problems, but on the other hand, she respects their own choices. Everything that she knows she found in books and from discussions with her chief. Mrs. Rojas has been recommending medicinal plants for 17 years. She believes that medicinal plants do not have the side effects that industrial medicines have.

### **3.4.5 Droguería y Herboristería “La Contra #5”**

The administrator of this shop is Mrs. Jasmin de la Hoz (38 years old). During the data collection, she had only worked in this shop for 7 months (September 2016), but she really enjoys this job. She thinks that her clients want to return to nature, which is the reason for their visit. All the knowledge she has, was transmitted and learned via her chief, Mrs. Enirida Pineda. Her *herboristería* is located in calle 22, #14 – 94 (Appendix VIII).

### **3.4.6 Botanica “Renacer”**

Renacer, which in English means revive or resurgence is situated in Carrera 7, #10 - 26. The owner is Mrs. Nancy Rodriguez (50 years old), who is also responsible for running the shop. Three of her family members help her to prepare herbal mixtures and attend to the clients. She had worked for 10 years as a secretary for a natural botanist. When she was rewriting all of his papers, she gained her knowledge about medicinal plants. She also studied specialized books about medicinal plants, so she expanded her wisdom even more. 15 years ago, she opened this herbalist's shop.

### **3.4.7 Botanica “Los Frutos”**

Mr. Alfonso Sala, the only male vendor of all the investigated herbalist's pharmacies (Appendix IX), is 66 years old. Sometimes his wife helps him to run the shop. He has been working with the public for 20 years, but he has known the botany of the plants for 40 years. Descendants inherited the knowledge about medicinal plants in his family, and Mr. Sala's father was a botanist. He thinks that industrial medicine does not do the battle against diseases, and only plants serve the people well. In the beginning of this research, his shop was situated in the calle 11, between #7 and 8, but later he moved his shop to the Mercado Público (calle 12, #8 - 81).

## **3.5 Data analysis**

Data obtained in the questionnaires were organized into four separated groups, corresponding to each ailment. Moreover, each of them was distributed into seven categories, according to the *herboristería*. This arrangement simplifies data processing, so data focusing on herbalist's pharmacies, ailment or plants can be easily obtained. Then, all the information was quantitatively evaluated, analysed and summarized using the standard statistics methods in Microsoft Excel.

All citations were afterwards converted in Use-Reports (UR). A number of UR is one of the most important tool, which is used to determine the cultural importance of each plant (Tardío and Pardo-de-Santayana, 2008). It can be expressed as a case, where informant (i) mentions the use of a species (s) for the treatment of a concrete ailment category (u; Chellappandian et al., 2012).

### 3.5.1 Frequency of Citation (FC)

In order to determine the importance and incidence of plants used to treat particular ailments (Ocvirk et al., 2013), the frequency of citation for each particular species was calculated. It is a very simple calculation that sums a number of informants that mention a species as useful (Tardío and Pardo-de-Santayana, 2008).

In this case, FC was calculated for each ailment category. In a simplified way, FC notes how many informants cited the same plant in one illness category. Higher number of FC indicates that the certain plant was mentioned the most.

### 3.5.2 Informant Consensus Factor (F<sub>IC</sub>)

To measure the homogeneity of obtained information among different vendors, we calculated FIC value. This factor shows the consensus of informants for the certain ailment category (Abet et al., 2014; Mahomoodally and Muthoorah, 2014). Informant consensus factor was calculated according to the following formula:

$$F_{IC} = (N_{ur} - N_t) / (N_{ur} - 1)$$

where  $N_{ur}$  refers to the number of Use Reports in each illness category, and  $N_t$  is the number of folk taxa that were mentioned in the same category by all respondents. FIC ranges from 0.00 to 1.00. High number of FIC (close to 1.00) indicates that certain species are described to be used by the majority (or all) of respondents to treat a particular illness. Plants with the FIC number close to 0.00 show a disagreement among informants over which plant to use (Cheikhyoussef et al., 2011; Pawera et al., 2016).

### 3.5.3 Fidelity Level (FL)

This index, which was first recommended by Jacob Friedman et al. (1986), defines the most frequently used species to treat a certain illness category (Rokaya et al., 2010). Therefore, fidelity level was calculated for each plant species in the concrete illness category, according to:

$$FL (\%) = \frac{Np}{N} * 100$$



where  $N_p$  corresponds to the number of use-reports cited for a certain plant species to cure the concrete illness category.  $N$  signifies the total number of use-report for the same plant species. High percentage of FL indicates the most preferred plant species in the particular ailment category, and on the contrary, plant species with low percentage of FL shows that this certain species is used in more ailment categories (Rokaya et al., 2010; Medeiros et al., 2011).

#### **3.5.4 Regression and Correlation Analysis**

In the software Statistica 12.0 the regression and correlation analysis was made, in order to measure the correlation of two variables. Regression determines the form of dependence and the correlation express the degree of dependence tightness. Simple linear regression that was made, investigates the form of the relationship of two random variables, using the regression function (Kába and Svatošová, 2012).

## 4 Results

The ethnobotanical data obtained in seven herbalist's pharmacies has documented 53 different folk taxa, although the number of scientific names is higher. As mentioned by Berlin et al. (1966), folk taxa not always correspond to botanical categories. Following calculations and results count with folk taxa instead of botanical names, because it is more adequate for understanding of the whole pattern (Hunn, 1976).

In three cases (*ortiga*, *toronjil* and *oregano*) the native plant name corresponds to two different botanical species. Nevertheless, two different botanical species of the same taxon are used in the same way and have the same healing effect.

A total of 56 plant species were determined, belonging to 35 families. The most of mentioned plant species belong to Lamiaceae and Fabaceae families.

### 4.1 Quantification of ethnobotanical data

#### 4.1.1 Informant Consensus Factor and Fidelity Level

In the Table 1 are compared values of Informant Consensus Factor, which are arranged in descending order. The highest value (FIC = 0.45) belongs to the diabetes category, which has also the broadest range of mentioned medicinal plants (25 folk taxa) and URs (45). This category is followed by obesity (FIC = 0.45, URs = 29, 17 folk taxa). The lowest value (FIC = 0.07) is shown in the heart diseases category, where also the number of URs is the lowest (15), but 14 mentioned folk taxa overcome the hypertension category's value (12 folk taxa). Those results mean that the diabetes category has the highest level of all respondents consensus, and on the contrary, heart diseases category indicates the biggest differences in the herbalist shops' answers. Generally, the homogeneity of all obtained information is low, they differ a lot, and the range of products is very broad.

**Table 1.** Ailment categories according to the Informant Consensus Factor (FIC)

Ailment category	Number of medicinal folk taxa	Number of UR	F <sub>IC</sub>
Diabetes	25	45	0.45
Obesity	17	29	0.43
Hypertension	12	19	0.39
Heart diseases	14	15	0.07

Table 2 is shows the Fidelity Level, which was calculated for every plant species in each of four illness categories. It presents the most preferred plant species within ailment categories. Only species that exceed FL of 50% are mentioned in that table. The level of 100% reached especially unique species (see Table 3; e.g. *Aloe vera* (L.) Burm.f., *Zingiber officinale* Roscoe, *Cecropia peltata* L., *Sambucus nigra* L.), but some species were mentioned in several *herboristerías* within one ailment category. In the case of diabetes, such species were *Momordica charantia* L., *Curatella americana* L., *Eucalyptus globulus* Labill., *Anacardium occidentale* L., *Juglans neotropica* Diels and *Smalanthus sonchifolius* (Poepp.) H.Rob. In the case of obesity, it was *Peumus boldus* Molina, *Marrubium vulgare* L., *Trichanthera gigantea* (Humb. & Bonpl.) Nees and *Camellia sinensis* (L.) Kuntze and regarding hypertension it was *Allium sativum* and *Salvia palifolia* Kunth. In the category of heart diseases are all the described plants exclusive in their category (unique species).

**Table 2.** Plant species with the Fidelity Level (FL) over 50 percent in each ailment category

Ailment category	FL (%)	Plant species
Diabetes	100	<i>Aloe vera</i> , <i>Anacardium occidentale</i> , <i>Aristolochia</i> sp. <sup>a</sup> , <i>Aristolochia</i> sp. <sup>a</sup> , <i>Cassia grandis</i> , <i>Cinchona pubescens</i> , <i>Curatella americana</i> , <i>Croton malambo</i> , <i>Eucalyptus globulus</i> , <i>Hymenaea courbaril</i> , <i>Juglans neotropica</i> , <i>Momordica charantia</i> , <i>Maytenus laevis</i> , <i>Myrcianthes leucoxylla</i> , <i>Nopalea cochenillifera</i> , <i>Petiveria alliacea</i> , <i>Randia</i> sp., <i>Smallanthus sonchifolius</i> , <i>Stevia</i> sp.
	83	<i>Bauhinia</i> sp.
	56	<i>Moringa oleifera</i>
Obesity	100	<i>Camellia sinensis</i> , <i>Cucumis sativus</i> , <i>Peumus boldus</i> , <i>Salvia Hispanica</i> , <i>Senna alexandrina</i> , <i>Symphytum officinale</i> , <i>Trichanthera gigantea</i> , <i>Zea mays</i> , <i>Zingiber officinale</i>
	80	<i>Marrubium vulgare</i>
	67	<i>Equisetum giganteum</i>
	60	<i>Cynara scolymus</i>
Hypertension	100	<i>Allium sativum</i> , <i>Cascabela thevetia</i> , <i>Lepidium bipinnatifidum</i> , <i>Lippia americana</i> <sup>b</sup> , <i>Minthostachys mollis</i> <sup>b</sup> , <i>Salvia palifolia</i>
	60	<i>Phthirusa stelis</i>
Heart diseases	100	<i>Cecropia peltata</i> , <i>Illicium verum</i> , <i>Linum usitatissimum</i> , <i>Melissa officinalis</i> <sup>c</sup> , <i>Ocimum tenuiflorum</i> <sup>c</sup> , <i>Sambucus nigra</i> , <i>Sechium edule</i> , <i>Valeriana</i> sp.

a- two different *Aristolochia* species

b- correspond to 1 folk taxon: *oregano*

c- correspond to 1 folk taxon: *toronjil*

#### 4.1.2 Mentioned medicinal plants per herbalist's shop

Each herbalist's pharmacy reported at least one medicinal plant in each ailment category, with the exception in heart diseases (Table 3). The highest number of medicinal plants was found in *La Contra* #3 (21 species), which also shows the broadest scale of cited plants for the treatment of obesity (8 species), hypertension (5 species) and heart diseases (7 species). In the case of diabetes, the highest number of plants was reported by *Los Frutos* (11 species). The lowest number of quoted species belongs to *La Contra* #5 (5 species).

