

Artículo Original / Original Article

Ethnobotanical knowledge of herbalists about medicinal plants from the semiarid region in northeastern Brazil

[Conocimiento etnobotánico de herbolarios sobre plantas medicinales de la región semiárida del noreste de Brasil]

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Abstract: Medicinal plants have been used since ancient times to treat illnesses. This study aimed to identify through questionnaire the medicinal plants most frequently sold on public and street markets in some municipalities of Paraíba state, northeastern Brazil, and the knowledge of herbalists about their therapeutic indications and forms of use. The sample consisted of 28 herbalists. Fifteen plants with a dental indication were identified, including barbatimão (*Stryphnodendron adstringens*), aroeira (*Myracrodruon urundeuva*), gengibre (*Zingiber officinale*), romã (*Punica granatum*), cajueiro-roxo (*Anacardium occidentale*), mulungu (*Erythrina velutina*) and quixaba (*Sideroxylon obtusifolium*), as well as 21 plants used for the treatment of general diseases, including barbatimão (*S. adstringens*), aroeira (*M. urundeuva*), cajueiro-roxo (*A. occidentale*), quixaba (*S. obtusifolium*), boldo (*Peumus boldus*) and erva doce (*Pimpinella anisum*). Bottled preparations ("garrafadas") and teas were the most frequently indicated forms of use. The results suggest that herbalists have a vast traditional knowledge of the therapeutic potential of commercialized plants.

Keywords: Traditional medicine; Ethnobotany; Medicine; Dentistry; Medicinal plants

Resumen: Las plantas medicinales se han utilizado desde la antigüedad para tratar enfermedades. Este estudio tuvo como objetivo identificar a través de cuestionario las plantas medicinales más vendidas en mercados públicos y callejeros en algunos municipios del estado de Paraíba, noreste de Brasil, y el conocimiento de los herbolarios sobre sus indicaciones terapéuticas y formas de uso. La muestra estuvo formada por 28 herbolarios. Se identificaron quince plantas con indicación dental, entre las que se encuentran barbatimão (*Stryphnodendron adstringens*), aroeira (*Myracrodruon urundeuva*), jengibre (*Zingiber officinale*), romã (*Punica granatum*), cajueiro-roxo (*Anacardium occidentale*), mulungu (*Erythrina velutina*) y quixaba (*Sideroxylon obtusifolium*), así como 21 plantas utilizadas para el tratamiento de enfermedades generales, incluidas barbatimão (*S. adstringens*), aroeira (*M. urundeuva*), cajueiro-roxo (*A. occidentale*), quixaba (*S. obtusifolium*), boldo (*Peumus boldus*) y erva doce (*Pimpinella anisum*). Las preparaciones embotelladas ("garrafadas") y los téis fueron las formas de uso más frecuentemente indicadas. Los resultados sugieren que los herbolarios tienen un vasto conocimiento tradicional del potencial terapéutico de las plantas comercializadas.

Palabras clave: Medicina tradicional; Etnobotánica; Medicina; Odontología; Plantas medicinales

INTRODUCTION

Since ancient times and the beginnings of medicine, plants with medicinal properties have been used by humans as a preventive and curative resource for the treatment of diseases (Maciel *et al.*, 2002; Brasil, 2006; Salvagnini *et al.*, 2008; Souza *et al.*, 2016; Aissa *et al.*, 2019; Orozco-Martínez *et al.*, 2020), with the information about their uses being passed down through generations (Maciel *et al.*, 2002; Brasil, 2006; Salvagnini *et al.*, 2008; Souza *et al.*, 2016; Velázquez-Vázquez *et al.*, 2019). The World Health Organization recognizes the existence of different integrative and complementary practices (Brasil, 2006), including phytotherapy, based on traditional and complementary/alternative medicine (Evangelista *et al.*, 2013; Souza *et al.*, 2016). Hence, the use of plant species for the treatment of diseases is a very common practice among people, with 65%-80% of the world population employing plants or plant preparations for therapeutic purposes (Brasil, 2006; Borba & Macedo, 2006; WHO, 2011; Rocha *et al.*, 2013; Souza *et al.*, 2016; Aissa *et al.*, 2019; Velázquez-Vázquez *et al.*, 2019; Rodríguez-Ferreiro *et al.*, 2020), especially in countries with a great biodiversity and broad traditional knowledge about the use of medicinal plants (Brasil, 2006).

The screening of new substances derived from plant species involves a multidisciplinary approach that includes the areas of pharmacology, phytochemistry, ethnobotany and ethnopharmacology. In addition, different methods are applied to the investigation of medicinal plants, such as random, ethological, chemotaxonomic and ethnodirected approaches (Maciel *et al.*, 2002; Albuquerque & Hanazaki, 2006). The last approach should be highlighted because of the emphasis given to the role of traditional knowledge about the selection, indication and use of plants related to their ethnobotanical and ethnopharmacological features (Maciel *et al.*, 2002; Albuquerque & Hanazaki, 2006), which contributes to guide additional studies in order to validate the information provided by their traditional use (Orozco-Martínez *et al.*, 2020). However, since the popular practices associated with traditional medicine show a wide regional variability because of the peculiarities related to different historical, cultural, social and philosophical contexts (Souza *et al.*, 2016), the investigation and preservation of the various forms of traditional knowledge and practices associated with its use are fundamental for the use of medicinal plants (Orozco-Martínez *et al.*, 2020).

