Vol. 12(26), pp. 435-447, 25 October, 2018
DOI: 10.5897/JMPR2018.6634
Article Number: 0C884A158795
ISSN: 1996-0875

http://www.academicjournals.org/JMPR

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Journal of Medicinal Plants Research

Full Length Research Paper

Knowledge of medicinal plants used by residents in two peripheral districts of Boa Vista, Roraima, Northern Brazilian Amazon: Phytotherapy as a new strategy in collective health

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Received 24 June, 2018; Accepted 20 August, 2018

The aim of the study was to describe local knowledge about the use of medicinal plants cited by study participants, as well as to examine how phytotherapy serves as an important strategy of integrative and complementary practice in coping with health problems. The research is characterized as an exploratory study of the descriptive type. Non-probabilistic snowball sampling generated a sample of one hundred and ten participants (n = 110). The study instruments were semi-structured interviews and questionnaires. The data collected were analyzed using Microsoft Excel 2007 and summarized with descriptive statistical methods. The study informants presented knowledge of 77 species and 46 plant families, showing the rich variety of medicinal flora present in the Northern Brazilian Amazon. Among the respondents, elderly women had the most diversified knowledge. Preserving this knowledge is essential and can help in the implementation of public health policies. The results showed high richness of the medicinal flora present in Northern Brazilian Amazon.

Key words: Medicinal plants, phytotherapy, local knowledge, collective health, Brazilian Amazon

INTRODUCTION

Brazil is the most biodiverse country in the world, associated with rich ethnic and socio-cultural diversity, including valuable traditional knowledge about the use of medicinal plants (National Policy of Medicinal Plants and Phytotherapy, 2006). In addition to its recognized natural group of indigenous peoples and traditional populations who have learned, over time, how to live in diverse environments. These groups (Indians, caboclos, riparians, rubber tappers, quilombolas, fishermen, small farmers and extractivists) have vast knowledge about

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plants and understanding of their environment (Vasquez et al., 2014).

According to the World Health Organization (WHO), 80% of the world's population, especially in developing countries such as Brazil, still treat diseases with herbal products and thus use traditional medicine for primary healthcare (Rahman and Singhal, 2002). Medicinal plants are already a significant part of Brazilian popular culture, and in recent decades, interest in phytotherapy has increased considerably among users, researchers and health service providers.

The WHO has also expressed its position on the need to value the use of medicinal plants in health and basic healthcare (Rosa et al., 2011). Given the importance of the subject, interest in conducting this study emerged after understanding and recognizing that healthcare programs should be designed to address not only the medical concerns of the health system but also community participation. Thus, planning must be oriented and constructed according to the needs of individuals, incorporating their social, cultural, environmental and economic characteristics, and with the participation of the people in the communities under study. In recent decades, the use of medicinal plants has grown considerably; this recognition and popular knowledge also contribute to the need for research to clarify and confirm information on the actions of the plants in order to include their use as another form of healthcare.

To better make use of phytotherapy, the Brazilian Ministry of Health implemented the National Policy of Medicinal Plants and Phytotherapy (PNPMF), created in 2006, whose premises concern the principles of safety and efficacy in public health and reconciling socio-economic development and environmental conservation, both locally and nationally. In addition, respect for regional and environmental diversity and particularities are also the guiding principle of this policy. The policy's model of development is aimed at recognizing and promoting proven practices and maintaining the great diversity of usage forms of medicinal plants, ranging from home and community use, through the pharmaceutical manipulation of medicines, to the use and manufacture of industrialized medicines (National Policy of Medicinal Plants and Phytotherapics, 2006).

According to Moraes (2011), the cultural richness in the Amazon constitutes an important component of the social identity of this region and, because it is dynamic, it changes constantly. In many communities, traditional knowledge is the only therapeutic and medicinal resource. Therefore, the objectives of this work are to describe local knowledge and use of medicinal plants mentioned by the participants of the study and to utilize phytotherapy to analyze how strategies used to confront health problems align with the needs and conceptions of the population's health.

The relevance of traditional medicines both in the world and as represented in the National Policy of Medicinal and Phytotherapeutic Plants in Brazil reflects the recognition of scientific evidence of the efficacy and safety of medicinal plants and herbal medicines. The use of synthetic drugs has failed to fulfill the implicit and explicit promises of health systems to address the treatment of diseases. Problems include high costs and the significant adverse effects of synthetic drugs, and the results that are not always satisfactory, which has led to a large number of people seeking less aggressive alternative forms of treatment (Bruning et al., 2012). Medicinal plants can form a new component in healthcare and play an essential role in the treatment of various diseases; this is especially true for developing countries, where phytotherapy is often the only option for primary treatment of diseases.

MATERIALS AND METHODS

Study area

In the Brazilian Amazon, approximately 15 million people live in urban areas according to data from the Brazilian Institute of Geography and Statistics (IBGE, 2010).

The State of Roraima, created by the Federal Constitution of 1988, is part of the Brazilian Amazon located in the extreme north of Brazil and is, therefore, a constituent of the Brazilian Amazon. The characteristics of its biome are well diversified and, thus, particularized from the rest of the Amazon Region. According to the IBGE (2010), the population of Roraima is composed of 450,479 people, distributed in fifteen municipalities, in an area of 224,303,187 km^2. The state has international borders with the Cooperative Republic of Guyana (East and Northeast) and the Bolivarian Republic of Venezuela (North and Northwest), and national borders with the state of Amazonas (South and Southwest) and the state of Pará (Southeast).

The study area, located in the municipality of Boa Vista (229,454 inhabitants), was in the neighborhood of Nova Cidade and Raiar do Sol in the west of the capital, with 5,708 inhabitants and 5,863 inhabitants, respectively (IBGE, 2010). The population is quite heterogeneous, consisting essentially of roraimenses (including Indians and descendants of the pioneers of the colonization of the State) and by smaller numbers of afrodescendants, southerners, northeasterners and northerners. This heterogeneity is important when analyzing the relationship between the use of medicinal plants and migration in the state of Roraima, since many plants were brought from elsewhere to the state, and their use remains as a local health practice. The city of Boa Vista, capital of the state of Roraima, is part of the subdivision Fronteira de Integração in the western portion of the Amazon. The city has an equatorial climate with an average temperature of 27.4ºC and typical savannah vegetation. It is located on the right bank of the Branco River within the hydrographic basin of the same name. The Raiar do Sol district, which is located near the Paca Creek in the western part of the municipality of Boa Vista, has the largest indigenous population in the city of Boa Vista with 287 self-declared indigenous inhabitants, according to data from the Brazilian Institute of Geography (IBGE, 2010). The Nova Cidade region is also located in the western zone of Boa Vista. The western zone is larger than all the other zones together (east, north and south) and is characterized by being peripheral, encompassing the poorer districts of the city, and presenting poor health indicators (Figure 1).