According to low  $F_{IC}$  mentioned in the previous chapter, the unique species were also considered. A unique species was mentioned by only one *herboristería* and in one ailment category only. Total number of unique folk taxa is 28. This number corresponds to 30 unique botanical species, because *oregano* and *toronjil* match both two botanical

species (*Minthostachys mollis* (Benth.) Griseb., *Lippia americana* L.; *Melissa officinalis* L., *Ocimum tenuiflorum* L.). The highest number of species that were exceptional among all the *herboristerías* and ailment categories shows *La Contra* #2 and *Los Frutos*. They both mentioned eight unique species. *La Contra* #3 stated five unique species, then *Los Arrayanes* and *Renacer* both 3 unique species and *La Contra* #5 only one. *La Contra* #4 did not introduce any species that would not be mentioned yet.

**Table 3.** Number of used folk taxa according to the *herboristerías* and ailment categories

<i>Herboristería</i>	Diabetes	Obesity	Hypertension	Heart diseases	Total number of folk taxa	Unique species in each <i>herboristería</i>
Los Arrayanes	6	3	1	-	10	<i>Cinchona pubescens</i> , <i>Myrcianthes leucoxyla</i> , <i>Zingiber officinale</i>
La Contra #3	10	5	4	-	18	<i>Lepidium bipinnatifidum</i> , <i>Nopalea cochenillifera</i> , <i>Petiveria alliacea</i> , <i>Salvia hispanica</i> , <i>Symphytum officinale</i>
La Contra #2	5	8	5	7	21	<i>Cecropia peltata</i> , <i>Cucumis sativus</i> , <i>Illicium verum</i> , <i>Linum usitatissimum</i> , <i>Lippia americana</i> <sup>a</sup> , <i>Melissa officinalis</i> <sup>b</sup> , <i>Minthostachys mollis</i> <sup>a</sup> , <i>Sechium edule</i> , <i>Ocimum tenuiflorum</i> <sup>b</sup> , <i>Zea mays</i>
La Contra #4	5	3	3	3	14	-
La Contra #5	2	4	1	-	5	<i>Senna alexandrina</i>
Renacer	6	4	4	4	16	<i>Sambucus nigra</i> , <i>Stevia</i> sp., <i>Valeriana</i> sp.
Los Frutos	11	2	1	1	13	<i>Aloe vera</i> , <i>Aristolochia</i> sp. <sup>c</sup> , <i>Aristolochia</i> sp. <sup>c</sup> , <i>Cascabela thevetia</i> , <i>Cassia grandis</i> , <i>Hymenaea courbaril</i> , <i>Maytenus laevis</i> , <i>Randia</i> ,
Total	25	17	12	14	54	28

A taxon may be reported in more than one ailment category

a- correspond to 1 folk taxon: *oregano*

b- correspond to 1 folk taxon: *toronjil*

c- two different *Aristolochia* species

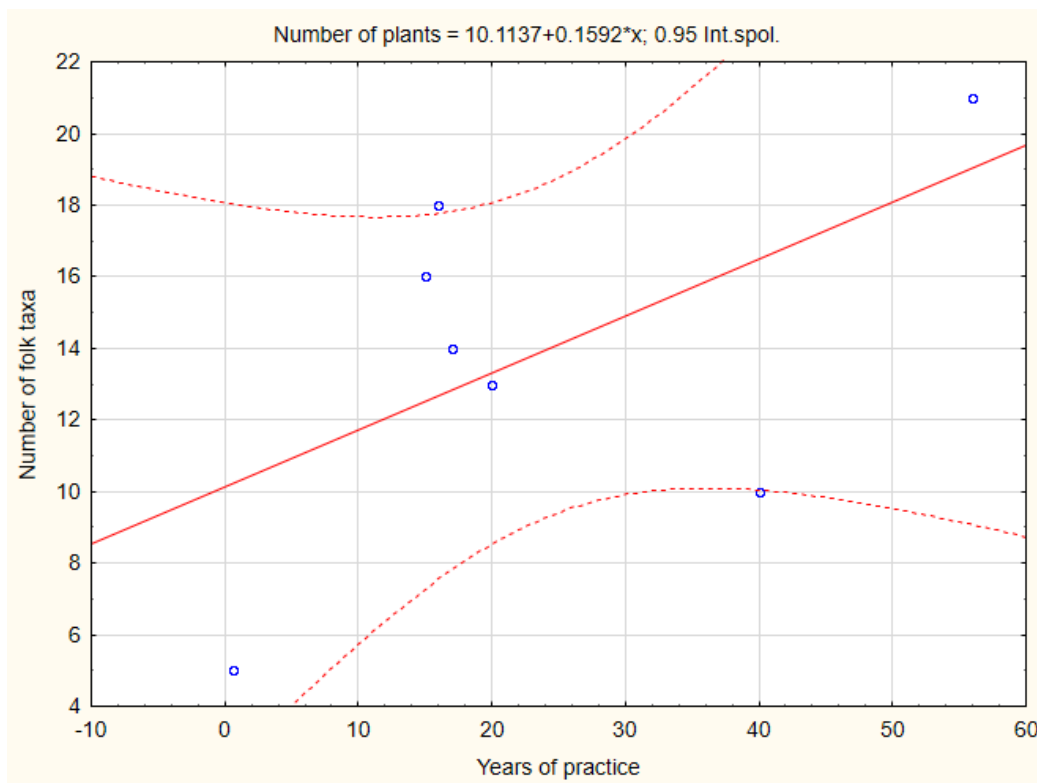
#### 4.1.2.1 Experience versus knowledge

It could be assumed that the longer practice and more experiences the herbalists have, the more plants they could recommend. Therefore, we determined the hypothesis:

$H_0$ : Between two variables (dependent variable: years of practice, independent variable: number of folk taxa) is no statistical dependence.

$H_A$ : These two variables (dependent variable: years of practice, independent variable: number of folk taxa) are statistically dependent.

The visualisation of variables was performed, using a scatter plot (Figure 3). It can be directly assumed that there will be no dependence between tracked characters. For verification, a regression analysis was tested. From the resulting p-value 0.195 it was proved that the dependence on the significance level  $\alpha=0.05$  is statistically insignificant. Therefore, this test showed that the number of mentioned medicinal plants is not influenced by the length of herbalist's shop's practice. We have accepted the null hypothesis, and the dependence between two observed variables is not statistically significant.



**Figure 3.** Comparison between the years of practice and the number of mentioned folk taxa (correlation coefficient = 0.5561, p value = 0.195)

### **4.1.3 Medicinal plants according to ailment category**

#### **4.1.3.1 Diabetes**

For the treatment of diabetes was reported the widest range of plants, compared to other illnesses (Table 4). A total of 25 different folk taxa are recommended by the vendors, where each one correspond with one botanical species. Frequency of citation shows that among the respondents, *Anacardium occidentale*, *Moringa oleifera* and *Bauhinia* sp. were the most cited (FC = 5 ). In addition, *Juglans neotropica* reached relatively high value (FC = 4). Five plants (*Momordica charantia*, *Eucalyptus globulus*, *Curatella americana*, *Croton malambo* H.Karst. and *Smalanthus sonchifolius*) were cited 2 times. The last 16 plant species were mentioned only by one respondent, thus have FC = 1. Species in this category belong to 18 botanical families with the most presented Fabaceae and Asteraceae, each with 3 species, and Aristolochiaceae, Myrtaceae and Rubiaceae with 2 species each.

Some of those plants are effective to cure diabetes because of their anti-anaemic effect (e.g. *Cassia grandis* L.f., *Hymenaea courbaril* L.), and some are thriving because of their aim is to decrease sugar (e.g. *Anacardium occidentale*, *Aloe vera*, *Croton malambo*).

All the species can be used separately or in the combination with other mentioned plants, especially in the case of infusion. Herbalist's shop "*Botanica Los Frutos*" even recommend to using all the mentioned plants (by the vendor) within 2 months.

**Table 4.** Medicinal plants used for the treatment of diabetes according the Frequency of Citation

Vernacular name(s)	Botanical name	Family	Plant part used	Preparation	Frequency of citation
Marañon	<i>Anacardium occidentale</i> L.	Anacardiaceae	bark	infusion	5
Moringa	<i>Moringa oleifera</i> Lam.	Moringaceae	leaves	infusion	5
			seed	infusion smoothie, fresh	
Pata de vaca	<i>Bauhinia</i> sp.	Fabaceae	leaves	infusion	5
Nogal	<i>Juglans neotropica</i> Diels	Juglandaceae	leaves	infusion	4
			bark	infusion	
Balsamina	<i>Momordica charantia</i> L.	Cucurbitaceae	leaves	infusion	2
Eucalypto	<i>Eucalyptus globulus</i> Labill.	Myrtaceae	leaves	infusion	2
			fruit	infusion	
Chaparro	<i>Curatella americana</i> L.	Dilleniaceae	bark	infusion	2
Malambo	<i>Croton malambo</i> H.Karst.	Euphorbiaceae	bark	infusion	2
Yacon	<i>Smallanthus sonchifolius</i> (Poepp. & Endl.) H.Rob.	Asteraceae	stem+leaves	infusion	2
Aguacate	<i>Persea americana</i> Mill.	Lauraceae	leaves	infusion	1
Alcachofa	<i>Cynara scolymus</i> L.	Asteraceae	the whole plant	infusion, syrup	1
Algarroba	<i>Hymenaea courbaril</i> L.	Fabaceae	bark	infusion,	1
			fruit	smoothie	
Almacigo	<i>Bursera simaruba</i> (L.) Sarg.	Burseraceae	bark	infusion	1
Aloe	<i>Aloe vera</i> (L.) Burm.f.	Asparagaceae	leaves	smoothie	1
Anamu	<i>Petiveria alliacea</i> L.	Petiveriaceae	the whole plant	infusion	1
Arrayan	<i>Myrcianthes leucoxylla</i> (Ortega) McVaugh	Myrtaceae	bark	infusion	1
Cañandonga	<i>Cassia grandis</i> L.f.	Fabaceae	fruit	smoothie	1
Capitan	<i>Aristolochia</i> sp.	Aristolochiaceae	the whole vine	infusion, capsule, spirit	1
Cedron	<i>Aloysia</i> sp.	Verbenaceae	seed	capsule	1
Cruzeta	<i>Randia</i> sp.	Rubiaceae	bark	infusion, capsule	1
Guaco	<i>Aristolochia</i> sp.	Aristolochiaceae	the whole vine	infusion, spirit	1
Chuchuhuasa	<i>Maytenus laevis</i> Reissek	Celastraceae	bark	infusion	1



Nopal	<i>Nopalea cochenillifera</i> (L.) Mill	Cactaceae	leaves	infusion, capsule	1
Quina	<i>Cinchona pubescens</i> Vahl	Rubiaceae	bark	infusion	1
Stevia	<i>Stevia</i> sp.	Asteraceae	leaves	infusion	1

#### 4.1.3.2 Obesity

A total of 17 different folk taxa were recorded to heal obesity, and they are presented in the Table 5. However, this number match 18 botanical names, because *Urtica dioica* L. and *Urtica urens* L. are both used under the vernacular name *ortiga*. As for FC, *Marrubium vulgare* (*marrubio*) was the most cited species (FC = 5). Other commonly mentioned plants were *Trichanthera gigantea* and *Cynara scolymus* L. (FC = 3). Further, boldo, marrubio, *Moringa oleifera*, *Camellia sinensis*, and *Equisetum giganteum* L. were cited by 2 informants out of 7. Each of the last ten plants was only quoted by one vendor. The scale of families is also wide. There are 15 botanical families most represented by Lamiaceae, Fabaceae and Urticaceae, with two plant species each.