Plants for medicinal use are traditionally obtained by direct collection or are traditionally purchased in places such as street markets (Maciel *et al.*, 2002; Nunes *et al.*, 2003; Alves *et al.*, 2007). The latter continue to be very common and are growing around the world (Maciel *et al.*, 2002; Rocha *et al.*, 2013), where different species of plants, including a variety of plant parts or products are marketed (Alves *et al.*, 2007). Within this context, herbalists (popularly known in Brazil as "raizeiros") stand out popularly as sellers of medicinal plants who have knowledge about their therapeutic indications (Alves *et al.*, 2007; Lós *et al.*, 2012), having a relevant role in maintaining and disseminating knowledge about medicinal plants (Xavier de França *et al.*, 2008; Lós *et al.*, 2012). Thus, it is clear that through herbalists, street markets are also important for the maintenance, perpetuation and transmission of traditional knowledge about the use and indication of therapeutic plant resources (Rocha *et al.*, 2013).

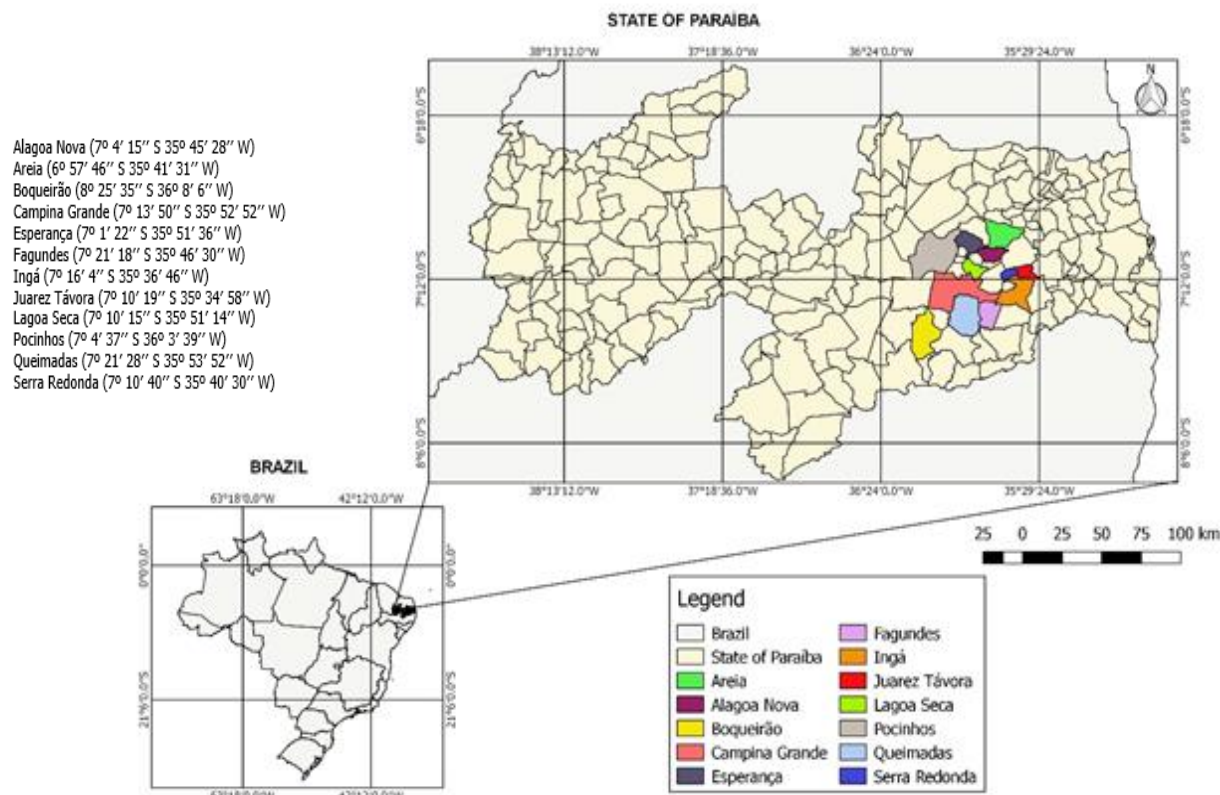
In addition to investigating the knowledge of herbalists about medicinal plants with therapeutic indications aimed at treating general diseases (Alves *et al.*, 2007; Xavier de França *et al.*, 2008; Santos *et al.*, 2009; Lós *et al.*, 2012; Rocha *et al.*, 2013; Souza *et al.*, 2016), some studies have specific approaches on medicinal plants that have therapeutic indications for the treatment of diseases of importance to Dentistry (Santos *et al.*, 2009; Evangelista *et al.*, 2013). Thus, considering that the investigation of the therapeutic properties of medicinal plants is an important scientific tool (Salvagnini *et al.*, 2008), the present study aimed to identify the medicinal plants most frequently sold and the knowledge of herbalists working on public and street markets in some municipalities of Paraíba state, northeastern Brazil about the indications and use of medicinal plants for both medical purposes in general and for dental therapeutic purposes.