Data collection and analysis procedures

This study respected the ethical principles that govern research

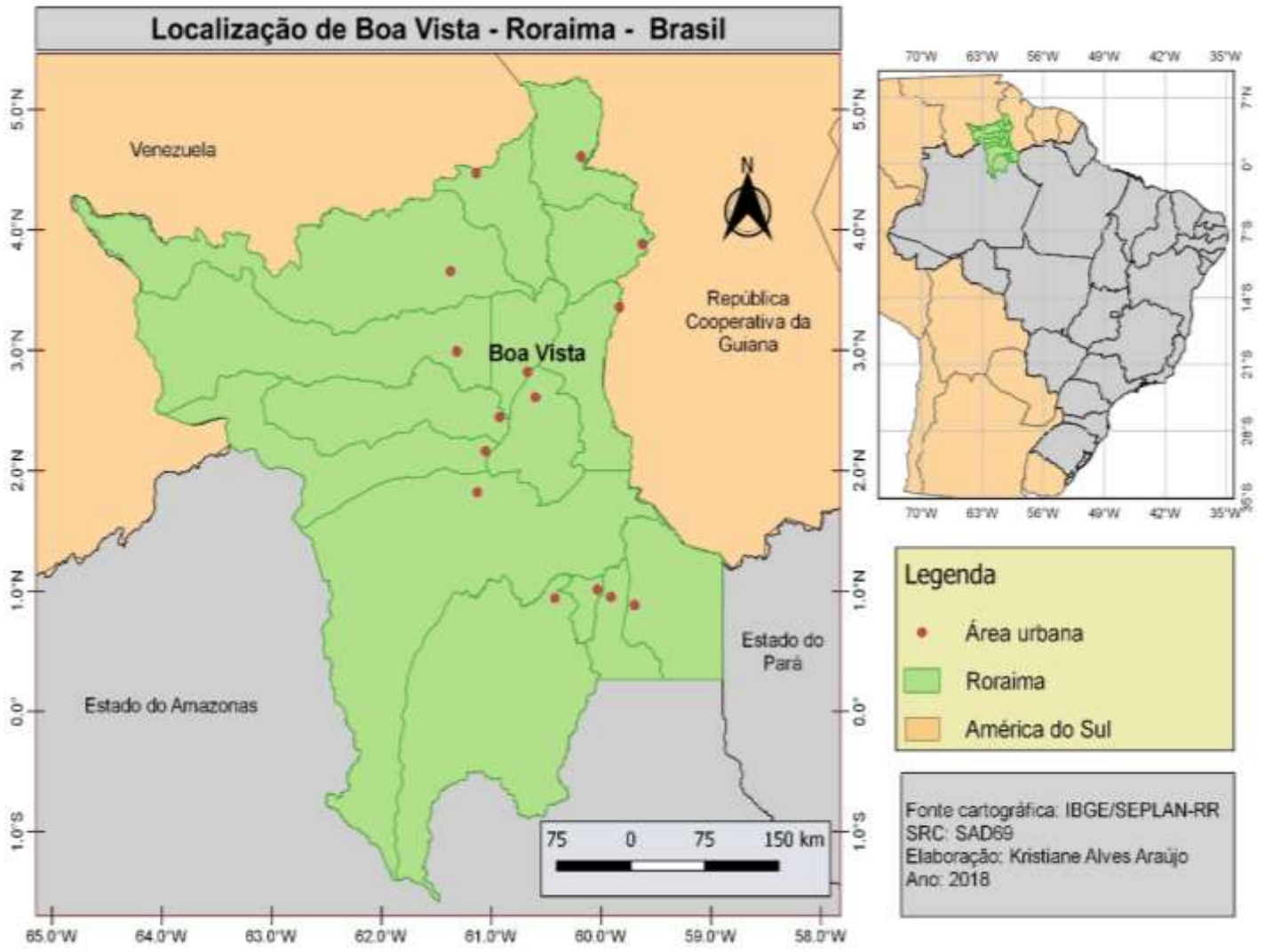

Figure 1. Map of Brazil with the State of Roraima and the municipality of Boa Vista.
Source: https://portugaldigital.com.br/wp-content/uploads/2018/04/MapaBrasilFotoViajero.jpg

involving human beings as defined by Resolution 466/12 of the National Health Council and used the Informed Consent Form (TCLE). The research was approved by the Research Ethics Committee (CEP) of the Federal University of Roraima (UFRR), under protocol numbers 2,288,847 and 9/21/2017 (PRPPG/UFRR) and registration number 1232017. It also had authorization, with letters of agreement, from the representatives of the Nova Cidade and Raiar do Sol districts and the Municipal Health Department of Boa Vista / RR.

Initial visits, mediated by representatives of the two neighborhoods and some community leaders, were made to the research neighborhoods. During the initial visits, the objectives and relevance of the research were presented in general lines, and residents were invited to participate. Study participants were asked to authorize monitoring and observation of their daily activities at home, in religious institutions and at health posts in order to be able to follow all the paths traveled by local residents in search of health. Once authorization was obtained, participant observation was performed in periods and activities as agreed with the community leaders and members of the Family Health Strategy team. During observation periods, the researcher's impressions were recorded in the form of notes in a field diary.

The participant-observation technique enables a researcher to become involved in the daily life of a population. Boiteux (2017) writes that participant observation presupposes interactivity between the researcher, the observed subjects and the context in which they live (and, in this case, in which they work). Participant observation was undertaken by the researchers in various moments that occurred in the houses of residents and in visits to fairs and markets where herbal medicine was sold.

Sites for the present research were selected according to several criteria: a) a region already studied by the researcher during her master's degree (on another topic) and, b) where the researcher had existing contacts with community leaders and with some former residents of the neighborhoods. The initial interview questionnaire solicited the socio-demographic profile of each interviewee. Responses were obtained through the use of a tape recorder. A 20-question elaborated script was used for the semi-structured interviews.