*Herboristerías* claimed that they always first recommend a diet to their client, and medicinal plant should serve only as an enhancer. Mentioned plants are used to reduce weight especially because of their diuretic properties (e.g. *Equisetum giganteum*, *Zea mays* L., *Camellia sinensis*), some can eliminate fat (e.g. *Cynara scolymus*, *Peumus boldus*, *Moringa oleifera*, *Marrubium vulgare*, *Trichanthera gigantea*), and some can work against anxiety (e.g. *Trichanthera gigantea*, *Marrubium vulgare*). Some respondents proclaimed that combination of several plants gives stronger effects.

**Table 5.** Medicinal plants used for the treatment of obesity according to Frequency of Citation

Vernacular name(s)	Botanical name	Family	Plant part used	Preparation	Frequency of citation
Marrubio	<i>Marrubium vulgare</i> L.	Lamiaceae	leaves+stem	infusion	5
Alcachofa	<i>Cynara scolymus</i> L.	Asteraceae	leaves	infusion, syrup	3
Quiebra barriga	<i>Trichanthera gigantea</i> (Humboldt & Bonpland) Nees	Acanthaceae	leaves	infusion	3
Boldo	<i>Peumus boldus</i> Molina	Monimiaceae	leaves	infusion	2
Cola de caballo	<i>Equisetum giganteum</i> L.	Equisetaceae	stem+leaves	infusion	2
Moringa	<i>Moringa oleifera</i> Lam.	Moringaceae	root leaves	infusion infusion	2
Té verde	<i>Camellia sinensis</i> (L.) Kuntze	Theaceae	leaves	infusion	2
Acacio	<i>Senna alexandrina</i> Mill.	Fabaceae	fruit	infusion	1
Aguacate	<i>Persea americana</i> Mill.	Lauraceae	seed	capsule	1
Barba de maíz	<i>Zea mays</i> L.	Poaceae	style	infusion	1
Cedron	<i>Aloysia</i> sp.	Verbenaceae	seed	capsule	1
Comfrey	<i>Symphytum officinale</i> L.	Boraginaceae	leaves+stem	infusion	1
Chia	<i>Salvia Hispanica</i> L.	Lamiaceae	seed	drink	1
Jengibre	<i>Zingiber officinale</i> Roscoe	Zingiberaceae	rhizome	infusion	1
Ortiga	<i>Urtica dioica</i> L.	Urticaceae	leaves, root	infusion	1
	<i>Urtica urens</i> L.	Urticaceae	leaves	infusion	
Pata de vaca	<i>Bauhinia</i> sp.	Fabaceae	leaves	infusion	1
Pepino cohombro	<i>Cucumis sativus</i> L.	Cucurbitaceae	fruit	smoothie	1

#### 4.1.3.3 Hypertension

Table 6 shows the obtained information about hypertension. For this disease, only 12 folk taxa are suggested for the treatment. Nevertheless, this this number does not correspond with the real number of used plants. There are 13 different plant species in total, because one of the herbalist's shop mentioned that *oregano* can be deputize by two different plant (both called *oregano* by the healer). However, both *oregano* plants (*Minhostachys mollis* and *Lippia americana*) are used for the same purpose and even their preparation and application is identical. *Salvia palifolia* was the plant that was the most

cited (FC = 4) in this illness category. *Phthirusa stelis* (L.) Kuijt was mentioned by three informants and *Allium sativum* together with *Moringa oleifera* were cited two times. This ailment category consist of 11 botanical families. The highest number of species belongs to Lamiaceae (3 species) and Verbenaceae (2 species).

Each plant can fight against hypertension using a different strategy. For example, *Minthostachys mollis*/*Lippia americana* (*oregano*) can decrease the level of blood sugar, *Cynara scolymus* can reduce the level of cholesterol and *Equisetum giganteum* is diuretic. Therefore, all the plants can be used separately or in the combination with other plants described in this illness category. In the case of the combination, only 2 or 3 species should be combined.

*Phthirusa stelis*, as it is a parasitical plant, is efficient against the hypertension only when it parasites on guamo, guasimo or cafeto. In the case that it parasites on another tree, the target illness is different. Also the use of *Cascabela thevetia* (L.) Lippold is worthy of notice. This tree is toxic, therefore its use is prohibited. The mode of application of *Cascabela thevetia* is external, its seed should be worn as a bracelet or necklace.

**Table 6.** Medicinal plants used for the treatment of hypertension according the Frequency of Citation

Vernacular name(s)	Botanical name	Family	Plant part used	Preparation	Frequency of citation
Mastranto	<i>Salvia palifolia</i> Kunth	Lamiaceae	leaves	infusion	4
Muerdago	<i>Phthirusa stelis</i> (L.) Kuijt	Loranthaceae	the whole plant leaves bark	infusion, syrup infusion infusion	3
Ajo	<i>Allium sativum</i> L.	Amaryllidaceae	bulb	capsule, drops	2
Moringa	<i>Moringa oleifera</i> Lam.	Moringaceae	leaves seed	infusion, smoothie	2
Alcachofa	<i>Cynara scolymus</i> L.	Asteraceae	fruit	infusion, fresh	1
Berenjena	<i>Solanum melongena</i> L.	Solanaceae	fruit	infusion	1
Cabalonga	<i>Cascabela thevetia</i> (L.) Lippold	Apocynaceae	seed	jewellery	1
Cidron	<i>Aloysia citrodora</i> Palau	Verbenaceae	leaves	infusion	1
Cola de caballo	<i>Equisetum giganteum</i> L.	Equisetaceae	leaves	infusion	1
Mastuerzo	<i>Lepidium bipinnatifidum</i> Donn. Sm.	Brassicaceae	leaves	infusion	1
Oregano	<i>Minthostachys mollis</i> (Kunth) Griseb. <i>Lippia americana</i> L.	Lamiaceae Verbenaceae	leaves	infusion, drops	1
Romero	<i>Rosmarinus officinalis</i> L.	Lamiaceae	leaves	infusion	1

#### 4.1.3.4 Heart diseases

Table 7 shows a total of 14 different plant taxa that were mentioned by healers for the treatment of heart diseases. This number correlate with the real number of 16 botanical species. In fact, two plants (*ortiga*, *toronjil*) are each represented by 2 different species (*Urtica dioica*, *Urtica urens*; *Melissa officinalis*, *Ocimum tenuiflorum*). Each of those plants has the same preparation and mode of application, and serve to the patient in the same way. The choice of each plat depends on its availability. There was only one plant with FC = 2 (*Phthirusa stelis*), the rest was cited only once. Plants in this category belong to 11 botanical families most represented by Lamiaceae (4 species) and Urticaceae (3 species).

Three out of seven *herboristerías* answered that they do not recommend any plant for the treatment of heart diseases. *Los Arrayanes* introduce the reason that they do not want to be involved in such a delicate ailment. *La Contra* #3 only offers omega-3 (fish oil capsules), which is according to the informant the most effective treatment to any heart problem. She does not recommend any medicinal plant. The third shop that does not offer anything plant-based for the heart is *La Contra* #5. In addition, this vendor knows only capsules based on fish oil. The rest of informants that recommended some plants also claimed that their clients already attend a doctor (and if not, they strongly recommend them to do it), and that their plants only serve as an accompaniment to the prescribed drugs.

Every mentioned plant has an unlike effect in the treatment of heart problems, each plant works in a little bit different way. *Persea americana* Mill. cleans the heart, *Aloysia citriodora* Palau is used especially for the palpitation and it is recommended for the people that suffer from preinfarct. *Urtica dioica*, *U. urens*, *Phthirusa stelis* and *Bursera simaruba* (L.) Sarg. can eliminate bad fat from the heart, thus they improve the circulation. *Illicium verum* Hook.f. fight against the gases that escape after the heart surgery. Other respondent said that all the medicinal plants he mentioned (*Cecropia peltata*, *Phthirusa stelis*, *Melissa officinalis*, *Ocimum tenuiflorum* and *Solanum melongena* L.) could clean the blood, boost the circulation, improve the condition after heart attack and are simply known as cardiogenic. *Phthirusa stelis*, just as in the case of hypertension, is efficient in the treatment of heart diseases only when it parasitizes on guamo, guasimo or cafeto. When it parasitizes on another tree, the effectiveness to deal with this ailment category disappear.

Again, all the plants that are used in the infusion can be consumed separately or in the combination with others.