METHODS

This was a cross-sectional, quantitative, descriptive study involving professionals selling medicinal plants on street or public markets, called herbalists, "raizeiros" or "root sellers". The sample was obtained by convenience (non-random or non-probability) sampling and consisted of 28 herbalists from Campina Grande, Paraíba, Brazil and from 11 neighboring towns located at a distance of 50 km and comprising the municipalities of Alagoa Nova, Areia, Boqueirão, Esperança, Fagundes, Ingá, Juarez Távora, Lagoa Seca, Pocinhos, Queimadas and Serra

Redonda, both located in the Paraíba state in the semiarid region of northeastern Brazil (Figure No. 1).

Figure No. 1
Map showing the geographic locations of the municipalities where the study was conducted



The samples included individuals who had worked as herbalists for at least one year and who had knowledge about medicinal plants used for general and dental therapeutic purposes. The data were collected using semi-structured questionnaire that was elaborated by the modification of methods used in preliminary studies on herbalists conducted by Alves *et al.* (2007), Xavier de França *et al.* (2007), Santos *et al.* (2009), Rocha *et al.* (2013), and Souza *et al.* (2016).

The questionnaire used in the present study addressed information about the sociodemographic profile of the participants (gender, age, educational level, household income), time of professional activity as a herbalist, factors/aspects related to professional choice/activity, and origin/source of knowledge about the medicinal properties of plants. Specifically regarding the traditional knowledge about plants, information about the knowledge of the most frequently commercialized plant species for general and dental use and their therapeutic

indications and forms of use/preparation was collected, as well as information about knowledge of possible restrictions/contraindications to their use and/or indication and the type of packaging used by herbalists for the commercialization of the plants.

The data were collected during the work of herbalists on public and street markets in the municipalities included the study after the individuals had signed the free informed consent form. The study was conducted in accordance with the 2013 guidelines of the World Medical Association's Declaration of Helsinki and Resolution No. 466 (2012) of the National Health Council (Brasil, 2012). The Research Ethics Committee of the State University of Paraíba approved the study (Approval number 889.012 and CAAE number 39012814.0.0000.5187). For access to the traditional knowledge of the herbalists, the present research was registered in the National System of Genetic Heritage Management and Associated Traditional Knowledge of the Brazilian Ministry of the Environment under

number A2E8936.

The results are reported using descriptive statistics (distribution of frequencies) and are presented in tables and graphs.

RESULTS

Regarding demographic and socioeconomic characteristics (Table No. 1), most herbalists were

female and age ranged from 40 to 59 years. The predominant educational level was incomplete elementary school (n=11, 39.3%) and most respondents reported an income of one minimum wage. All participants were from the towns where the study was conducted and most of them were born in Campina Grande, Paraíba.