Data collection was carried out between September 2017 and

sample consisted of intentional non-probabilistic sampling in the search for individuals identified as holders of local knowledge on medicinal plants, including those who cultivated or used plants purchased locally. The topics of the research were randomly determined; in each interview, when it became clear which topic the subject was the most knowledgeable about, they were asked to indicate others that had the same domain. Further recommendations were sought until no additional relevant information was being added to the research. This finding indicated that the research had found a saturation point, when information begins to repeat itself, characterizing the "snowball" method. This type of sampling, referred to as “snowball,” is a non-probabilistic sample form, which uses reference chains (Vinuto, 2014).

Data were collected from 110 local residents in the two neighborhoods of the study. Of these, 100 participants responded to the questionnaires with 20 open-and-closed questions on local knowledge of medicinal plants and local basic sanitation. The rest (n = 10) of the interviews used semi-structured interview guides; these targeted the people considered to be legal representatives or leaders and articulators in the research sites.

Guided tours (Albuquerque et al., 2010; Albuquerque et al., 2014) were carried out around their residences, usually in backyards and at free fairs in the city of Boa Vista, Roraima, Brazil. All plants cited in the interviews were photographed, collected or bought at the fairs during guided tours or on subsequent visits. Some domesticated plants were already known or obtained through purchase and were identified based on specialized literature (Lorenzi and Matos, 2002; Souza and Lorenzi, 2012). The spelling of scientific names was checked using the Tropics database, available at http://www.tropicos.org. The list of taxa followed the APG III (2009). The diseases (or symptoms) cited by informants as responding to plant-based remedies were categorized according to the International Statistical Classification of Diseases and health-related problems (ICD-10 2008).

For the interpretation of the data, several independent variables were considered, including age, gender, schooling, income, marital status, and place of residence, among others. The data collected were analyzed using descriptive statistical methods, such as tables, graphs and percentages. Descriptive analyses, including means with standard deviations, were performed. The comparison between sample means was performed using Student’s t-test. The chi-square test was used to compare proportions. The estimation of risk quantification was performed by odds ratio with a 95% confidence interval (Newcombe-Wilson method). The statistical program used was the SPSS: Statistical Package for the Social Sciences / IBM SPSS Statistics Version 24. The level of significance was set at 5% for rejection of the null hypothesis.

RESULTS AND DISCUSSION

Socio-demographic profile

The socio-economic and demographic data of the two communities studied were analyzed using the questionnaires and interviews with 110 participants aged between 20 and 74 years. The average age of the interviewees was 49 years for women and 46 years for men. Of all the interviewees, 80% were over 40 years of age. Regarding gender, 26.6% (n = 29) declared themselves men and 73.4% (n = 71) women. Female predominance can be explained by the greater willingness of women to respond to the questionnaire, and because women were reported to take up more responsibility in caring for children; leading them to learn more about using plants to treat major diseases and symptoms that family members present, and may also be justified by the greater willingness of women to respond to the questionnaire. A similar profile of respondents was found by Oliveira et al. (2014) in a study on the survey on the use of medicinal plants with anticancer therapy among patients of the Annapolis Oncology Unit.

Several studies have shown that there is a high correlation between the number of species and the number of subspecies that can be found in species (Oliveira et al., 2008; Silva et al., 2008). In addition, the attribution of knowledge on the medicinal use of plant species to women, noting that even in urban areas with interior characteristics, such as the present research in Boa Vista/RR, women can demonstrate strong interest and knowledge about medicinal plants.

Figure 2 shows the age groups of the interviewees with their respective percentages. The chi-square test showed that the difference between the age groups of the informants is generally very significant ($\chi^2 = 19.33$, gl = 7, $p < 0.01$) and continues to be significant when gender-specific analyses are performed ($\chi^2 = 6.30$, gl = 6, $p > 0.05$). Thus, the most frequent age group was 40-59 years (49%), followed by 60-74 years (31%) and then 20-39 years (20%). These results indicate that most of the informants are of mature age (40-69 years), making up a good part of this sample. In this case, there is a great deal of evidence that young people (aged 20-39) have less interest in the use and knowledge of medicinal plants, preferring to use industrialized medicines.

According to the interview findings, the 40-59-year age group has greater knowledge about medicinal plants than other classes, and the number of citations of plant species was similar to the number mentioned by the oldest age group (60-74 years).

Informants in both neighborhoods knew an average of 77 (± 8) useful plant species. The 20-39-year age group knew fewer species than the other two age categories ($H = 16.13674$; $p = 0.0003$). There were significant gender differences in the number of species known, with female informants knowing a larger number of species as compared to male informants ($U = 222.5$; $p = 0.001571$). Between male and female informants in the 60-74 yearage group, there was a statistically insignificant difference in the knowledge of species.

Schooling

The traditional medicine professionals had limited advanced education. None of the study participants had a university education; 39.7% were illiterate; 33% fundamental; 15.5% high school; and 12.3% incomplete higher education. As for schooling of traditional medicine practitioners, 14.70% had university education; 44.7%, illiterate; 27%, fundamental; 18.3%, elementary school; 10.0%, high school. Thus, this study observed that knowledge about medicinal plants by both traditional

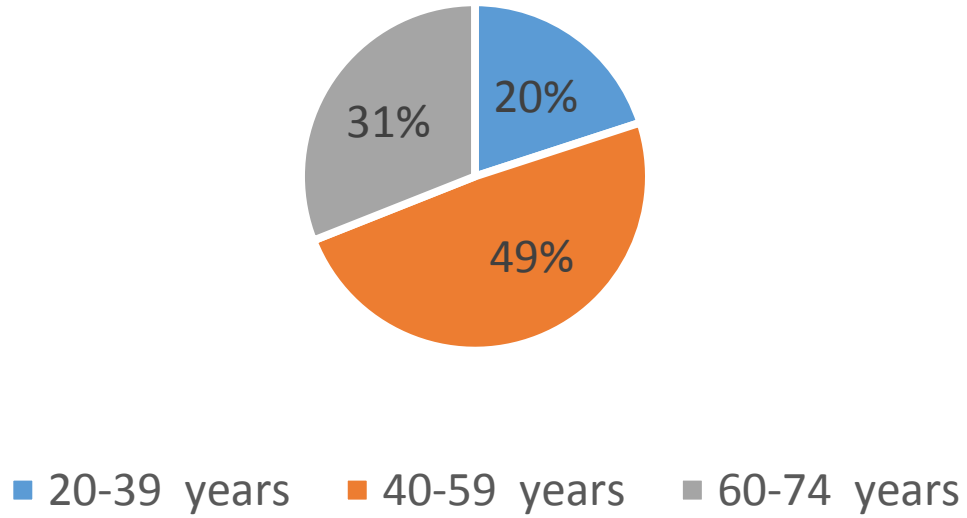

Figure 2. Percentage referring to the age categories of the research participants who are residents of the neighborhoods Nova Cidade and Raiar do Sol.

