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Medicinal plants in oral health and the intergenerational transfer of knowledge: Resilience to cocoa culture in southern Bahia

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Ethnobotanical surveys have proved plant usage in the treatment of oral diseases; however, in areas where cocoa farming influenced socioeconomic reality there is a lack of information about preservation of traditional knowledge related to oral conditions treatment. Family Health Strategy (FHS) users and community experts were interviewed with socioeconomic characteristics and ethnobotanical information being obtained through a semi-structured questionnaire. Plants informed by participants were harvested and lower socioeconomic conditions were statistically associated with medicinal plant usage. Lower level of education showed a tendency to influence medicinal plant use. Religious belief, gender or ethnicity and indigenous ancestry were not associated with medicinal plant usage. Of the 66 medicinal plants informed by interviewees from the FHS services, 12 were confirmed by experts for use in oral conditions. Leaves root and bark were used as decoction infusion or crushing/grinding for mouthwash ingestion or gargle. The most cited indications of oral conditions were inflammation and toothache. Plants most mentioned were *Dysphania ambrosioides, Schinus terebinthifolius, Plantago major, Piper hayneanum, Anacardium occidentale, Zingiber officinale, Punica granatum, Mimosa pudica, Gossypium barbadense, Cajanus cajan, Bidens pilosa* and *Hyptis pectinata.* Fifty-four species were recorded on the virtual information system. Overall, the results indicated that in the municipality studied the community is able to withstand exclusionary factors and pass on the ability to meet their own health needs with medicinal plants to future generations. The information herein may support public policies establishment in the region and bring benefits to excluded communities in relation to oral diseases.

Key words: Municipality of Una, oral diseases, ethnobotany surveys, medicinal plants.

INTRODUCTION

Despite government and non-governmental agency efforts to improve oral health in recent decades, oral diseases remain highly prevalent around the world, posing a serious public health challenge to policy makers

(Kassebaum et al., 2017). To enlarge population possibilities in public health assistance through low cost in the process of health promotion, the Brazilian government inserted in 2006 the use of Phytotherapy in the Unified Health System (UHS) what, with difficulties, also applies to dentistry (Arada and Perez, 2019).

Between the most common diseases, there are dental caries (tooth decay) and periodontal

disease (gum), which are both related to dental plaque and/or imbalance of normal microbiota (Peres et al., 2019). Dental caries, for example, belong to a group of complex or multifactor diseases that results in the phasic demineralization and remineralization of dental hard tissues (Pitts et al., 2017) for which herbs have been effective at the initial of the lesion (Bilgin et al., 2016).

Recently, newer and faster strategies of evaluating medicinal plants such as phylogenetic clustering have been reported (Zaman et al., 2021). In Brazil, although the study of the Brazilian flora has a long history, it was only recently (2010/2011) that Brazilian Government established an online program, globally linked, to rescue and make available images and information concerning Brazilian plants deposited chiefly in overseas herbaria through an on-line facility (Flora do Brasil 2020, 2021). Thus, despite this organization and availability of plant data, there is still a lack of information to establish faster and broader strategies for the rational use of medicinal plants.

It is wort to note that the field documentation and traditional knowledge of the plants in regions of poor communities are important to facilitate food diversification, economic development, and to create awareness among local communities for nature preservation (Abidullah et al., 2021). Moreover, the meaningfulness of such a plant for the community, specificity of products related to environment conditions, and the preservation of plants accessed still need ethnobotany surveys and taxonomic validation of plant species.

Taking into consideration the lack of information on medicinal plants in dentistry and the need for cataloguing plants in the local biodiversity, the present study aimed to verify the use of medicinal plants for the treatment of oral conditions in the cocoa culture socioenvironmental context and validate popular knowledge through the identification of plant species. To this end, the current ethnobotanical survey was conducted in a specific and unique area of the Brazilian Atlantic Forest biome, around the communities of Una, in the Bahia Cocoa Region, Brazil, by interviewing public health assistance users and community experts and in the same time harvests and identify local plant species.