Table No. 1
Demographic and socioeconomic characteristics of herbalists

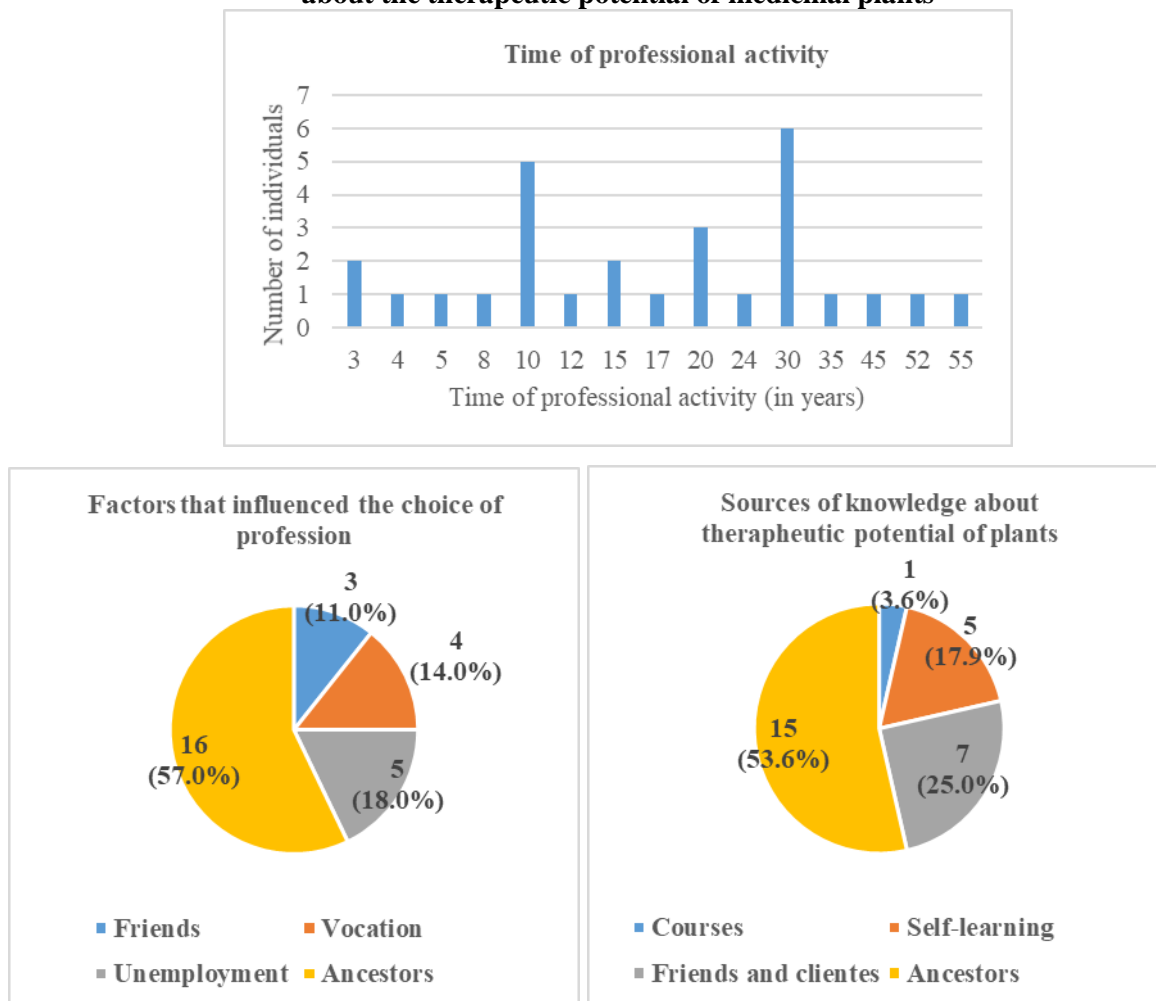
Demographic and socioeconomic characteristics	n (%)
Gender	
Female	17(60,7%)
Male	11(39,3%)
Total	28(100%)
Age	
20-39 years old	7(25%)
40-59 years old	14(50%)
≥ 60 years old	7(25%)
Total	28(100%)
Educational level	
Illiterate	6(21,4%)
Incomplete elementary school	11(39,3%)
Complete elementary school	4 (14,3%)
Incomplete high school	5(17,9%)
Complete high school	2 (7,1%)
Total	28(100,0%)
Household income	
< 1 minimum wage	3 (10,7%)
1 minimum wage	20 (71,4%)
2 minimum wages	4 (14,3%)
≥3 minimum wages	1(3,6%)
Total	28(100,0%)
Place of birth	
Alagoa Nova	1(3,6%)
Areia	1(3,6%)
Boqueirão	2(7,1%)
Campina Grande	8(28,6%)
Esperança	1(3,6%)
Fagundes	1(3,6%)
Ingá	2(7,1%)
Juarez Távora	2(7,1%)
Lagoa Seca	1(3,6%)
Pocinhos	3(10,7%)
Queimadas	3(10,7%)
Serra Redonda	3(10,7%)
Total	28(100,0%)

Legend: n = number of citations

The sample was heterogeneous in terms of the time the participants had worked as herbalists (Figure No. 2), being the most frequent responses of them (n=6, 21.4%) those referring to individuals that practicing the profession already for 30 years. Within this context, considering the factors associated with the choice of the herbalist profession, most participants (n=16, 57.1%) reported that exercise the

job as herbalist consists mainly in a way to perpetuate the tradition and activity carried out by their ancestors (Figure No. 2). Regarding the source of knowledge about the pharmacological properties of plants (Figure No. 2), most participants (n=15, 53.6%) reported to have acquired this knowledge from their ancestors.

Figure No. 2
Time of activity as a herbalist, factors that influenced the choice of profession, and sources of knowledge about the therapeutic potential of medicinal plants



Regarding the medicinal plants mentioned by the herbalists, 30 different plant species were identified. These species belonged to 23 botanical families, with Fabaceae and Lamiaceae corresponding to the largest number of plants. The most frequently commercialized plants were divided into two categories: plants used to treat general

diseases (n=21) and plants used for dental conditions (n=15) (Table No. 2). The following six plants were reported to be used for both general and dental purposes: ameixa (*X. americana*), aroeira (*M. urundeuva*), barbatimão (*S. adstringens*), cajueiro-roxo (*A. occidentale*), quixaba (*S. obtusifolium*) and romã (*P. granatum*).