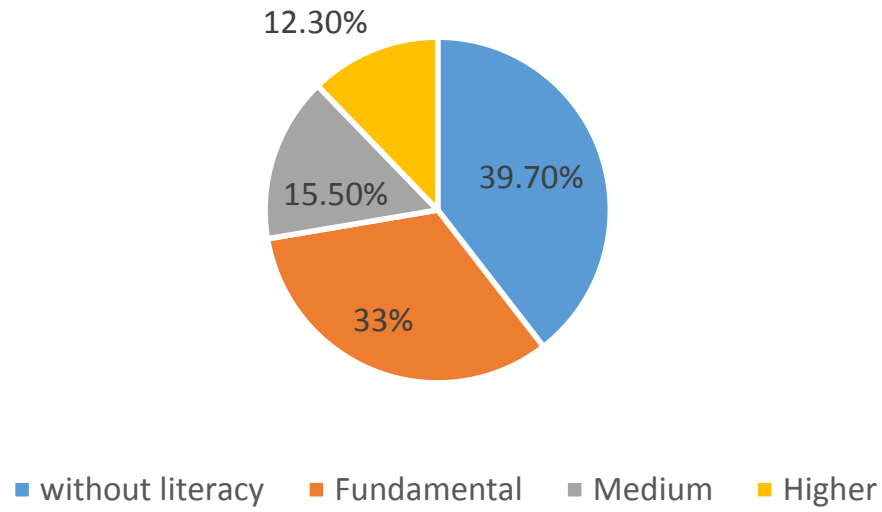

Figure 3. Percentage of educational level of traditional medical professional.

medicine practitioners and practitioners tends to decrease with the level of schooling. Since educational level is associated with economic conditions, the lower educational level associated with greater familiarity with the medicinal power of plant species may reflect the need, due to low purchasing power to find ways of treating diseases other than purchasing expensive drugs. It may also be inferred that increased levels of schooling involve a certain massification of customs, related to globalization; leading to a gradual loss of ancestral habits related to phytotherapy. These findings support the findings of other studies, such as Santos et al. (2008) and Souza et al. (2017) (Figure 3 and 4).

Family income

Figure 5 shows the average income groups of study participants' families: up to one family member earning minimum wage (30%); from 01 to 03 family members earning minimum wage (67%); and above 03 family members earning minimum wage (03%). Figure 5 shows that an inverse relationship exists between the minimum wage and the percentage of people receiving it, highlighting the low economic conditions of most of the respondents. These conditions may drive them to use other health strategies, such as herbal medicine, to improve health. This explains the use of the form either in

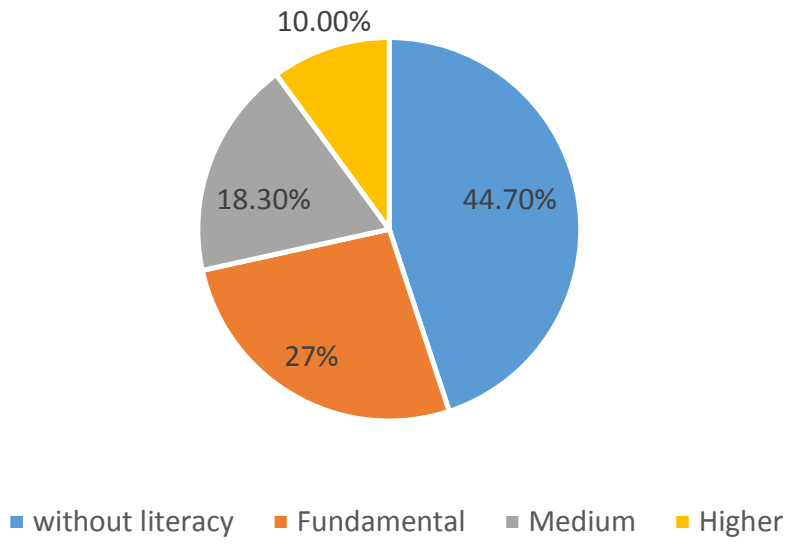

Figure 4. Percentage Level of schooling of traditional medicine practitioners

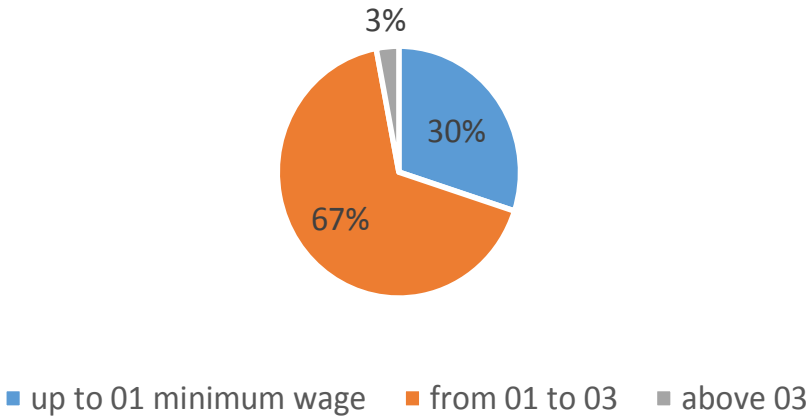

Figure 5. Percentage referring to the average family income of the research participants who are residents of the neighborhoods of Cidade Nova and Raiar do Sol.

addition to or instead of the services offered by SUS. Strategies are invented and reinvented every day according to health needs and problems, utilizing local knowledge and available resources, be they financial, agricultural or even cultural. Among the participants, 58% receive benefits and 42% do not. These data reinforce the idea that they are low-income people, that is, they have low purchasing power. Again, low income levels can influence therapeutic decisions, since people need to use strategies within economic reach for health services. Using herbal and phytotherapeutic plants can be an important strategy for coping with existing health inequalities in Boa Vista. Plant-based medicine offers lower-cost options for healthcare among populations with poor social and health indicators. According to the analysis made by Sundquist (1995), socioeconomic factors influence health in its various dimensions—to a certain point. Among higher income classes, however, differences in health practices depend, above all, on individual choices conditioned by cultural factors.

Lifting of medical plants in the two neighborhoods, New City Center and Raiar of the Sun

The National List of Medicinal Plants of Interest to SUS (RESINUS), elaborated by the Ministry of Health (MS) in 2009, lists 71 species of medicinal plants that are used by the Brazilian population for which there is some scientific evidence about their uses in basic healthcare.