MATERIALS AND METHODS

Study area and ethnographic background

The present study was developed in the municipality of Una, in the state of Bahia, Brazil (Figure 1). This municipality is located in the Atlantic Forest biome and is characterized by cocoa culture in the surrounding area and in most of the neighboring cities. Historically, the economy of the region flourished with plantation owners enjoying great wealth with the boom in cocoa cultivation in the late nineteenth and early twentieth centuries expanding into the forest areas. From the 1980s, the region experienced a decline in cocoa production due to the fungal disease known as witches' broom, which is a plague that devoured a large part of the cultivations and rocked the economic and social situation across the entire region (Bahia and De Moura, 2019).

The Una county had an estimated population of 18,108 (IBGE, 2021b). The municipality occupies 1,126,733 km² (IBGE, 2021a) and is bordered by the Una River basin, which is surrounded by a Hygrophilous Forest (Coastal Forest). In its central zone, there are cocoa cultivations and places named ‘capoeira’, which are a secondary type of vegetation, composed of grasses and sparse shrubs. The ‘capoeira’ term is derived from the Amerindian Tupi language and means ‘the bush that was born in place of cut vegetation’. Along the coast there is also cultivation of the Sharinga tree (*Hevea brasiliensis*), black pepper (*Piper nigrum*), cloves (*Syzygium aromaticum*), coconut, and, especially, the piassava tree (*Attalea funifera*). Also, at the Una River mouth, swamp, mangrove, and sandbank formations can be observed.

The municipality of Una was chosen among the cities in the region because of its public health organization in primary care, which closely adheres to what is proposed by Brazil’s Unified Health System (UHS) - the Family Health Strategy (FHS) (Ministry of Health, 2017), in addition to the easy access of researchers to the FHS. The local primary care includes three dental clinics associated to FHSs in the downtown area (Sucupira, Bairro Novo, and Marcel Ganem districts), in addition to another three dental clinics in FHSs situated in the rural zone (Pedras, Vila Brasil/Lençóis, and Comandatuba/Outeiro). The professionals serving in each FHS include at least one physician, one nurse, one dentist, and community health agents. The community health agents are trained professionals and members of the community responsible for the integration between patients and the FHS, through identification, recording, and visiting of community members from a determined micro-area (Ministry of Health, 2017).

Ethical approval

The research was approved by the Research Ethics Committee for research involving human beings of the State University of Santa Cruz (Universidade Estadual de Santa Cruz) under protocol number CAAE53177516.3.0000.5526. Ethnobotanical data were obtained from experts and FHS users.

Subjects and data collection

The so-called experts were key informants recognized by their community (Pedras de Una, Lençóis, Comandatuba, and Outeiro) as healers. The number of experts interviewed was defined by non-probabilistic sampling. Previously, the identification and location of

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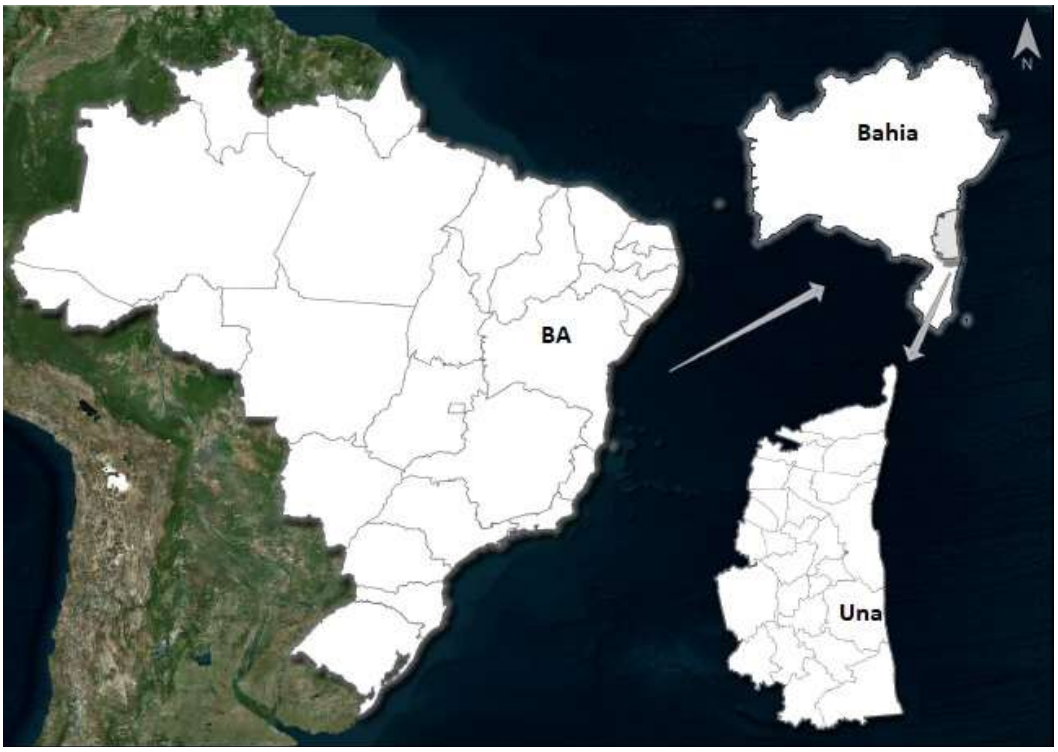