Table No. 2
Most frequently sold medicinal plants for general and dental use

PLANTS	FOR GENERAL	USE	
Scientific nomenclature	Family	Common name	Citations
<i>Rosmarinus officinalis</i> L.	Lamiaceae	Alecrim	1
<i>Ximenia americana</i> L.	Rosaceae	Ameixa	2
<i>Myracrodruon urundeuva</i> (Engl.) Fr. All.	Anacardiaceae	Aroeira	10
<i>Stryphnodendron adstringens</i> (Mart.) Cov.	Fabaceae	Barbatimão	11
<i>Peumus boldus</i> Mol.	Monimiaceae	Boldo	6
<i>Anacardium occidentale</i> L.	Anacardiaceae	Cajueiro roxo	7
<i>Matricaria chamomilla</i> L.	Asteraceae	Camomila	3
<i>Cinnamomum zeylanicum</i> Blume	Lauraceae	Canela	4
<i>Cymbopogon densiflorus</i> (Steud.) Stapf.	Poaceae	Capim santo	1
<i>Allium cepa</i> L.	Liliaceae	Cebola branca	1
<i>Syagrus oleracea</i> (Mart.) Becc.	Arecaceae	Côco catolé	1
<i>Anethum graveolens</i> L.	Apiaceae	Endro	4
<i>Pimpinella anisum</i> L.	Apiaceae	Erva doce	5
<i>Eucalyptus globulus</i> L.	Myrtaceae	Eucalipto	1
<i>Cnidioscolus quercifolius</i> Pohl.	Euphorbiaceae	Favela	4
<i>Mentha spicata</i> L.	Lamiaceae	Hortelã	2
<i>Hymenaea courbaril</i> L.	Caesalpiniaceae	Jatobá	3
<i>Guapira opposita</i> (Vell.) Reitz	Nyctaginaceae	João mole	1
<i>Alcea rósea</i> L.	Malvaceae	Malva rosa	1
<i>Sideroxylon obtusifolium</i> (Roem. & Schult.) T.D. Penn.	Sapotaceae	Quixaba	6
<i>Punica granatum</i> L.	Lythraceae	Romã	1
		Total of citations	75
PLANTS	FOR DENTAL	USE	
Scientific nomenclature	Family	Common name	Citations
<i>Curcuma longa</i> L.	Zingiberaceae	Açafrão	1
<i>Ximenia americana</i> L.	Rosaceae	Ameixa	1
<i>Myracrodruon urundeuva</i> (Engl.) Fr. All.	Anacardiaceae	Aroeira	9
<i>Stryphnodendron adstringens</i> (Mart.) Cov.	Fabaceae	Barbatimão	11
<i>Luffa operculata</i> (L.) Cogn.	Cucurbitaceae	Cabacinha	1
<i>Anacardium occidentale</i> L.	Anacardiaceae	Cajueiro roxo	6
<i>Dipteryx odorata</i> (Aubl.) Willd.	Fabaceae	Cumarú	2
<i>Zingiber officinale</i> Rosc.	Zingiberaceae	Gengibre	8
<i>Ziziphus joazeiro</i> Mart.	Rhamnaceae	Juá/Juazeiro	1
<i>Erythrina velutina</i> Willd.	Fabaceae	Mulungu	3
<i>Hibanthus ipecacuanha</i> (L.) Oken.	Violaceae	Papaconha/Pepaconha	1
<i>Mentha pulegium</i> L.	Lamiaceae	Poejo	1
<i>Sideroxylon obtusifolium</i> (Roem. & Schult.) T.D. Penn.	Sapotaceae	Quixaba	3
<i>Petiveria alliacea</i> L.	Phytollacaceae	Tipí	1
<i>Punica granatum</i> L.	Lythraceae	Romã	6
		Total of citations	55

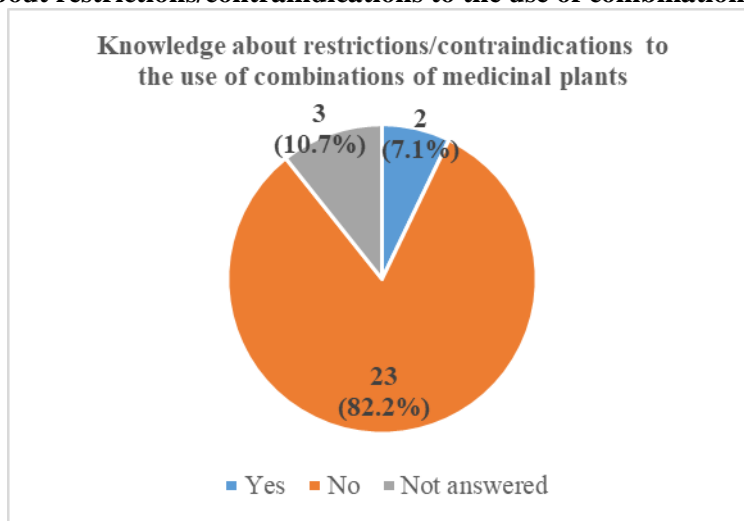
Additionally, the herbalists provided details about the specific therapeutic indications of some of the cited plants. These data were also divided into two categories based on their general (Table No. 3) or dental use (Table No. 4). The participants reported the indications of 17 plants for the treatment of general diseases and of 15 plants for dental conditions. In the case of five plants, both general and dental indications were described.

The forms of use of the commercialized plants most frequently recommended by the herbalists (Table No. 5) were bottled preparations

(combinations of various plants, popularly known in Brazil as "garrafadas"), followed by teas and syrup. Other unspecified forms were also reported by the professionals.

Considering the forms of use reported above, the herbalists were asked about their opinions/knowledge on the existence of possible restrictive effects or contraindications to the combined use of different medicinal plants (Figure No. 3). Most participants (n=23, 82.2%) had no knowledge about restrictions/contraindications to the use of combinations.

Figure No. 3
Knowledge of herbalists about restrictions/contraindications to the use of combinations of medicinal plants



As reported by 67.9% (n=19) of the herbalists, most frequently commercialized raw material was from the municipality of Campina Grande, Paraíba (data not shown). However, plant material was also obtained from neighboring towns

and other regions of the state (data not shown). In view of the different origins of the medicinal plants, the types of packaging used for commercialization of the plants was also investigated (Figure No. 4).