Nevertheless, the need for studies that broaden and deepen the knowledge about these and other species, as well as how to disseminate knowledge about uses, safety and efficacy, are still urgent (Brazil, 2009). This study contributes to that knowledge base, which can contribute to expand the available healthcare options. The dissemination of the results to more people is one of the contributions of this research carried out in two districts in Boa Vista/RR by the present author.

From the verification of the applied questionnaires, the names of the vegetable species most cited by the residents of the neighborhoods Nova Cidade and Raiar do Sol, shown in Table 1, were obtained, in a total of 77 species within 46 families. The chi-square test showed a significant difference between the number of plant citations made by the residents of the two studied districts ($\chi^2 = 29.26$, gl = 9, $p < 0.001$). Interviewees said that many of the medicinal plants on this list can be found in their backyards and that most are available at fairs and other places where herbal medicines are sold in Boa Vista.

Table 1 lists the most frequently cited medicinal plants by the research participants. Through the analyzed data, it was verified that, in cases of less complex diseases in the primary health treatment, the use of medicinal plants, through home remedies or phytotherapeutics, is recommended by relatives, neighbors, religious leaders or health post staff and are the most immediate measures.

The number of species recorded in the present study is lower than the results found in other similar studies of ethnobotanicals and medicinal plants (Vasquez et al., 2014; Oliveira et al., 2010; Brito and Senna-Valle, 2011). This finding can be explained with the fact that, in the present study, only species mentioned by the sample of participants and which were related to their knowledge and uses were included.

The number of plant species cited by respondents varied by the age categories. The average was 26 species (20%) from the 20-39-year group; 56 species (49%) from the 40-59 year olds; and 32 species (39%) from the 60-74-year group. The most cited species were cows (56%), lemongrass (42%), stone breakage (48%) and cow's foot (32%). The paw plant (*Bauhinia forficata*), which has proven hypoglycemic activity and is indicated for use by the Ministry of Health in Brazil, was the most prominent among the mentioned species.

As for the number of citations per informant, the mean was 16 (± 09) for each species. Female informants cited more than males. Despite numerical differences between the number of citations for male and female informants in the range of 40-59 years, there were few significant differences between genders. The categories in 40-59 years of age did not present significant differences among themselves; however, a tendency was observed for the older participants to know more uses for the species, in both genders.

Information acquired in communities that use medicinal flora should be combined with chemical and pharmacological studies conducted in specialized laboratories to test hypotheses about the pharmacological activities and the active substances responsible for the therapeutic actions. This integration of traditional and scientific approaches will optimize local knowledge and benefit the population by generating safety and effectiveness data. This will facilitate, at least for the population studied, the implementation of Portaria no. 971/2006 of the Ministry of Health of Brazil.

Parts of medicinal plants cited by research participants

Figure 6 shows which parts of plants were used and how frequently in the preparation of remedies: flower, leaf, stem, bark, root, sap, seed and fruit. Leaves, bark, and roots or other parts were most frequently used (60, 30 and 10%, respectively). The chi-square test showed that the difference between the number of citations of plant parts is significant ($\chi^2 = 484.54$, gl = 10, $p < 0.001$).

The study by Lacerda et al. (2013) reported the following citation results: the leaves (440 citations), the peels (130 citations), the fruits (72 citations)), flowers (68 citations), latex (44 citations), seeds (27 citations), bulbs (17 citations), intercuts (14 citations) and roots (5 citations). Thus, disease treatments based on phytotherapy can be derived from various parts of plants, such as roots, barks, leaves, fruits and seeds, according to the herbs in question.

This study in Boa Vista/Roraima corroborates other works, such as that of Vasquez et al. (2014) and Alves and Povh (2013). The most frequently cited vegetative part was the leaf, which presented the highest total number (290) of citations and a higher percentage among women than men. This was followed by bark (150 citations) and roots/other parts (50 citations). Women presented a higher percentage of citations referring to leaves, fruit, seeds, and bark, while men presented a higher percentage of roots and stems uses.

"Ethnobotany of medicinal plants in riverside communities of the Municipality of Manacapuru, Amazonas, Brazil" by Vasquez et al. (2014) found that the vegetable part mostly used in the preparations of the home remedies was the leaves (68%). Other parts used were stem bark (12%), fruit (7.4%), stem (5.5%), root (3%), seed (2%), and flower (1%).

"The Use of Medicinal Plants with Antimicrobial Activity by Users of the Public Health Service in Campina Grande - Paraíba" by Souza et al. (2013) reached similar conclusions to the present study in Roraima regarding the way that residents of Raiar do Sol and New Town districts use plants and other products in their traditional medicine; it is subordinated not only looking for efficacy enshrined in the experience of use but also how they perceive the etiology of diseases and the therapeutic actions of the remedies. This highlights the importance of

Table 1. List of medicinal species indicated by the informants in the neighborhoods of Nova Cidade and Raiar do Sol, in the municipality of Boa Vista, Roraima, Brazil.