Figure 1. Geographical representation of the study area. A. The outline shows the mesoregion of South Bahia and, within this, the microregion Ilhéus-Itabuna (Cocoa Region), where the municipality of Una is located (Santos, 2019).

experts counted on community health agent participation. Later, the experts themselves recommended other experts to be interviewed, following snowball sampling (Noy, 2008). The number of experts was stipulated as a minimum of two and a maximum of 12.

The FHS participants constituted patients or caregivers with ≥ 18 years-old selected spontaneously in the waiting room of Una's FHS services. For this group, the stratified sampling method was used (Baptista and Campos, 2016), whereby the sample was grouped according to home address criteria, giving more homogeneous subgroups in relation to the characteristics of interest reproducing the original population. Five strata were formed corresponding to the five regions of the municipality – the downtown area and the districts – and following criteria established by the Brazilian Institute of Geography and Statistics (Instituto Brasileiro de Geografia e Estatistica) – IBGE (IBGE, 2011).

The sample size for each stratum was based on the total population (15,645) of each locality, based on the 2010 census and established considering 90% confidence interval and 6.8467% of error. Participants were interviewed using a semi-structured questionnaire containing three kinds of questions:

a) Demographic and socioeconomic data: name, address, gender, age, educational level, income, ethnicity, indigenous/afro descent, occupation, religion, place of origin, time living in the area, and number of residents in the household;
b) Ethnobotanical data: name of the plants, parts used, usage (isolated or combined, preparation methods, forms of use/administration, therapeutic use (oral infections/other uses), restrictions on use, knowledge of adverse effects, frequency of use, duration of use, definitive/temporary resolution, how subject acquired knowledge about plants, reason for use (preference/need), and indication of use (prescription/self-medication);
c) Botanical and cultivation data: place of acquisition/collection (garden, neighboring area), time of collection, plant age, and flowering.

To apply the questionnaires, the moment of interview was random (day and time) and data collection finished when the estimated total sample size (n=140) was reached. The exclusion criteria consisted of people belonging to indigenous ethnic groups officially registered with the Brazilian National Foundation of Indigenous population Fundação Nacional do Índio (FUNAI), since previous authorization was necessary and at the time of this study permissions were suspended.

Ethnographic and ethnobotanical data analysis

The collected data were analyzed qualitatively and analytically. The association between variables (plant use, sex, age, income, etc.) was established using Pearson's Chi Squared Test considering $p < 0.05$ and 95% confidence interval. The test established a relationship between the proportions observed in the study for each category analyzed and the expected proportions, adopting the overall proportions of the sample as a parameter. R software (R Core Team, 2017) was used to run statistical analysis and Canva Pty Ltd. (2021) was used to build the graphs.