Figure No. 4
Types of packaging/storage used for the commercialization of plants

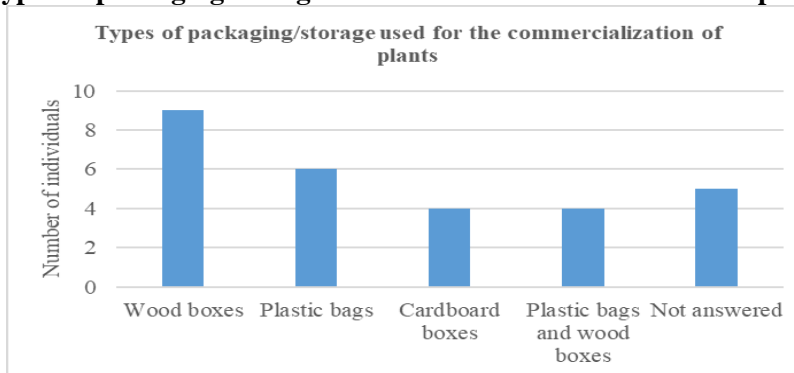


Table No. 3
Medicinal plants for general use and their therapeutic indications

MEDICINAL PLANTS FOR GENERAL USE AND THERAPEUTIC INDICATIONS	Number of citations
Alecrim (<i>Rosmarinus officinalis</i> L.) Heart attack	1
Ameixa (<i>Ximenia americana</i> L.) Infection	1
Inflammation	1
Aroeira (<i>Myracrodruon urundeuva</i> (Engl.) Fr. All.) Infection	1
Inflammation	6
Barbatimão (<i>Stryphnodendron adstringens</i> (Mart.) Cov.) Burns	1
Expectorant	2
Infection	1
Inflammation	5
Pain	1
Boldo (<i>Peumus boldus</i> Mol.) Intestinal problems	1
Cajueiro roxo (<i>Anacardium occidentale</i> L.) Infection	1
Inflammation	5
Camomila (<i>Matricaria chamomilla</i> L.) Sedative	2
Cebola branca (<i>Allium cepa</i> L.) Cough	1
Endro (<i>Anethum graveolens</i> L.) Stomach cramps	1
Headache	1
Erva doce (<i>Pimpinella anisum</i> L.) Sedative	1
Intestinal problems	1
Favela (<i>Cnidocolus quercifolius</i> Pohl.) Inflammation	1
Hortelã miúdo (<i>Mentha villosa</i> Huds.) Amoebiasis	1
Hortelã (<i>Mentha spicata</i> L.) Fever	1
Jatobá (<i>Hymenaea courbaril</i> L.) Expectorant	1
Cough	1
João mole (<i>Guapira opposita</i> (Vell.) Reitz) Inflammation	1
Malva rosa (<i>Alcea rosea</i> L.) Cough	1
Quixaba (<i>Sideroxylon obtusifolium</i> (Roem. & Schult.) T.D. Penn.) Inflammation	2
Total of citations	43

Table No. 4
Medicinal plants for dental use and their therapeutic indications

MEDICINAL PLANTS FOR DENTAL USE AND THERAPEUTIC INDICATIONS	Number of citations
Açafrão (<i>Curcuma longa</i> L.) Inflammation	1
Ameixa (<i>Ximenia americana</i> L.) Tooth pain	1
Aroeira (<i>Myracrodruon urundeuva</i> (Engl.) Fr. All.) Inflammation Tooth pain	6 1
Barbatimão (<i>Stryphnodendron adstringens</i> (Mart.) Cov.) Healing Inflammation Tooth pain	1 6 1
Cabacinha (<i>Luffa operculata</i> (L.) Cogn.) Inflammation	1
Cajueiro roxo (<i>Anacardium occidentale</i> L.) Inflammation Tooth pain	4 1
Cumaru (<i>Dipteryx odorata</i> (Aubl.) Willd.) Inflammation Tooth pain	1 1
Gengibre (<i>Zingiber officinale</i> Rosc.) Inflammation Sore throat	6 2
Juá/Juazeiro (<i>Ziziphus joazeiro</i> Mart.) Tooth brushing	1
Mulungu (<i>Erythrina velutina</i> Willd.) Tooth pain Sore throat	3 1
Papaconha/Pepaconha (<i>Hibanthus ipecacuanha</i> (L.) Oken.) Primary tooth eruption	1
Poejo (<i>Mentha pulegium</i> L.) Inflammation	1
Quixaba (<i>Sideroxylon obtusifolium</i> (Roem. & Schult.) T.D. Penn.) Inflammation	3
Tipí (<i>Petiveria alliacea</i> L.) Tooth pain	1
Romã (<i>Punica granatum</i> L.) Inflammation Tonsillitis	4 1
Total of citations	49

Table No. 5
Most frequently indicated forms of use of medicinal plants

	Form of use			
	Bottled preparations ("garrafadas") n (%)	Tea n (%)	Syrup n (%)	Other forms* n (%)
Yes	21(75,0)	9 (32,1)	4(14,3)	7 (25,0)*
No	7(25,0)	19(67,9)	24 (85,7)	21 (75,0)
Total	28 (100,0)	28 (100,0)	28 (100,0)	28 (100,0)