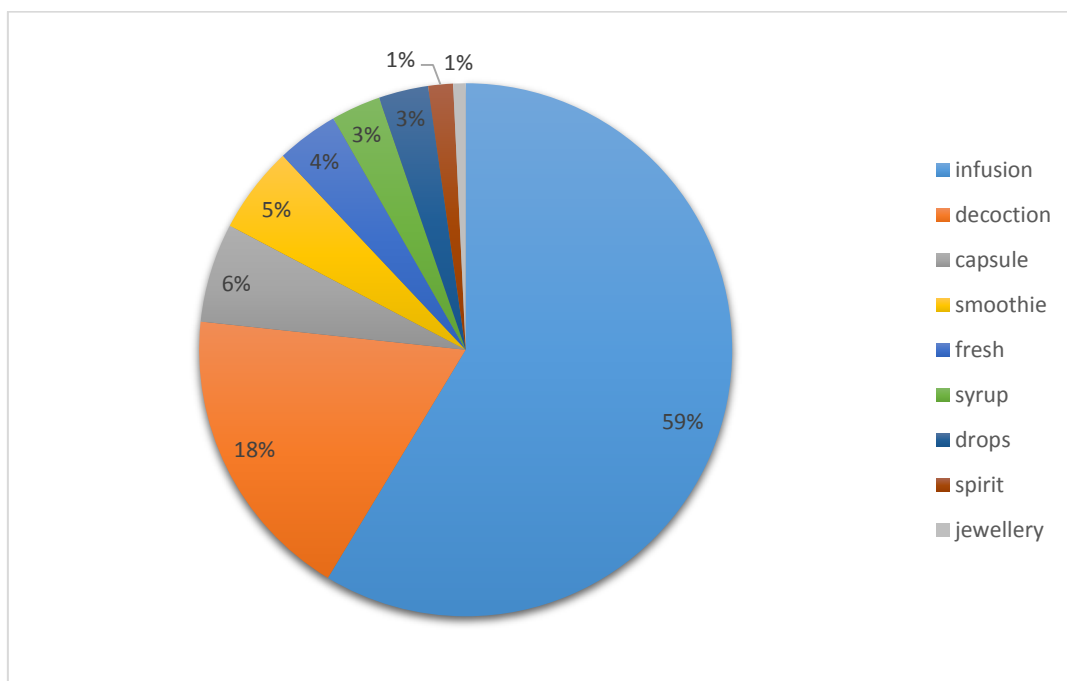
**Table 7.** Medicinal plants used for the treatment of heart diseases according the Frequency of Citation

Vernacular name(s)	Botanical name	Family	Plant part used	Preparation	Frequency of citation
Muerdago	<i>Phthirusa stelis</i> (L.) Kuijt	Loranthaceae	leaves	infusion	2
Aguacate	<i>Persea americana</i> Mill.	Lauraceae	seed	capsule	1
Almacigo	<i>Bursera simaruba</i> (L.) Sarg.	Burseraceae	bark	infusion	1
Anis	<i>Illicium verum</i> Hook.f.	Schisandraceae	fruit seeds	infusion infusion	1
Berenjena	<i>Solanum melongena</i> L.	Solanaceae	fruit	infusion	1
Cidra	<i>Sechium edule</i> (Jacq.) Sw.	Cucurbitaceae	fruit	smoothie, fresh	1
Cidron	<i>Aloysia citrodora</i> Palau	Verbenaceae	leaves	infusion	1
Lino	<i>Linum usitatissimum</i> L.	Linaceae	seed	infusion	1
Ortiga	<i>Urtica dioica</i> L.	Urticaceae	leaves, root	infusion	1
	<i>Urtica urens</i> L.	Urticaceae	leaves	infusion	1
Romero	<i>Rosmarinus officinalis</i> L.	Lamiaceae	leaves	infusion	1
Saúco	<i>Sambucus nigra</i> L.	Adoxaceae	leaves, flowers	infusion	1
Toronjil	<i>Melissa officinalis</i> L.	Lamiaceae			1
	<i>Ocimum tenuiflorum</i> L.	Lamiaceae	leaves	infusion	1
Valeriana	<i>Valeriana</i> sp.	Lamiaceae	root+leaves+stem	infusion	1
Yarumo	<i>Cecropia peltata</i> L.	Urticaceae	leaves	infusion	1

## 4.2 Mode of preparation, mode of application, plant part used

Figure 4 shows the proportion of different modes of preparation. For the treatment of our four ailment categories, 133 modes of preparation were reported. This number correspond to nine different modes of preparation. The majority of medicinal plants should be prepared as infusion (59%). Patients should usually drink 2 - 3 cups of the certain infusion per day, or they can drink a certain quantity of the infusion during the whole day. The second place represents decoction (18%), typical for bark and fruit as a plant part used. Other reported modes of preparation are taking capsules (6%) and drinking smoothies (5%). Both are with their detailed administration in the Table 8. 4% of the plant parts should be consumed fresh. Even less frequently reported preparations

were consuming medicinal plants via drops (3%), syrup (3%), or drinking them as a spirit (1%). In the case of spirit, medicinal plants are macerated in strong alcohol (rum) for a few weeks. Other 1% of preparation matches with the use of *Cascabela thevetia* as a jewellery. This plant is toxic, therefore it is used only externally.

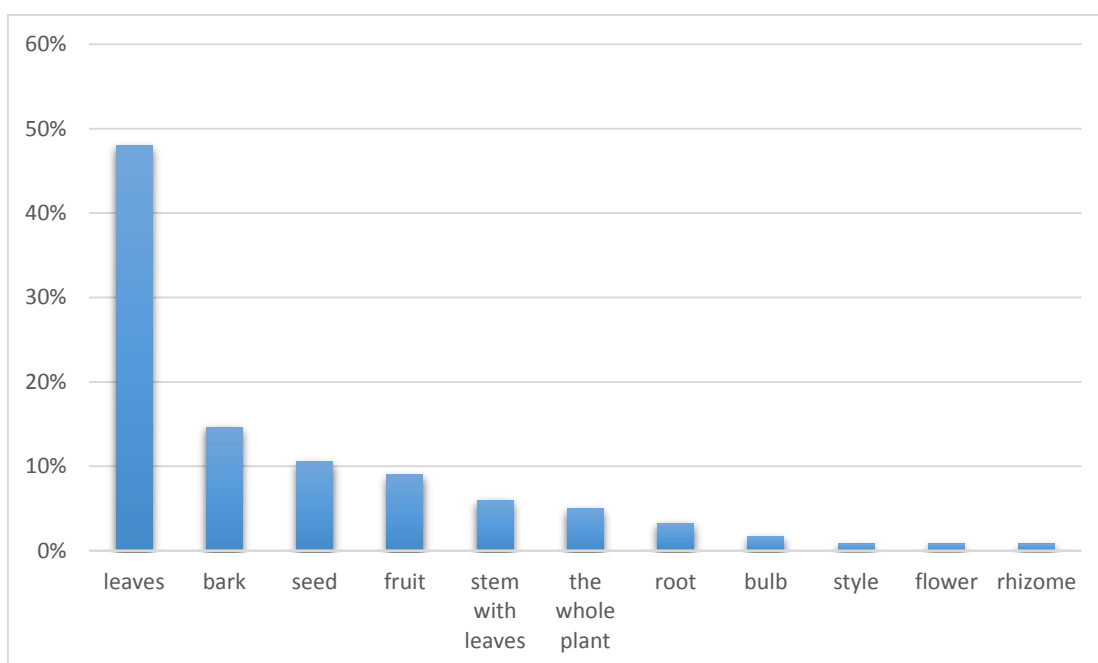


**Figure 4.** Mode of preparation of used medicinal plants in the treatment of selected lifestyle diseases (diabetes, obesity, hypertension, heart diseases)

The mode of application of mentioned medicinal plants does not take pride in such a broad scale. 99% (108 cases) of all the application of mentioned plants is oral, whether it is for the infusion, taking capsules or swallowing drops. The only case where the mode of application was external (1%), was again the case of the seed of *Cascabela thevetia*. Seeds of this tree are utilized in the production of bracelets or necklaces.

Figure 5 presents the proportion of plant parts used among all *herboristerías* and ailment categories. Almost a half (48%) of all the used plant parts represents leaves. Leaves were in general available just in a dry form, crumbled and packed in a plastic bag. 15% consists bark, which was sold in shorter or longer sticks. Bark should be usually cooked in a hot water as an infusion, and in a few cases, it was grinded and put into capsules. Other quite broadly used plant parts were seeds (11%) and fruits (9%). The least

frequently cited part of plant was bulb of *Allium sativum* (2%), which were sold in a prepared capsules, then style of *Zea mays* (1%), flower of *Sambucus nigra* (1%), and rhizome of *Zingiber officinale* (1%). Regarding *ortiga* (*Urtica dioica*, *Urtica urens*) leaves from both plants work well, but in the case of root *Urtica dioica* is stronger and gives better results than *Urtica urens*. *Toronjil*, which is also represented by two species (*Melissa officinalis*, *Ocimum tenuiflorum*), always gives the same results when the infusion from leaves is prepared. Lastly, the third case of two plant species under one folk taxon, which is *oregano* (*Mintostachys mollis*, *Lippia americana*), is also equally beneficial. From both plant species are used only leaves to treat hypertension, whether the infusion or drops are prepared.



**Figure 5.** Ratio of plant parts used among all *herboristerias* and ailment categories

### 4.3 Summary of collected data

The complete data collected are characterized in Table 8. It counts 108 overall mentioned UR across 7 *herboristerias*. Therefore, this table is divided into 7 groups, according to one of each herbalist's shop. Plants (folk taxa) belonging to each *herboristeria* are alphabetically arranged. There is also a detailed information for each plant, describing which part of the plant is used, what is the mode of preparation (infusion,



syrup, capsules, fresh, smoothie, spirit, jewellery) and how it should be applied by patient (oral, external), including all necessary details, recommendations and dosages.

As already mentioned, 53 folk taxa (56 plant species) come from 35 botanical families. The highest number of plant species belongs to the family of Lamiaceae (14%) with eight botanical species. Other relatively numerous family is Fabaceae (7%), where all the representatives (4) are trees. Each of the families Asteraceae, Cucurbitaceae, Urticaceae and Verbenaceae forms 5% with 3 species each. A total of 25 families (e.g. Brassicaceae, Apocynaceae, Solanaceae, Euphorbiaceae) were represented by one species only.

Any vendor did not consider himself a doctor. However, they are aware of the side effects of the conventional medicine. They referred that many of their clients tend to return to the natural medicine because they are tired of the conventional medicine. Some of them use medicinal plants because those plants do not have side effects and some of the patients have already a good personal experience with natural medicine (or someone that they know and gave them the recommendation). Each of the seven herbalists could prove that his medicinal plants improved the health status of his clients. They also know that many medicinal plants have only enhancing character and a patient should first visit a professional doctor.