Plant material collection and identification

The plant material cited by the interviewees was harvested locally (vegetable gardens backyards, vacant lots or public places), herborized, and identified by botanists from the State University of Santa Cruz. The geographical coordinates of the plants were

recorded using Google maps (https://www.google.com.br/maps). Plant materials were collected in Pedras de Una, Lençóis, Outeiro, Comandatuba, Águas de Olivença, and Vila Brasil, from April 25 to September 28, 2017, from both urban and rural areas. Voucher number and geographical coordinates were recorded at http://specieslink.net.

The activity of access to Brazilian environment genetic heritage/CTA/SisGen, in compliance with the provisions of Law 13,123/2015 and its regulations received permission through access registration number A049678.

RESULTS AND DISCUSSION

A total of 160 people were invited to participate in this study, with 148 participants being interviewed in the FHS services and 12 in their own homes (experts). Eight of the 148 participants were excluded from the study as they declared as being registered with FUNAI at the end of the interview. The participants' sociodemographic characteristics are summarized in Table 1.

The FHS respondents were resident in rural or urban areas, all being native to the municipality of Una. Of the participants, 83.57% were from the cocoa culture region. The number of women (n=102/72.85%) prevailed over the men (n=38/27.14%). Historically, women have a prominent role in healthcare, being more attentive to their own health or playing the role of caregivers of other members of the family (Sharma et al., 2016; Souza et al., 2018), which reflects in them going to healthcare places more frequently than men. It was expected that women would recommend more medicinal plant usage to treat oral diseases than men; however, no statistically significant difference was observed between the sexes (p=0.9956). In addition, the average age of FHS interviewees was 38.7 years-old and there was no significant association between age and greater knowledge on medicinal plants (p=0.3697) for this group. Among the experts, female gender and age over 45 years-old prevailed. Based on the snowball method used in this study and interviewee's impressions, it seems that people recognize that older members are guardians of healing knowledge through natural sources in the community. During the interviews, the elderly participants were often 'helped' to remember by younger relatives, and in one of the interviews the participant had to be changed for a younger member of the family. The fact that age was not associated with greater knowledge on medicinal plants in FHS respondents and the traditional knowledge of younger members of the experts' families may indicate that, in this community, folk medicine knowledge has been valued and transferred from one generation to another. This diverges from what ethnobotanical studies conducted in Brazil in recent years have demonstrated, in which the younger population has distanced itself from traditional knowledge as the generations pass (Lauer-Leite and Novais, 2021). From data obtained in this study 73.57% (n=103) self-declared as "pardo" (brown skin color derived from miscegenation) and 26.42% (n=37) as African, Caucasian, or indigenous descent (Table 1). Thus, ethnical admixture was the predominant characteristic of the participants, favoring a greater knowledge of the surrounding natural resources and the maintenance of traditions among generations. Current genetic characterization of Brazilian population revealed a predominant (>70%) European genomic ancestry in Brazilian Whites regardless of geographical region and on a high average European genomic ancestry (37.1%) in Brazilian 1899Blacks and confirmed the low correlation between color and genomic ancestry (Pena et al., 2020). In this study, although it has been used self-declared color criteria to describe ancestrally and no statistical significance was observed in relation to indigenous ancestry and medicinal plant usage (p=0.0856), it was possible to observe a strong tendency of this variable to influence the usage pattern. This seems to be well-matched with the reality of the local environment where dissemination and maintenance of Brazilian Amerindians traditions has taken place (Carvalho, 2017). From our hypothesis, in the region studied, traditional knowledge was expected to come mostly from a few individuals, especially the experts. However, 57.85% of the 140 respondents in the waiting rooms of the FHS services referred to the use of plants to treat mouth conditions (Table 1). This may be associated with a specific characteristic of the municipality of Una where urban and rural areas intersect.

The lower socioeconomic condition of the participants (p=0.0015) and a lower level of education (p=0.0878) were associated with medicinal plant usage in the studied group. Both variables are related to poor welfare state where conventional drugs are expensive and often unaffordable (Balogun et al., 2016). Despite some authors demonstrated that traditional medicine usage is declining (Oyebode et al., 2016) in situations like above, communities have to meet their healthcare needs in natural and accessible sources (Abidullah et al., 2021). In Brazil, other factors such as lack of access to medicine and assorted process of institutionalization of medical care (Souza et al., 2017) may contribute to the search for healthcare alternatives. In this study, in general, habitation (rural or urban area) and medicinal plant usage showed only a tendency to be associated (p=0.0607); however, when two districts (Vila Brasil and Lençóis) distant from urban areas were analyzed, a strong association was observed (p=0.0021) (Figure 2A). Both places have no paved roads, being very difficult to access on rainy days, in addition to a lack of pharmacies and regular public transport.