Legend: n = number of citations; *=not specified by the respondents

DISCUSSION

As part of the common knowledge about the use of medicinal plants, the sale of plant products with therapeutic purposes on street markets reflects a reality that is still widely present in different regions of Brazil (Maciel *et al.*, 2002). The expressiveness of this reality among the municipalities in the semiarid region of Paraíba investigated here exemplifies and adds to the scenario reported in other studies regarding the commercialization of medicinal plants on street markets (Amaral *et al.*, 2003; Nunes *et al.*, 2003; Alves *et al.*, 2007; Xavier de França *et al.*, 2008; Santos *et al.*, 2009; Lós *et al.*, 2012; Rocha *et al.*, 2013; Souza *et al.*, 2016), indicating that the massive and still current practice of this activity reflects and confirms the importance that the use of plant products in the treatment and cure of diseases continue to have in different regions of the country both in poorer regions and in large cities and metropolitan areas (Maciel *et al.*, 2002). This fact is particularly important when considering that in regions in development or underprivileged regions (as occurs in some of the municipalities studied), plants can be the only therapeutic resource to which the population has access for the treatment and cure of diseases (Maciel *et al.*, 2002; Borba & Macedo, 2006; WHO, 2011; Evangelista *et al.*, 2013; Rocha *et al.*, 2013).

According Maciel *et al.* (2002), the dissemination of knowledge about the application and therapeutic use of plants reflects and exemplifies the value attributed to the acquisition and transmission of this information through traditional knowledge. In this context, the present study seems to corroborate this fact, showing that based on self-reports from herbalists, their primary sources of knowledge about phytotherapy was acquired mainly from relatives, friends or close persons, being these information

transmitted over time between individuals. Furthermore, the low educational level of the most of herbalists demonstrated by the present study and others (Alves *et al.*, 2007; Xavier de França *et al.*, 2008; Santos *et al.*, 2009) allows us to confirm that the main form of phytotherapy learning was acquired mainly from the transmission of knowledge from generation to generation or through popular learning among close individuals. In this point of view this corroborates with Maciel *et al.* (2002), since according to these authors, the indication of plant species for different therapeutic purposes is based on the perpetuation of traditional knowledge about their different properties, indications and forms of use. Nevertheless, as demonstrated in the present study, these professionals have knowledge about the diversity of plants with therapeutic potential, as well as their indications, as described by Xavier de França *et al.* (2008).

Based on the reported indications of different plant species for the treatment of general and/or oral conditions, the most frequently commercialized plants for the treatment of general diseases were barbatimão (*S. adstringens*), aroeira (*M. urundeuva*), cajueiro roxo (*A. occidentale*), quixaba (*S. obtusifolium*), boldo (*P. boldus*) and erva doce (*P. anisum*). Other species were mentioned at lower percentages. The different therapeutic indications reported in the present study are consistent with the findings of other studies, including the use of alecrim (*R. officinalis*) for cardiovascular problems (Pasa, 2011), ameixa (*X. americana*) for infection and inflammation (Alves *et al.*, 2007), aroeira (*M. urundeuva*) for inflammation (Alves *et al.*, 2007; Pasa, 2011), barbatimão (*S. adstringens*) for inflammation (Cunha & Bortolotto, 2011), boldo (*P. boldus*) for indigestion (Pasa, 2011), cajueiro roxo (*A. occidentale*) for inflammation (Alves *et al.*, 2007),

cebola branca (*A. cepa*) for cough (Borba & Macedo, 2006; Franco & Barros, 2006; Xavier de França *et al.*, 2008), favela (*C. quercifolius*) for infection (Xavier de França *et al.*, 2008) and inflammation (Alves *et al.*, 2007), jatobá (*H. courbaril*) for cough/flu (Franco & Barros, 2006; Cunha & Bortolotto, 2011), malva rosa (*A. rósea*) for bronchitis (Xavier de França *et al.*, 2008) and cough (Xavier de França *et al.*, 2008; Costa and Mayworm, 2011), and quixaba (*S. obtusifolium*) for inflammation (Alves *et al.*, 2007).

Considering that the most important plants with dental indications were barbatimão (*S. adstringens*), aroeira (*M. urundeuva*), gengibre (*Z. officinale*), romã (*P. granatum*), cajueiro roxo (*A. occidentale*), mulungu (*E. velutina*) and quixaba (*S. obtusifolium*), the findings regarding their indications and popular use corroborate the results of different studies, including reports of the healing and anti-inflammatory activities of aroeira (*M. urundeuva*), quixaba (*S. obtusifolium*) and cajueiro-roxo (*A. occidentale*) (Santos *et al.*, 2009). The last specie is indicated for the relief of tooth and gingival pain (Borba & Macedo, 2006). Furthermore, gengibre (*Z. officinale*) is indicated to treat inflammation of the throat (Borba & Macedo, 2006), romã (*P. granatum*) to treat a sore throat/pharyngitis (Xavier de França *et al.*, 2008; Santos *et al.*, 2009; Costa & Mayworm, 2011; Pasa, 2011; Freitas *et al.*, 2012), and mulungu (*E. velutina*) to treat tooth pain (Ribeiro *et al.*, 2014). For some of the plants cited at a lower percentage, the findings also agree with some studies in the literature; for example, the indications of açafrao (*C. longa*) to treat inflammation (Borba & Macedo, 2006), of juá/juazeiro (*Z. joazeiro*) for gingival bleeding (Santos *et al.*, 2009), of papaconha/pepaconha (*H. ipecacuanha*) for application to children during tooth eruption (Alves *et al.*, 2007, Xavier de França *et al.*, 2008) and of poejo (*M. pulegium*) for a sore throat (Pasa, 2011).