**Table 8.** Summary of collected information divided according to each *herboristería*

<i>Herboristería</i>	Vernacular name(s)	Other vernacular names	Botanical name	Family	Plant life-form	Plant part used <sup>a</sup>	Form of product	Local medicinal use/ailments treated	Preparation	Mode of application	Detailed administration
1	Alcachofa		<i>Cynara scolymus</i> L.	Asteraceae	herb	WP	dry prepared fresh	diabetes	infusion syrup decoction	oral	Prepare a tea, 5g/1 l (3 cups/day) 1tbsp/3× day Incorporate into food
1	Arrayan		<i>Myrcianthes leucoxylla</i> (Ortega) McVaugh	Myrtaceae	tree	Ba	dry	diabetes	decoction	oral	Prepare a tea, cook 3 pieces of bark/1 l (3 cups/day)
1	Chaparro		<i>Curatella americana</i> L.	Dilleniaceae	tree	B	dry	diabetes	decoction	oral	Prepare a tea, 3 pieces of bark/1 l (3 cups/day)
1	Jengibre	Ginger	<i>Zingiber officinale</i> Roscoe	Zingiberaceae	herb	R	dry fresh	obesity	infusion	oral	Prepare a tea, (3 cups/day)
1	Marrubio		<i>Marrubium vulgare</i> L.	Lamiaceae	herb	WP	dry	obesity	infusion	oral	Prepare a tea, 1 tbsp/0.5 l (3 cups/day)
1	Muerdago	Suelda con suelda	<i>Phthirusa stelis</i> (L.) Kuijt	Loranthaceae	shrub	WP	dry, fresh prepared	hypertension	infusion syrup	oral	Prepare a tea, 1 tbsp/0.5 l (3 cups/day) 1 tbsp/3×/day
1	Nogal		<i>Juglans neotropica</i> Diels	Juglandaceae	tree	L Ba	dry	diabetes	infusion decoction	oral	Prepare a tea, (3 cups/day) Cook few sticks/1 l (3 cups/day)

<i>Herboristería</i>	Vernacular name(s)	Other vernacular names	Botanical name	Family	Plant life-form	Plant part used <sup>a</sup>	Form of product	Local medicinal use/ailments treated	Preparation	Mode of application	Detailed administration
1	Pata de vaca	Patevaca	<i>Bauhinia</i> sp.	Fabaceae	tree	L	dry	diabetes	infusion	oral	Prepare a tea, 1 tbsp/0.5 l (3 cups/day)
1	Quiebra barriga		<i>Trichanthera gigantea</i> (Humboldt & Bonpland) Nees	Acanthaceae	tree	L	dry	obesity	infusion	oral	Prepare a tea, 1 tbsp/0.5 l (3 cups/day)
1	Quina		<i>Cinchona pubescens</i> Vahl	Rubiaceae	tree	Ba	dry	diabetes	decoction	oral	Prepare a tea, 3 pieces of bark/1 l (3 cups/day)
2	Ajo		<i>Allium sativum</i> L.	Amaryllidaceae	herb	Bu	prepared	hypertension	capsule drops	oral	Take 1 capsule in the morning and 1 in the night Take 20 drops 3×/day (60 in total)
2	Alcachofa		<i>Cynara scolymus</i> L.	Asteraceae	herb	L	dry, prepared	obesity	infusion syrup	oral	Prepare a tea, 25 g/2 l 1 tbsp/3× day
2	Almacigo		<i>Bursera simaruba</i> (L.) Sarg.	Burseraceae	tree	Ba	dry	diabetes	decoction	oral	Prepare a tea, 7 g/1 l
2	Anamu		<i>Petiveria alliacea</i> L.	Petiveriaceae	shrub	WP	dry, fresh	diabetes	infusion	oral	Prepare a tea, 10 g/2 l
2	Balsamina		<i>Momordica charantia</i> L.	Cucurbitaceae	herb	L	dry	diabetes	infusion	oral	Prepare a tea, 7 g/ 1 l
2	Comfrey	Gofrey	<i>Symphytum officinale</i> L.	Boraginaceae	herb	SL	dry	obesity	infusion	oral	Prepare a tea, 10 g /2 l/day
2	Eucalypto		<i>Eucalyptus globulus</i> Labill.	Myrtaceae	tree	L	dry	diabetes	infusion	oral	Prepare a tea, 10 g/2 l

<i>Herboristería</i>	Vernacular name(s)	Other vernacular names	Botanical name	Family	Plant life-form	Plant part used <sup>a</sup>	Form of product	Local medicinal use/ailments treated	Preparation	Mode of application	Detailed administration
2	Chia		<i>Salvia Hispanica</i> L.	Lamiaceae	herb	Se	dry	obesity	smoothie	oral	Mix 1 tbsp of seeds in a cup of water, milk, smoothie or yoghurt
2	Malambo		<i>Croton malambo</i> H.Karst.	Euphorbiaceae	tree	Ba	dry	diabetes	decoction	oral	Prepare a tea, 7 g/1 l
2	Marañon		<i>Anacardium occidentale</i> L.	Anacardiaceae	tree	Ba	dry	diabetes	decoction	oral	Prepare a tea, 10 g/1 l
2	Marrubio		<i>Marrubium vulgare</i> L.	Lamiaceae	herb	L	dry	obesity	infusion	oral	Prepare a tea, 7 g/2 l
2	Mastranto		<i>Salvia palifolia</i> Kunth	Lamiaceae	herb	L	dry	hypertension	infusion	oral	Prepare a tea, 10 g/2 l
2	Mastuerzo	Bolsa de pastor	<i>Lepidium bipinnatifidum</i> Donn. Sm.	Brassicaceae	herb	L	dry	hypertension	infusion	oral	Prepare a tea, 10 g/2 l
2	Moringa	Árbol de aceite	<i>Moringa oleifera</i> Lam.	Moringaceae	tree	Se	dry	diabetes	smoothie	oral	Prepare a tea, 30 g/3 l Mix 1 tbsp of seed in a cup of water, milk, smoothie or yoghurt
						-	prepared		syrup		1tbsp/3× day
2	Moringa	Árbol de aceite	<i>Moringa oleifera</i> Lam.	Moringaceae	tree	Se	dry	hypertension	smoothie	oral	Prepare a tea, 30 g/3 l Mix 1 tbsp of seed in a cup of water, milk, smoothie or yoghurt

<i>Herboristería</i>	Vernacular name(s)	Other vernacular names	Botanical name	Family	Plant life-form	Plant part used <sup>a</sup>	Form of product	Local medicinal use/ailments treated	Preparation	Mode of application	Detailed administration
2	Nogal		<i>Juglans neotropica</i> Diels	Juglandaceae	tree	L	dry	diabetes	infusion	oral	Prepare a tea, 7 g/2 l
2	Nopal		<i>Nopalea cochenillifera</i> (L.) Mill	Cactaceae	shrub	L	fresh, dry prepared	diabetes	infusion capsule	oral	Prepare a tea, cut a piece of fresh leaf/1 l or 1 tbsp/1 cup Take 1 in the morning and 1 in the night
2	Pata de vaca	Patevaca	<i>Bauhinia</i> sp.	Fabaceae	tree	L	dry	diabetes	infusion	oral	Prepare a tea, 5 leaves/1
2	Té verde		<i>Camellia sinensis</i> (L.) Kuntze	Theaceae	shrub	L	dry	obesity	infusion	oral	Prepare a tea, 1 tea bag/cup
3	Alcachofa		<i>Cynara scolymus</i> L.	Asteraceae	herb	F	fresh, dry	hypertension	fresh, infusion	oral	Add to food, prepare a tea with 5 g/1 l, recommended with boldo or guaco
3	Alcachofa		<i>Cynara scolymus</i> L.	Asteraceae	herb	L	dry	obesity	infusion	oral	Prepare a tea, 5 g/1 l/day
3	Anis		<i>Illicium verum</i> Hook.f.	Schisandraceae	tree	F, Se	dry	heart diseases	infusion	oral	Prepare a tea, 5 g/1 l (3 cups/day)
3	Barba de maíz	Estigma de choclo	<i>Zea mays</i> L.	Poaceae	herb (grass)	St	dry	obesity	infusion	oral	Prepare a tea, 5 g/1 l/day
3	Berenjena		<i>Solanum melongena</i> L.	Solanaceae	shrub	F	fresh	heart diseases	infusion	oral	Prepare a tea, 1 piece of fruit/1 l/day
3	Berenjena		<i>Solanum melongena</i> L.	Solanaceae	shrub	F	fresh	hypertension	decoction	oral	Prepare a tea, boil 1 piece of fruit/1 l/day

<i>Herboristería</i>	Vernacular name(s)	Other vernacular names	Botanical name	Family	Plant life-form	Plant part used <sup>a</sup>	Form of product	Local medicinal use/ailments treated	Preparation	Mode of application	Detailed administration
3	Boldo		<i>Peumus boldus</i> Molina	Monimiaceae	tree	L	dry	obesity	infusion	oral	Prepare a tea, 5 g/ 1 l/day; can be combined with <i>alcachofa</i>
3	Cidra	Yota, Guatila	<i>Sechium edule</i> (Jacq.) Sw.	Cucurbitaceae	herb	F	fresh	heart diseases	decoction fresh	oral	Cook the fruit (125 g/1 l) and blend it (recommended) add to food; recommended with linseed
3	Cola de caballo		<i>Equisetum giganteum</i> L.	Equisetaceae	herb	SL	dry	obesity	infusion	oral	Prepare a tea, 5 g/1l/day
3	Eucalypto		<i>Eucalyptus globulus</i> Labill.	Myrtaceae	tree	L F	dry dry, fresh	diabetes	infusion decoction	oral	Prepare a tea, 5g/1l Boil 3 fruits/1l (do not blend it)
3	Lino	Linaza	<i>Linum usitatissimum</i> L.	Linaceae	herb	S	dry	heart diseases	decoction	oral	Cook 10 g/1 l and blend it
3	Marañón		<i>Anacardium occidentale</i> L.	Anacardiaceae	tree	B F	dry	diabetes	decoction fresh	oral	Prepare a tea, cook 5 g/1 l/day Add to food
3	Marrubio	Marrubio blanco	<i>Marrubium vulgare</i> L.	Lamiaceae	herb	SL	dry	obesity	infusion	oral	Prepare a tea, 5 g/1 l/day
3	Mastranto		<i>Salvia palifolia</i> Kunth	Lamiaceae	herb	L	dry	hypertension	infusion	oral	Prepare a tea, 5 g/1 l/day
3	Moringa	Árbol de aceite	<i>Moringa oleifera</i> Lam.	Moringaceae	tree	L Se	dry	diabetes	infusion decoction	oral	Prepare a tea, 5g/1l/day Grind 4 seeds and cook in 1 l of water