Family	Scientific name	Popular name	Used part	Therapeutic indication
Malvaceae	*Abelmoschus esculentum L.*	Okra	Seed	Asthma
	Hibiscus sabdariffa	Vinegar	Leaves	Antifungal
Meliaceae	*Carapa guianensis aubl*	Andiroba	Seed	Healing, the flu
Musaceae	*Musa paradisiaca L.*	Banana	Fruit	Ulcer, toothache, wart,
Malpighiaceae	*Malpighia emarginata*	Acerola	Fruit	The flu
Lamiaceae	*Rosmarinus officinalis*	Rosemary	Leaf	The flu
	Mentha spicata	Mint	Leaf	The flu / analgesic
Monimiaceae	*Plectranthus barbatus*	Boldo	Leaf	Intestine function
Anacardiaceae	*Anacardium occidentale*	Cashew	Stalk	Anti-inflammatory / dysentery
	Myracrodruon urundeuva	Aroeira	Stalk	Anti-inflammatory
Asteraceae	*Matricaria chamomilla*	Chamomile	Leaf	Soothing
Myrtaceae	*Eucalyptus globulus*	Eucalyptus	Leaf, fruit	Hypoglycaemic, antipyretic / antibiotic
	Psidium guajava	Guava	Leaf	Disinterest
Rutaceae	*Citrus sinensis Osbeck*	Orange	Leaf	Soothing / the flu
	Citrus aurantifolia	Lemon	Fruit	The flu, sore throat
	Citrus reticulata B.	Tangerine	Fruit	High cholesterol, labyrinthitis
	Ruta graveolens L.	Rue	Leaf	Menstrual cramps, ear pain, general aches, cramps
Lythraceae	*Punica granatum*	Pomegranate	Fruit	Anti-inflammatory
Cucurbitaceae	*Momordica charantia L.*	Melon de-são-caetano	Leaf/ seed	Verminose, antidiarrheal, hemostatic, burns
	Cucumis sativus L.	Cucumber	Fruit	High pressure
	Sechium edule SW	Chuchu	Fruit	High pressure
Fabaceae	*Libidibia ferrea (Mart. ex Tul.) L.P.Queiroz*	Jucá	Stalk/ fruit	The flu, inflammation of the kidneys, soothing
	Mimosa arenosa (Willd.) Poir.	Cat nail	Root	The flu
	Bauhinia foficata	Cow's foot	Leaf/ stalk	Antidiabetic / diuretic
	Stryphnodendron barbatimam Mart	Barbatimão	Stalk	Pain / Astringent and Antiseptic Infections
Acanthaceae	*Ocimum sp.*	Alfavaca	Root	The flu
Passifloraceae	*Passiflora foetida L*	Passion fruit	Root, leaf and fruit	Inflammation of the throat, insomnia, depression, antirheumatic
Phyllanthaceae	*Phyllanthus niruri L.*	Smasher	Root and leaf	Kidney stones liver
Acanthaceae	*Justicia pectoralis Jacq*	Noun	Leaf	Dor de cabeça
Anacardiaceae	*Mangifera indica L*	Mango	Leaf	The flu
	Spondia purpurea L	Stick it	Leaf	The flu
Annonaceae	*Annona muricata L*	Graviola	Fruit and leaf	Lose weight

Table 1. Contd.

Apiaceae	*Petroselinum crispum L*	Parsley	Leaf	Ear infection, hepatitis
	Pimpinella anisum L	Fennel	Leaf	Bellyache (child), soothing
Asteraceae	*Matricaria chamomilla L.*	Chamomile	Leaf	Clean infant's intestine, soothing
	Bidens pilosa L	Picão	Leaf	Hepatitis
Bignoniaceae	*Tabebuia caraiba*	Yellow ipê	Leaf	Wound / uterus
	Tabebuia hepthaphyla	Purple ipê	Leaf	Lung / cough / wound in uterus
Caricaceae	*Carica papaia L*	Papaya	Fruit	Clean skin, verminoses, bad digestion
Euphorbiaceae	*Manihot esculenta L*	Manioc	Stalk	Malnutrition
	Phyllanthus orbiculatus L L	Breaking stone	Leaf	Kidney stones
Lamiaceae	*Mentha piperita L*	Mint	Leaf	Verminose,
	Rosmarium offcinale L	Rosemary	Leaf	Brokenness in children, infection, heart
	Salvia officinalis L	Sage	Leaf	The Flu, infection
Lauraceae	*Cinamomum zeylannicum Breyn*	Cinnamon	Stalk	Internal infection, hypoglycemic
Liliaceae	*Allium sativum L*	Garlic	Seed	Cough, verminose, antioxidant
Arecaceae	*Cocos nucifera L.*	Coconut	Fruit	Urinary tract infection, kidney pain
Asteraceae	*Baccharis trimera (Less.)*	Carqueja	Leaf	Pain in the liver, hypoglycemic
Brassicaceae	*Brassica integrifólia (H. West) Rupr*	Mustard	Seed	Thrombosis, dizziness, stroke, headache, girth
	Nastrutium officinale W. t.	Cress	Leaf	Hoarseness, child colic, earache
Bromeliáceas	*Ananas comosus (L.) Merril*	Pineapple	Fruit	Cough
Caricaceae	*Carica papaya L.*	Papaya	Leaf and fruit	Flu, poor digestion, child cramps, bowel
Amaranthaceae	*Chenopodium ambrosioides L.*	Mastruz	Leaf	Rheumatism, ulcer, strokes, healing, inflammation, pain in the stomach, fractures
Convolvulaceae	*Ipomoea batatas (L.) Lam*	Sweet potato	Root	Inflamed tooth
Cucurbitaceae	*Citrullus vulgaris Schrad*	Watermelon	Seed	Stomach ache
Fabaceae	*Stryphnodendron coriaceum Benth.*	Barbatimão	Leaf	Inflammation
Lamiaceae	*Pogostemon cablin (Blanco) Benth*	Patchuli	Leaf	Heart disease
Lauraceae	*Cinnamomum zeylanicum Blume*	Cinnamon	Stalk	Soothing, high blood pressure
	Laurus nobilis L.	Blond	Leaf	Menstrual cramps
	Persea americana Mill.	Avocado	Semente	Inflammation of the mouth, kidney stones, urinary tract infection, kidney pain
Leguminosae	*Allium cepa L.*	White onion	Leaf	Flu, bronchitis, sinusitis
	Allium sativum L.	Garlic	Leaf	Flu and sore throat, high blood pressure, cramps, weight loss, headache, fever, cancer
	Aloe vera (L.) Burm. f.	Slug	Leaf	Inflammation, flu, blood thinner, hair tonic, cancer, hemorrhoids, general pain

Table 1. Contd.

Monimiaceae	*Peumus boldus Mol*	Boldo	Leaf	Labirinitis, stomach pain, general pain, flu, poor digestion, stomach pain, intestinal infection, liver pain
	Eugenia caryophyllus Spreg.	Clove of india	Leaf	Menstrual cramps
Myrtaceae	*Eugenia Malaccensis Linn.*	Jambo	Stalk	Toothache
	Psidium guajava L.	Guava	Fruit	Diarrhea
Pedaliaceae	*Sesamum indicum L.*	Sesame	Stalk	Fever, tones blood, inflammation, hair tonic, bruising
Piperaceae	*Piper nigrum L.*	Black pepper	Fruit	Depurative
	Cymbopogon citratus (D.C.) Stapf.	Holy grass	Fruit	Nervousness, flu, soothing, high blood pressure, lack of appetite
Poaceae	*Saccharum officinarum L.*	Purple sugar cane	Fruit	High blood pressure, swelling, ophthalmic problems
	Zea mays L.	Corn	Stalk	Stomach pain, Vomiting, Poor digestion
Rubiaceae	*Coffea arabica L.*	Coffee	Seed	Sore throat
	Genipa americana L.	Genipap	Fruit	Fractures
Solanaceae	*Solanum tuberosum L.*	English potato	Root	Gastritis, migraine
	Solanum lycopersicum L.	Tomato	Fruit/ stalk	Ophthalmologic problems
	Solanum melongena L.	Eggplant	Leaf	High cholesterol
	Waltheria indica L.	Kingdom mallow	Leaf	Inflamed throat, flu, headache, cough, inflammation, stomach pain,

Source: Data from the survey conducted in the neighborhoods Nova Cidade and Raiar do Sol, 2018.

discussing perceptions and concepts of health and disease in the construction of public health policies focused on health promotion.