Some of the plants with therapeutic indication cited in the present study, such as aroeira (*M. urundeuva*), cajueiro roxo (*A. occidentale*), cumaru (*D. odorata*), favela (*C. quercifolius*), jatobá (*H. courbaril*), João mole (*G. opposita*), juá/juazeiro (*Z. joazeiro*), mulungu (*E. velutina*), papaconha/pepaconha (*H. ipecacuanha*) and quixaba (*S. obtusifolium*) are native to the Caatinga biome where the municipalities studied are located according to the Brazilian Institute of Geography and Statistics (IBGE, 2020). These species are an example of those that, together with

ethnopharmacological knowledge, comprise the vast therapeutic potential of native plants in this biome (Pereira *et al.*, 2016).

With respect to the forms of use of the plants, the main recommendation of herbalists was their use as bottled preparations ("garrafadas"), in agreement with the findings of Souza and Feifili (2006) who described the extensive traditional use of "garrafadas" as a common formulation commercialized on street markets. The popularity of this formulation is attributed to the fact that it consists of a combination of different plants with diverse therapeutic indications (Franco & Barros, 2006; Souza & Feifili, 2006; Cunha & Bortolotto, 2011).

It is important to highlight the considerable percentage of herbalists who have no knowledge about the existence of restrictions/contraindication to the use of medicinal plants. Similar results have been reported by Freitas *et al.* (2012), corroborating the lack of knowledge of herbalists regarding possible risks associated with the use of medicinal plants. These findings highlight the need for instructing these individuals on the rational use of plant products (Alves *et al.*, 2007; Freitas *et al.*, 2012).

Besides the aspects discussed above, it is important to contextualize that the present findings agree with the statement of Maciel *et al.* (2002) that the extensive commercialization of medicinal plants is not only important because of their therapeutic properties but also within an economic context. The latter is illustrated by the representativeness that the sale of these products has as an alternative to supplement the income of these individuals (Lós *et al.*, 2012). This is demonstrated by the economic profile of herbalists in the present study and in other works published in the literature (Alves *et al.*, 2007; Santos *et al.*, 2009).

In addition to the economic perspective associated with the commercialization of medicinal plants, considering the types of packaging/storage used for the commercialization of plants, the role of hygiene and sanitary conditions must be highlighted, due to their implications for controlling the quality of plant products (Amaral *et al.*, 2003; Alves *et al.*, 2007). These considerations are valid for the present study since the plant products reported here originated from different locations and are stored in wood boxes, plastic bags and cardboard boxes on street markets. These conditions of packaging / storage are similar to those reported in other studies (Xavier de França *et al.*, 2008; Freitas *et al.*, 2012).

Thus, within this context, the importance of the handling, packaging and storage of these plant products during sale must be highlighted and clarified for herbalists (Amaral *et al.*, 2003; Alves *et al.*, 2007; Xavier de Franca *et al.*, 2007). These aspects are important since poor storage conditions can render the raw plant material susceptible to the action of moisture, impurities and other contaminants, resulting in degradation and/or microbiological contamination and consequent negative effects on its pharmacological activity and potentially harmful health implications (Amaral, 2003; Nunes *et al.*, 2003; Alves *et al.*, 2007; Xavier de Franca *et al.*, 2008). Therefore, it is essential to instruct herbalists about the importance of observing and complying with good practices regarding sanitary and hygiene conditions when preparing, cleaning, handling and storing these products (Alves *et al.*, 2007; Xavier de Franca *et al.*, 2008; Freitas *et al.*, 2012).

CONCLUSION

Based on self-reports of herbalists, the findings regarding the identification of plants with medicinal

properties and their knowledge about the pharmacological indications of different plant species suggest that this group has knowledge of the therapeutic potential of plants derived mainly from traditional knowledge acquired from their ancestors, accumulated and passed down through generations. Within this context, the socioeconomic and cultural importance of this activity is not only due to its role in the perpetuation and valorization of traditional culture but also to the complementation of income of those involved in this activity. Based on the findings about plants and their therapeutic indications, the medicinal use of 30 different plant species was mentioned, 21 for the treatment of general disease and 15 for the treatment of conditions of interest to dentistry. Details of the respective therapeutic indications were reported for some species. In addition to ethnobotanical and ethnopharmacological data, continuing education covering measures related to sanitary and hygiene practices for commercialization, as well as to the adequate and rational use of plant resources for therapeutic purposes is necessary.

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