<i>Herboristería</i>	Vernacular name(s)	Other vernacular names	Botanical name	Family	Plant life-form	Plant part used <sup>a</sup>	Form of product	Local medicinal use/ailments treated	Preparation	Mode of application	Detailed administration
3	Moringa	Árbol de aceite	<i>Moringa oleifera</i> Lam.	Moringaceae	tree	Ro	dry	obesity	infusion	oral	Prepare a tea, 5 g/1 l/day
3	Muerdago	Suelda con suelda	<i>Phthirusa stelis</i> (L.) Kuijt	Loranthaceae	shrub	L	dry	heart diseases	infusion	oral	Prepare a tea, 5 g/1 l/day
3	Muerdago	Suelda con suelda	<i>Phthirusa stelis</i> (L.) Kuijt	Loranthaceae	shrub	L	dry	hypertension	infusion	oral	Prepare a tea, 5 g/1 l/day
3	Nogal		<i>Juglans neotropica</i> Diels	Juglandaceae	tree	L	dry	diabetes	infusion	oral	Prepare a tea, 5 g/1 l/day
3	Oregano		<i>Minthostachys mollis</i> (Kunth) Griseb.	Lamiaceae	herb	L	dry prepared	hypertension	infusion	oral	Prepare a tea, 5 g/1 l/day
			<i>Lippia americana</i> L.	Verbenaceae	herb				drops		30 drops/3× day (90 drops/day)
3	Pata de vaca	Patevaca	<i>Bauhinia</i> sp.	Fabaceae	tree	L	dry	diabetes	infusion	oral	Prepare a tea, 5 g/1 l/day
3	Pepino cohombro		<i>Cucumis sativus</i> L.	Cucurbitaceae	herb	F	fresh	obesity	smoothie	oral	blend 1/4 of cucumber (125 g) with 1 l of water and drink it Drops: 20 - 30 drops/3× day
		prepared					drops				
3	Té verde		<i>Camellia sinensis</i> (L.) Kuntze	Theaceae	shrub	L	dry	obesity	infusion	oral	Prepare a tea, 5 g/1 l/day
3	Toronjil		<i>Melissa officinalis</i> L.	Lamiaceae	herb	L	dry	heart diseases	infusion	oral	Prepare a tea, 5 g/1 l/day, should be used with linseed
			<i>Ocimum tenuiflorum</i> L.	Lamiaceae	shrub						
3	Yarumo	Guarumo	<i>Cecropia peltata</i> L.	Urticaceae	tree	L	dry	heart diseases	infusion	oral	Prepare a tea, 7 g/1 l/day
4	Ajo		<i>Allium sativum</i> L.	Amaryllidaceae	herb	Bu	prepared	hypertension	drops	oral	20 drops 3×/day (60 in total)

<i>Herboristería</i>	Vernacular name(s)	Other vernacular names	Botanical name	Family	Plant life-form	Plant part used <sup>a</sup>	Form of product	Local medicinal use/ailments treated	Preparation	Mode of application	Detailed administration
4	Alcachofa		<i>Cynara scolymus</i> L.	Asteraceae	herb	L	dry	obesity	infusion	oral	Prepare a tea, 25 g/2 l (3 cups/day)
4	Almacigo		<i>Bursera simaruba</i> (L.) Sarg.	Burseraceae	tree	Ba	dry	heart diseases	decoction	oral	Prepare a tea, boil 25 g/2 l (3 cups/day)
4	Balsamina		<i>Momordica charantia</i> L.	Cucurbitaceae	herb	L	dry	diabetes	infusion	oral	Prepare a tea, 25 g/2 l (3 cups/day)
4	Cola de caballo		<i>Equisetum giganteum</i> L.	Equisetaceae	herb	SL	dry	hypertension	infusion	oral	Prepare a tea, 25 g/2 l (3 cups/day)
4	Marañón		<i>Anacardium occidentale</i> L.	Anacardiaceae	tree	Ba	dry	diabetes	decoction	oral	Prepare a tea, boil 25 g/2 l (3 cups/day)
4	Marrubio		<i>Marrubium vulgare</i> L.	Lamiaceae	herb	L	dry	obesity	infusion	oral	Prepare a tea, 25 g/2 l (3 cups/day)
4	Mastranto		<i>Salvia palifolia</i> Kunth	Lamiaceae	herb	L	dry, fresh	hypertension	infusion	oral	Prepare a tea, 25 g/2 l (3 cups/day)
4	Moringa	Árbol de aceite	<i>Moringa oleifera</i> Lam.	Moringaceae	tree	Se	dry fresh	diabetes	infusion fresh	oral	Prepare a tea, 30 g/3 l (3 cups/day)  Chew a seed 2×/day
4	Muerdago	Suelda con suelda	<i>Phthirusa stelis</i> (L.) Kuijt	Loranthaceae	shrub	L	dry	heart diseases	infusion	oral	Prepare a tea, 25 g/2 l (3 cups/day)
4	Nogal		<i>Juglans neotropica</i> Diels	Juglandaceae	tree	L	dry	diabetes	infusion	oral	Prepare a tea, 25 g/2 l (3 cups/day)
4	Ortiga	Pringamosa	<i>Urtica dioica</i> L. <i>Urtica urens</i> L.	Urticaceae Urticaceae	herb herb	L, Ro L	dry	heart diseases	infusion	oral	Prepare a tea, 25 g/2 l (3 cups/day)



<i>Herboristería</i>	Vernacular name(s)	Other vernacular names	Botanical name	Family	Plant life-form	Plant part used <sup>a</sup>	Form of product	Local medicinal use/ailments treated	Preparation	Mode of application	Detailed administration
4	Pata de vaca	Patevaca	<i>Bauhinia</i> sp.	Fabaceae	tree	L	dry	diabetes	infusion	oral	Prepare a tea, 25 g/2 l (3 cups/day)
4	Quiebra barriga		<i>Trichanthera gigantea</i> (Humboldt & Bonpland) Nees	Acanthaceae	tree	L	dry	obesity	infusion	oral	Prepare a tea, 25 g/2 l (3 cups/day)
5	Acacio		<i>Senna alexandrina</i> Mill.	Fabaceae	shrub	F	dry	obesity	infusion	oral	Prepare a tea, 10 g/2 l (1 cup in the morning and 1 cup in the evening)
5	Boldo		<i>Peumus boldus</i> Molina	Monimiaceae	tree	L	dry	obesity	infusion	oral	Prepare a tea, 10 g/2 l (1 cup in the morning and 1 cup in the evening)
5	Moringa	Árbol de aceite	<i>Moringa oleifera</i> Lam.	Moringaceae	tree	L	dry	hypertension	infusion	oral	Prepare a tea, 30 g/3 l (3 cups/day, in total 1 l/day)
5	Moringa	Árbol de aceite	<i>Moringa oleifera</i> Lam.	Moringaceae	tree	L	dry	obesity	infusion	oral	Prepare a tea, 30 g/3 l (3 cups/day, in total 1 l/day)
5	Pata de vaca	Patevaca	<i>Bauhinia</i> sp.	Fabaceae	tree	L	dry	obesity	infusion	oral	Prepare a tea, 15 g/3 l (3 cups/day)
5	Pata de vaca	Patevaca	<i>Bauhinia</i> sp.	Fabaceae	tree	L	dry	diabetes	infusion	oral	Prepare a tea, 15 g/3 l (3 cups/day)
5	Yacon		<i>Smallanthus sonchifolius</i> (Poepp. & Endl.) H. Rob.	Asteraceae	herb	SL	dry	diabetes	infusion	oral	Prepare a tea, 10 g/2 l (1 cup in the morning and 1

<i>Herboristería</i>	Vernacular name(s)	Other vernacular names	Botanical name	Family	Plant life-form	Plant part used <sup>a</sup>	Form of product	Local medicinal use/ailments treated	Preparation	Mode of application	Detailed administration
											cup in the evening)
6	Aguacate		<i>Persea americana</i> Mill.	Lauraceae	tree	L		diabetes	infusion	oral	Prepare a tea, 10 g/1 l (2 cups/day)
6	Cidron		<i>Aloysia citrodora</i> Palau	Verbenaceae	shrub	L	dry	hypertension	infusion	oral	Prepare a tea, 10 g/1 l (3 cups/day)
6	Cidron		<i>Aloysia citrodora</i> Palau	Verbenaceae	shrub	L	dry	heart diseases	infusion	oral	Prepare a tea, 10 g/1 l (3 cups/day)
6	Cola de caballo		<i>Equisetum giganteum</i> L.	Equisetaceae	herb	SL	dry	obesity	infusion	oral	Prepare a tea, 10 g/1 l (3 cups/day)
6	Chaparro		<i>Curatella americana</i> L.	Dilleniaceae	tree	Ba	dry	diabetes	decoction	oral	Prepare a tea, boil 15 g/1 l (2 cups/day)
6	Marañón		<i>Anacardium occidentale</i> L.	Anacardiaceae	tree	Ba	dry	diabetes	decoction	oral	Prepare a tea, boil 15 g/1 l (3 cups/day)
6	Marrubio		<i>Marrubium vulgare</i> L.	Lamiaceae	herb	L	dry, fresh	obesity	infusion	oral	Prepare a tea, 10 g/1 l (3 cups/day)
6	Mastranto		<i>Salvia palifolia</i> Kunth	Lamiaceae	herb	L	dry	hypertension	infusion	oral	Prepare a tea, 10g/1 l (2 cups/day)
6	Moringa	Árbol de aceite	<i>Moringa oleifera</i> Lam.	Moringaceae	tree	L Se	dry	diabetes	infusion fresh	oral	Prepare a tea, 5 g/1 l (2 cups/day) Chew 2 seeds per day
6	Muerdago	Suelda con suelda	<i>Phthirusa stelis</i> (L.) Kuijt	Loranthaceae	shrub	L	dry	hypertension	infusion	oral	Prepare a tea, 15 g/1 l (3 cups/day)

<i>Herboristería</i>	Vernacular name(s)	Other vernacular names	Botanical name	Family	Plant life-form	Plant part used <sup>a</sup>	Form of product	Local medicinal use/ailments treated	Preparation	Mode of application	Detailed administration
						Ba			decoction		Prepare a tea, boil 10 g/1 l (3 cups/day)
6	Ortiga	Pringamosa	<i>Urtica dioica</i> L. <i>Urtica urens</i> L.	Urticaceae Urticaceae	herb herb	L, Ro	dry	obesity	infusion	oral	Prepare a tea, 10 g/1 l (3 cups/day)
6	Quiebra barriga		<i>Trichanthera gigantea</i> (Humboldt & Bonpland) Nees	Acanthaceae	tree	L	dry	obesity	infusion	oral	Prepare a tea, 10g/1l (2 cups/day)
6	Romero		<i>Rosmarinus officinalis</i> L.	Lamiaceae	shrub	L	dry	hypertension	infusion	oral	Prepare a tea, 10 g/1 l (2 cups/day)
6	Romero		<i>Rosmarinus officinalis</i> L.	Lamiaceae	shrub	L	dry	heart diseases	infusion	oral	Prepare a tea, 10 g/1 l (2 cups/day)
6	Saúco		<i>Sambucus nigra</i> L.	Adoxaceae	tree	L, Fl	dry	heart diseases	infusion	oral	Prepare a tea, 10 g/1 l (3 cups/day)
6	Stevia		<i>Stevia</i> sp.	Asteraceae	herb	L	dry	diabetes	infusion	oral	Prepare a tea, 10 g/1 l (3 cups/day)
6	Valeriana		<i>Valeriana</i> sp.	Lamiaceae	herb	L S	dry	heart diseases	infusion	oral	Prepare a tea, root: 10 g/1 l (3 cups/day) leaves: 10 g/1 l (3 cups/day) stem: 15 g/1 l (3 cups/day)