The most used parts according to studies by Alves and Povh (2013) and Soares et al. (2009) were leaves (73%), flower (17%), fruit (7%) and seed (3%). Validating the data of Alves and Povh (2013), Soares et al. (2009) also demonstrate the predominance of leaf use in the preparation of home remedies. The data of Alves and Povh (2013) affirm that, after the leaf, the vegetal parts most used by their interviewees were the root, the fruit and the bark.

Similar results were also reported by Birhanu and Ayalew (2018), in the study entitled, "Indigenous knowledge on medicinal plants used in and around the town of Robe, in the Bale region, in the Oromia region of southeastern Ethiopia"; they found that the leaf is the most harvested plant part (52.7%) in the study area for medicinal use, followed by seed (9.4%), root (8.14.5%), stem (4.3%), root leaf (2.6%), fruit (2.6.6%) and bulb (1.8%).

Finally, Barbara Bäckström (2011) presented similar results in her study on "Health Behaviors and Disease in a Cape Verdian Community in Lisbon". The author states that flora plays a fundamental role as a medical resource and is explained by its isolated geographical situation. The plants are mainly used in the form of infusions or syrups, prepared using leaves and peels.

Therapeutic procedures

Methods of preparation and administration

The oral route was mentioned most as the route for administering therapeutic treatment of many diseases (219 citations, 44.7%), followed by the topical route (90 citations, 18.4%); this was a significant result (χ^2 = 30.69, gl = 1, p <0.001). These data corroborate the findings of Ribeiro et al. (2014), in which the external route represented 79% of the household income; while the topical route, only 21%. It also corroborates the studies of Vasquez et al. (2014), in which the oral route was the most frequently mentioned as an administrative route for the therapeutic treatment of many diseases (244 citations, 64%), followed by the topical route (136 citations, 34%) (χ^2 = 30.69, gl = 1, p <0.001).

There are also different forms of elaboration, with tea being the most used in decoction or infusion preparations, similar to results found in studies by Lacerda et al. (2013), Silva et al. (2014) and Ribeiro et al. (2014).

Vasquez et al. (2014) recorded various practical procedures for the treatment of diseases: the use

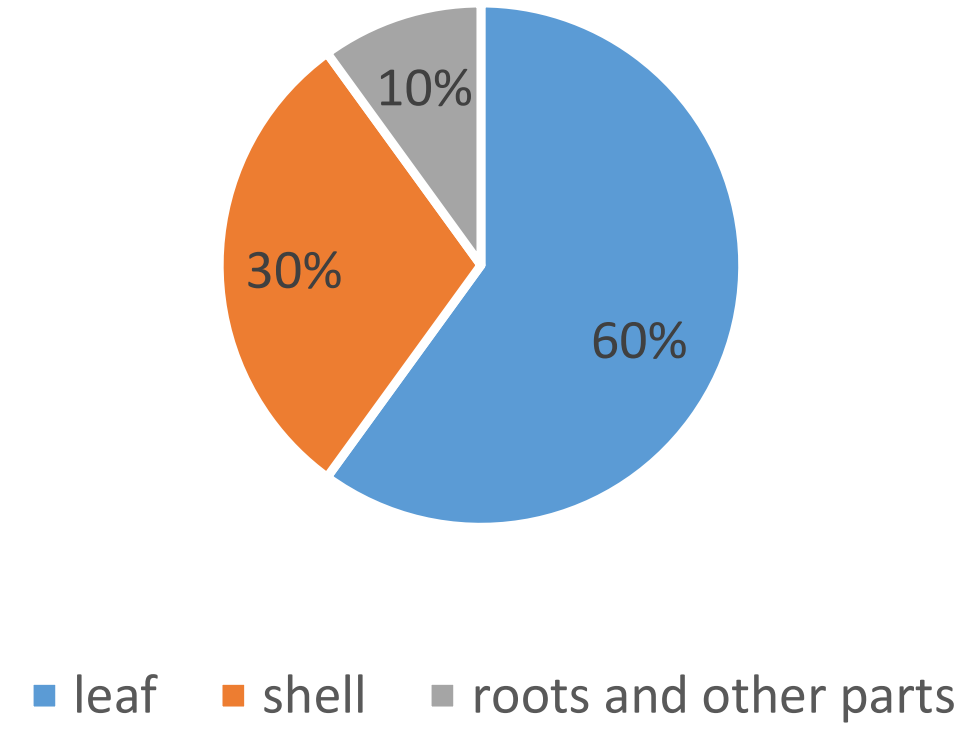

Figure 6. Percentage referring to the main parts of the plants mentioned by the research participants who are residents of the neighborhoods Nova Cidade and Raiar do Sol.

of friction, application of patches, use of oral tea, and application of baths and toiletries. In the Boa Vista/Roraima research, the preparation of the remedies used in the therapeutic procedures also showed the combined uses of plants in these treatments, being used several times for several medicinal plants or several parts of the same plant species, mainly in bottles or baths.

Birhanu and Ayalew (2018) researched the indigenous knowledge of medicinal plants used in and around the town of Robe in the Bale region in the Oromia region of southeastern Ethiopia (26.47, 3%) who were the most prominent, followed by the dermal (19.34, 5%).

In the study by Vasquez et al. (2014), the method of preparation of the medicinal plants was diverse, the main one being tea (62.2%) used in the preparation of several species, followed by juice (11.8%), plaster (7.1%), maceration (7%), bath (6.1%), syrup (4.8%) and juice (2.2%). According to the informants, teas can be prepared by infusion or by decoction depending on the part of the plant being used.

Transmission of knowledge

The study methodology was designed to ensure that all the participants knew and used the plants they cited as medicine. Their local knowledge of plants has been acquired over the years, both by trial and error and by the transmission of knowledge from one generation to the next. The chi-square test showed that there was a significant difference ($\chi^2 = 14.02$, gl = 5, $p < 0.01$) among the different individuals responsible for knowledge transmission in the study districts. Knowledge about the use of plants as medicines was transmitted mainly through the family (including parents, grandparents, siblings, aunts and uncles) (48%) (Figure 8).