<i>Herboristería</i>	Vernacular name(s)	Other vernacular names	Botanical name	Family	Plant life-form	Plant part used <sup>a</sup>	Form of product	Local medicinal use/ailments treated	Preparation	Mode of application	Detailed administration
6	Yacon		<i>Smallanthus sonchifolius</i> (Poepp. & Endl.) H.Rob.	Asteraceae	herb	SL	dry	diabetes	infusion	oral	Prepare a tea, 15 g/1 l (2 cups/day)
7	Aguacate		<i>Persea americana</i> Mill.	Lauraceae	tree	Se	dry, prepared	heart diseases	capsule	oral	Grind the seed and put the powder into capsules (1 seed = 30 capsules), eat 3 capsules/day
7	Aguacate		<i>Persea americana</i> Mill.	Lauraceae	tree	Se	dry, prepared	obesity	capsule	oral	Grind the seed and put the powder into capsules (1 seed = 30 capsules), eat 3 capsules/day
7	Algarroba		<i>Hymenaea courbaril</i> L.	Fabaceae	tree	Ba F	dry fresh	diabetes	decoction smoothie	oral	Prepare a tea, boil 10 cm/1 l/3x per day Blend 2 fruits for 1 cup
7	Aloe	Sábila	<i>Aloe vera</i> (L.) Burm.f.	Asparagaceae	succulent herb	L	fresh	diabetes	smoothie	oral	Blend the interior of the leaf, drink 1 cup in the morning and 1 cup in the evening (2 leaves/day)

<i>Herboristería</i>	Vernacular name(s)	Other vernacular names	Botanical name	Family	Plant life-form	Plant part used <sup>a</sup>	Form of product	Local medicinal use/ailments treated	Preparation	Mode of application	Detailed administration
7	Cabalonga		<i>Cascabela thevetia</i> (L.) Lipp old	Apocynaceae	tree	Se	dry	hypertension	jewellery	external	Make a bracelet or necklace with the seed
7	Cañandong	Cañafitula	<i>Cassia grandis</i> L.f.	Fabaceae	tree	F	fresh	diabetes	smoothie	oral	Blend the ripe fruit into juice/smoothie (1 - 2 cups/day)
7	Capitan		<i>Aristolochia sp.</i>	Aristolochiaceae	woody vine	WV	dry, prepared	diabetes	infusion spirit capsule	oral	Prepare a tea, 2 small sticks of 20 cm/1 l/day Drink 2 shots of ron (macerated poles)/day Grind into 30 g capsules (2 capsules/ day)
7	Cedron		<i>Aloysia sp.</i>	Verbenaceae	tree	Se	dry, prepared	obesity	capsule	oral	Grind the seed and put the powder into capsules (1 seed = 7 – 10 capsules), eat 2 capsules/day
7	Cedron		<i>Aloysia sp.</i>	Verbenaceae	tree	Se	dry, prepared	diabetes	capsule	oral	Grind the seed and put the powder into capsules (1 seed = 7 – 10 capsules), eat 2 capsules/day

<i>Herboristería</i>	Vernacular name(s)	Other vernacular names	Botanical name	Family	Plant life-form	Plant part used <sup>a</sup>	Form of product	Local medicinal use/ailments treated	Preparation	Mode of application	Detailed administration
7	Cruzeta		<i>Randia</i> sp.	Rubiaceae	tree	Ba	dry prepared	diabetes	decoction capsules	oral	Cook 20 cm of bark/1 l (3 cups/day) Grind the bark and put the powder into 30 g capsules (3 capsules/day)
7	Guaco		<i>Aristolochia</i> sp.	Aristolochiaceae	woody vine	WV	dry, fresh	diabetes	infusion spirit	oral	Prepare a tea, cut 20 cm/1 l of water/3x per day Put it into rum (1 shot/day)
7	Chuchuhuasa		<i>Maytenus laevis</i> Reissek	Celastraceae	tree	Ba	dry	diabetes	decoction	oral	Prepare a tea, 20 cm of bark/1 l water
7	Malambo		<i>Croton malambo</i> H.Karst.	Euphorbiaceae	tree	Ba	dry	diabetes	decoction	oral	Prepare a tea, 10 cm of bark/1 l/day
7	Marañon		<i>Anacardium occidentale</i> L.	Anacardiaceae	tree	Ba	dry	diabetes	decoction	oral	Prepare a tea, 20 cm of bark/1 l (3 cups/day)
7	Moringa	Árbol de aceite	<i>Moringa oleifera</i> Lam.	Moringaceae	tree	L	dry	diabetes	infusion	oral	Prepare a tea, 5 g/1 l (3 cups/day)

<sup>a</sup>Plant part used: Ba – bark, Bu – bulb, F – fruit, Fl – flower, L – leaves, R – rhizome, Ro – root, S – stem, Se – seed, SL – stem+leaves, St – style, WP – the whole plant, WV – the whole vine

## 5 Discussion

### 5.1 Folk taxonomy and local naming of plants

In this thesis, we worked more with folk taxa instead of botanical names, because it was closer to the population. Although the folk taxonomy is sometimes understood as incomplete and non-systematic (Berlin et al., 1966), local natives rather believe in their knowledge and experience and therefore they may ignore the European science (Hunn, 1976).

One of the three taxa, corresponding to two botanical species, was *toronjil*, later determined as *Melissa officinalis* and *Ocimum tenuiflorum*. Regarding other researches done in Latin America, *toronjil* was determined as *Melissa officinalis* by local population in Colombia (Toscano Gonzalez, 2006; Ceuterick et al., 2008; Ministerio de la protección Social de Colombia, 2008; Acevedo et al., 2013), Ecuador (Tinitana et al., 2016), Cuba (Fiallo et al., 2000), Peru and Bolivia (Ceuterick et al., 2011; Mathez-Stiefel and Vandebroek, 2011). However, *toronjil* was also recognized as *Ocimum tenuiflorum* in Colombia (Gómez-Estrada et al., 2011) and Panama (Torres et al., 2008). In our research, *toronjil* was recommended for heart diseases. Informants from mentioned publications that know *toronjil* as *Melissa officinalis* described that it serves for the heart ailments as well. On the other hand, some of them did not mention its use to cure heart, but nervous system or headache. *Ocimum tenuiflorum* was used for the cardiac problems or flatulence.

The second folk taxon corresponding to two species was *oregano*. Both, *Minthostachys mollis* and *Lippia americana* were in this thesis determined to heal hypertension. Each of them belongs to different botanical family (Lamiaceae, Verbenaceae). Gómez-Estrada et al. (2011) admit that in the northern part of Colombia *oregano* is also known as *Lippia graveolens* Kunth. In other parts of Colombia was *oregano* determined as *Origanum vulgare* L. and it was mainly used for stomach, digestion, cough, to alleviate fatigue or to eliminate parasites (Toscano Gonzalez, 2006; Ceuterick et al., 2008; Ministerio de la protección Social de Colombia, 2008; Paternina and Gómez, 2015) or it was determined as *Plectranthus unguentarius* Codd and *Origanum × majoricum* Cambess. and used to help with digestive system (Tinitana et al., 2016). Other Latin American communities also use *Minthostachys mollis* as a medicinal plant, but it does not correspond to our folk name and medicinal use (Scandaliaris et al.,

2007; Monigatti et al., 2013; Lock et al., 2016). Therefore, our data about *oregano* is rather unique among other studies. As *Minthostachys mollis* is very similar to *Origanum* spp. (Scandalariis et al., 2007), it cannot be excluded that those species were mistaken.

In addition, *ortiga* was sold as *Urtica dioica* and *Urtica urens*, depending on its availability. *Urtica dioica*, sometimes distinguished as *ortiga mayor*, came from the warmer climate, such as the city of Bonda. *Urtica dioica* has smaller leaves and grows in cooler climate, in the area of Medellín, Bogotá and Bucaramanga. (Ministerio de la protección Social de Colombia (2008) pointed out that *Urtica dioica* has diuretic properties, which helps with obesity, as in our study. *Urtica urens* was recommended by certain Colombians for healing a musculoskeletal system, but it was also marked as a blood cleaner, which may explain its use for heart disease. It was also the mentioned use in this study (Cadena-González et al., 2013). Toscano Gonzales (2006) described that *Urtica urens* was used by Colombian population for rheumatic fever and alopecia (Toscano Gonzalez, 2006). Both plants of *ortiga* are used by the local population to treat investigated diseases.

The fact of various vernacular names for one folk taxon is probably influenced by the location, experience and habit of each informant. There is still a big lack of similar ethnobotanical investigations, where the folk taxonomy could be compared with other parts of Colombia.

## **5.2 Treatment of lifestyle diseases in other areas**

As it was already mentioned above, there are no investigations made in Colombia focused utterly on the treatment of lifestyle diseases by medicinal plants, or only on the treatment of each of those ailments individually.

In our study, herbalists mentioned 25 medicinal plants to treat diabetes. In other countries where ethnobotanical studies were focused only on diabetes revealed more species than in our case, such as 67 plant species in Algeria (Telli et al., 2016), 71 plant species in China (Guo et al., 2017) or 27 taxa in Turkey (Durmuskahya and Ozturk, 2013). In the zone of Latin America, in Peru it was 31 plants (Bussmann and Glenn, 2011), in Brazil 81 species (Trojan-Rodrigues et al., 2012), in Mexico 36 plants (Villarreal-Ibarra et al., 2015). Some species across the Latin America were same as in this thesis, such as



*Aloe vera*, *Aristolochia* sp., *Bauhinia* sp., *Bursera simaruba*, *Eucalyptus globulus*, *Cynara scolymus*, *Hymenaeae coubaril*, *Maytenus* sp., *Nopalea cochenillifera* (L.) Salm-Dyck, *Momordica charantia*, *Persea americana*, *Stevia* sp., *Petiveria alliacea* L. (Jaramillo, 1981; Toscano Gonzalez, 2006; Bussmann and Glenn, 2011; Trojan-Rodrigues et al., 2012, Villarreal-Ibarra et al, 2015; Giovannini et al., 2016; Naranjo et al., 2016). Higher number of plants in non-Latin America's countries probably denotes that other continents are more ethnobotanically explored.