Figure 8 shows how knowledge is transmitted or learned by residents of the New City and Sun Ratio neighborhoods. It is often passed on from generation to generation (48%); other times, it is taught by neighbors (13%), which demonstrate the existence of a network of relationships. At other times, people use plant-based medicines under the guidance of healers, raitarians and spiritual counselors (10%) in their religious or faith network. Others learned by reading books or magazines (20%). Some also mentioned having been guided by community health agents (ACS) (7%) working in the formal healthcare network. Additionally, 2% reported having acquired knowledge through the internet. When referring to the term network, it means the set of relations constructed with a common goal.

Most research subjects said that they usually pass on knowledge to their children, neighbors, friends and anyone who needs guidance on home remedies. In the Raiar do Sol neighborhood (Boa Vista/RR) there was a practice of selling 'bottled' medicinal preparations, which are an alternative source of income for some residents who are traditional medicine professionals.

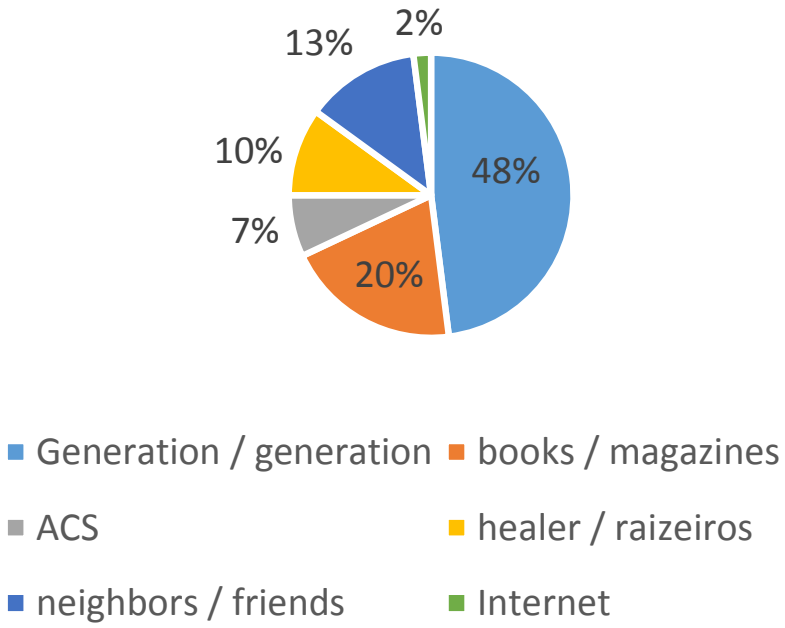

Figure 7. Percentage referring to the main forms of transmission of local knowledge cited by the research participants who are residents of the neighborhoods, Nova Cidade and Raiar do Sol.

Contrary to what happens in the Raiar do Sol neighborhood, according to reports from the residents of the Nova Cidade neighborhood, there is no practice in this area of selling of medicinal preparations by traditional medicine professionals. Instead, phytotherapeutic products are easily found in pharmacies in the neighborhood and in many pharmacies of manipulation and networks of existent franks in the municipality of Boa Vista. In this neighborhood, a religious institution and the basic health unit had long been offering phytotherapy to assist the treatment of the needy population. However, for a number of reasons, it is suggested that some of them do not do it anymore (because of lack of interest of people involved in the process, work overload, lack of skilled people, and lack of financial resources, among others).

Since these are neighborhoods in which there are large populations of indigenous, Afrodescendant and Northeastern (migrant) peoples, the inhabitants have brought in other local knowledge, which is then passed on to their families, neighbors and friends. These form a network of relationships and transmission of knowledge. Thus, migration is important to the dissemination and transfer of knowledge.

It can be emphasized that the family network of knowledge transmission is highly relevant in these neighborhoods and reinforces the transfer of local knowledge among the people who settle there. The community's existing therapeutic system is basically syncretic, with the presence of indigenous, African, northeastern and northern elements. New knowledge, once achieved, beyond purely academic interest, can bring practical results by providing resources to lay on the foundation of health systems more adapted to the culture and conditions of the region. Flor and Barbosa (2014) reported similar findings in a study on popular wisdom in the use of medicinal plants by the residents of the quiet district in the district of Marudá – PA (Figure 7).

Conclusion

Although modern medicine is continually growing in the two neighborhoods where the research was conducted, traditional medicine still plays a large role in treating different diseases. It has been proven that this biodiversity is being used in addressing a variety of diseases. The results show the richness in the knowledge and use of medicinal flora present in the Northern Brazilian Amazon. The main diseases mentioned in the research as responding to plant-based medicine were diabetes mellitus, hypertension, cardiorespiratory and digestive disorders, parasitoses, skin diseases and others. This study will allow for the expansion of therapeutic options for users through access to medicinal plants.

The ethnobotanical study with emphasis on collective health showed remarkable knowledge and use of therapeutic properties of a range of species. Although the number of exotic medicinal plants was high, species such

as *Bauhinia forficata* stood out and is a promising subject for bioprospecting studies. The present work is the first to document the vegetal species Bauhina forficata in Roraima, and knowledge of its traditional use as hypoglycemic in the concomitant treatment to the biomedical model of the diabetes mellitus type II metabolic syndrome in the Nova Cidade and Raiar do Sol neighborhoods, Good View/RR. Of all the plants cited, most show broad medical potential, although there are just little scientific proofs on their biological activities.

Various species—*Chenopodium ambrosioides* (mastruz), *Myracrodruon urundeuva* (aroeira), *Plectranthus barbatus* (boldo), *Mentha spicata* (peppermint), *Citrus sinensis* (orange), *Cymbopogon citratus* and the culturally important *Ruta graveolens*—deserve special attention for future pharmacological and phytochemical studies to confirm their therapeutic properties and to test their toxicity or safety for humans. Popular knowledge that is backed by scientific knowledge will contribute to the rational use of medicinal plants and awareness of the importance of conserving them.

From this perspective, this study can contribute to further work related to the practices, using medicinal plants. The information provided is essential for guiding and consolidating knowledge of the therapeutic properties present in key species and also contributes to the formulation of public policies in the state of Roraima/Brazil.

CONFLICT OF INTERESTS

The authors have not declared any conflicts of interests.

ACKNOWLEDGMENTS

The authors appreciate REDEBIONORTE and UFRR for the support as well as the opportunity to carry out this research and to disseminate it.

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