Although that obesity is preventable and since 1980, it has more than doubled in the whole world, there were even less ethnobotanical investigations focused on obesity and overweight than on diabetes (WHO, 2016). Our *herboristerías* mentioned 18 botanical species. Molaes et al. (2012) described which plant products were sold at naturism store (“*tienda naturista*”) in Mexico. They described 40 products, which corresponded to 75 plant species. The majority of their plant products was sold in the form of capsule, while in this thesis it was dry plant parts. In this study we were not focused on “slimming products”, but on real plants. Cercato et al. (2015) said that across Brazil there are 50 species for weight loss. Species for obesity and weight loss that were equal in our research and previous researches in Latin America are *Bauhinia* sp., *Camellia sinensis*, *Cynara scolymus*, *Equisetum* sp., *Marrubium vulgare*, *Persea americana*, *Salvia hispanica* L., *Senna alexandrina*, *Symphytum officinale* L., *Trichanthes gigantea*, *Zea mays*, *Zingiber officinale* (Cadena-González et al., 2013; Alonso-Castro et al., 2015; Molaes et al., 2015; Cercato et al., 2015). Still, these diseases should rather be prevented by following a healthy lifestyle (WHO, 2016).

13 plant species were recorded by our *herboristerías* as having hypotensive effects. Unfortunately, Web of Science ([www.webofknowledge.com](http://www.webofknowledge.com)) and Scopus ([www.scopus.com](http://www.scopus.com)) do not offer a big scale of studies focused straightforwardly and only on the traditional use of hypotensive medicinal plants by the local population. Nevertheless, Tahraoui et al. (2006) mentioned that 400 individuals of Moroccan population uses 36 medicinal plants with those properties, where *Allium sativum* and *Rosmarinus officinalis* L. corresponded to our research. In Brazil it was documented that people with hypertension use 112 medicinal plants to treat them, but only 10 species with the highest citation were described (Nunes et al., 2015), and none of them corresponded to our species. It is possible, that the number of equal species would be higher, as the flora

in Latin America is similar (Hillstrom and Hillstrom, 2003), if we would know the whole list of plants. Because higher scale of used medicinal plants reflect higher number of informants. However, *Allium sativum*, *Rosmarinus officinalis* and *Salvia palifolia* were also reported by other Colombian sources as hypotensive (Ministerio de la protección Social de Colombia. 2008; Cadena-González et al., 2013).

From 16 botanical species that were identified in this thesis for heart diseases, *Mellisa officinalis* was also mentioned to help with heart problems in Colombia by Toscano Gonzalez (2006) and by Ceuterick et al. (2011) by Peruvian and Bolivian population. They also claimed *Rosmarinus officinalis* for heart ailments. Similar number of plants showed the investigation made by Olorunnisola et al. (2011) in Nkonkobe Municipality in South Africa, which described 19 plant species for problems regarding the heart, but none of them was same as in this study.

*Herboristerías* claimed that some plants are becoming more popular than in the past (e.g. *Salvia palifolia* and *Phthirusa stelis* are being replaced by *Moringa oleifera*), which can be the reason why certain plants from our research were not mentioned in similar ethnobotanical researches across Latin America that were done in the previous years. In the future, more ethnobotanical investigation could reveal which plants are used directly by the local population to treat those diseases and it could be compare with the knowledge of herbalists.

### **5.3 Biological activity and chemical compounds**

Do our plants really contain some chemical compounds? Or is their success only due to a placebo effect? 29 species have been described and their chemical compounds have been characterized within the proper lifestyle disease. In general, those species belong rather to a well-known and popular species, such as *Rosmarinus officinalis*, *Zea mays* or *Cynara scolymus* (Andrade-Cetto and Heinrich 2005; Fernández et al., 2014; Chaiittianan et al., 2016). Some species biological activity has been explored, but their aiming on the certain ailment is still missing and in the future researches could be done, e.g. *Juglans neotropica*, *Hymenaea coubaril*, *Croton malambo*, *Maytenus laevis*, *Curatella americana*, *Bursera simaruba*, *Symphytum officinale*, *Senna alexandrina*, *Urtica urens* (Gonzalez et al., 1982; Lopez et al., 2001; Farag et al., 2015; Lopes et al., 2016; Torres

et al., 2012; Bah et al., 2014; Munoz-Acevedo et al., 2014; Jaradat et al.; Spînu et al., 2016). A lack of biological activity and health benefits investigations is present in 3 following species: *Lepidium bipinnatifidum* Desv., *Petiveria alliacea* and *Salvia palifolia*. Therefore this thesis could serve as a background for further research focused on the biological activity and chemical compounds of those plant species. Especially *Salvia palifolia* and *Phthirusa stelis*, which were the most cited species in their categories.

#### **5.4 Low consensus among *herboristerías***

This thesis is special especially because of the low agreement among herbalist's shops, as it was already mentioned above. It is relatively extraordinary, because usually the consensus among informants is high, especially if the research took place in the same small city. Focusing only on Latin America, Tinitana et al. (2016) showed that  $F_{IC}$  for hormonal system (diabetes) was 0.81, Geck et al. (2016) noticed for diabetes  $F_{IC}$  of 0.48 and 0.60, Canales et al. (2005) 0.76, Alonso-Castro et al. (2017) described  $F_{IC}$  for endocrine and metabolic diseases (diabetes) 0.75 and del Carmen Juárez-Vázquez et al. (2013) the value of 0.77. Our  $F_{IC}$  reached only 0.48. About eight plant species in the diabetes category are still missing deeper investigation on their antidiabetic properties, which can be the reason of low consensus. They draw information from different sources; some herbalist rather give preference to reference books and some prefer to follow family experience.

Regarding hypertension and heart diseases category, we observed the same situation. In comparison with our hypertension ( $F_{IC} = 0.39$ ) and heart diseases ( $F_{IC} = 0.07$ ) categories, other ethnobotanical researches within Latin America exposed that circulatory system (blood pressure, blood circulation), had Informant Consensus Factor of 0.88 (Tinitana et al., 2016), 0.86 (del Carmen Juárez-Vázquez et al., 2013), 0.5 (Alonso-Castro et al., 2017) and 0.33 (Gazzaneo et al., 2005). Cardiovascular systems showed the agreement of 0.59 (Heinrich et al., 1998). If we again take into consideration that five species in hypertension category are lacking investigation about their antihypertensive effect and four species in heart diseases category need to be deeper explored within heart problems, it could mean that each *herboristería* follows its own verified practice, whether it is focused on specialised literature or traditional habits and experiences. Therefore, the consensus is low.

## 6 Conclusion

This study has documented 53 folk taxa corresponding to 56 botanical species recommended by 7 *herboristerías* in Santa Marta (Colombia) to treat 4 lifestyle diseases; obesity, diabetes, hypertension and heart diseases. Although that those diseases present a big treat for the local population, this thesis proved that there is a deficiency in ethnobotanical studies focused on medicinal plants in Colombia.

The most species were cited in diabetes category, and the most frequently cited species in this category were *Anacardium occidentale*, *Moringa oleifera* and *Bauhinia* sp. In obesity category it was *Marrubium vulgare*, in hypertension it was *Salvia palifolia* and in heart diseases it was *Phthirusa stelis*. Some of the used species were used in the traditional medicine in Latin America. This thesis was remarkable for 30 botanical species that were unique. It also strongly influenced Fidelity Level and Informant Consensus Factor. The highest F<sub>IC</sub> was measured in diabetes category (0.45) and the lowest (0.07) in heart diseases category, and the agreement heterogeneity was probably influenced by different way of gaining information about medicinal plants.

We have found that 3 species (*Lepidium bipinnatifidum*, *Petiveria alliacea*, *Salvia palifolia*) have not been well-explored yet, therefore laboratory testing should be performed to evaluate biological activity and health benefits of these species.

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## Appendices

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**Appendix I.** Package of Quiebra barriga (*Trichanthera gigantea*) sold at herboristeria



**Appendix II.** Package of romero (*Rosmarinus officinalis*)



**Appendix III.** Preparing Cola de caballo (*Equisetum giganteum*) for packaging





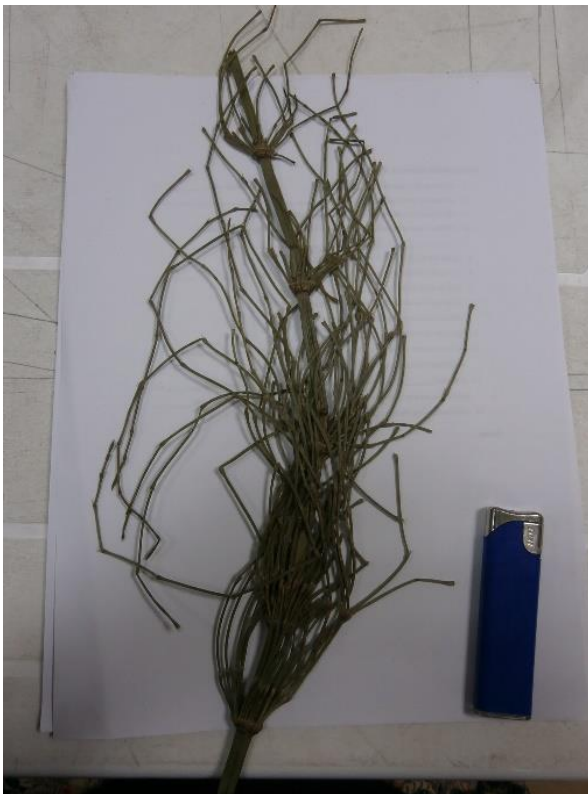
**Appendix IV.** Bark of marañon (*Anacardium occidentale*) sold at herboristería



**Appendix V.** Selling of medicinal plants at Mercado Público de Santa Marta



**Appendix VI.** Pressed and dried anamú (*Petiveria alliacea*)



**Appendix VII.** Pressed and dried cola de caballo (*Equisetum giganteum*)





**Appendix VIII.** Droguería y Herboristería “La Contra #5”



**Appendix IX.** Mr. Alfonso Sala at his Botanica “Los Frutos”