The socioeconomic aspects revealed two main results in this study: Occupation and religion. Rural workers (82.6%, p=0.0077) and public officials (72.2%, p=0.1761) prevailed in medicinal plant usage to treat oral diseases (Figure 2B). In this context, although the viability of practices related to the popular use of medicinal plants by local communities constitutes an alternative for the treatment.

Table 1. Sociodemographic profile of dental care assistance units population and *experts* in Una municipality, Bahia, Brazil.

	FHS participants					*Experts*			
			U	N	χ^2			U	N
	n	%	%	%	p value	n	%	%	%
Total	140		**57.85**	**42.14**		12		**91.66**	**8.33**
Gender					0.9956				
Male	38	27.14	**55.88**	**44.11**		1	8.33	**-**	**100**
Female	102	72.85	**57.84**	**42.15**		11	91.66	**100**	**-**
Age range					0.3697				
18 - 21(young adult)	16	11.42	**43.75**	**56.25**		-	-	**-**	**-**
22 - 44 (adult)	79	56.42	**58.22**	**41.77**		1	8.33	**100**	**-**
45 - 59 (middle-age)	26	22.34	**69.23**	**30.72**		5	41.66	**100**	**-**
≥60 (elderly)	18	12.85	**50**	**50**		6	50	**83.33**	**16.66**
NI	1	0.71	**100**	**-**		-	-	**-**	**-**
Education					0.0878				
Unschooled to 9th year	67	47.85	**65.67**	**34.32**		11	91.66	**90.9**	**9.09**
12nd year of schooling to undergraduate	72	51.42	**51.38**	**48.61**		1	8.33	**100**	**-**
NI	1	0.71	**-**	**100**		-	-	**-**	**-**
Income (MW)					0.0015*				
<1	39	27.85	**79.48**	**20.51**		1	8.33	**100**	**--**
≥1	100	71.42	**50**	**50**		11	91.66	**90.09**	**9.09**
NI	1	0.71	**-**	**100**		-	--	**--**	**-**
Origin									
Cocoa region	117	83.57	**58.97**	**41.02**		10	83.33	**100**	**-**
Other regions from Bahia state	17	12.17	**47.05**	**52.94**		1	100	**-**	**100**
Other states	4	2.86	**50**	**50**		1	100	**100**	**-**
NI	2	1.43	**50**	**50**		-	-	**-**	**-**
Housing					0.0607				
Urban area	63	45.00	**50.79**	**49.20**		-	-	**-**	**-**
Rural area	77	55.00	**64.93**	**35.06**		12	100	**91.66**	**8.33**
Religion					0.8217				
Catholic	55	39.29	**58.18**	**41.81**		9	75	**100**	**-**
Protestant (Evangelic)	52	37.14	**53.84**	**46.15**	0.5434	2	16.66	**100**	**-**
Spiritualist	-	-	**-**	**-**		-	-	**-**	**-**
Afro influenced (*candomblé*, *umbanda*, etc)	-	-	**-**	**-**		-	-	**-**	**-**
Without religion	25	17.86	**60**	**40**		1	8.33	**--**	**100**
Others	-	-	**-**	**-**		--	--	**--**	**-**
NI	8	5.71	**75**	**25**		--	--	**--**	**-**
Ancestry									
Quilombola	5	3.57	**60**	**40**		2	16.66	**100**	**-**
Indian	42	30.00	**69.04**	**30.95**	0.0856	2	16.66	**100**	**-**
No ancestry definition	87	62.14	**52.87**	**47.12**		5	41.66	**80**	**20**
NI	6	4.28	**50**	**50**		3	25	**100**	**-**
Color/race									
White	7	5	**57.14**	**42.85**		3	25	**66.66**	**33.33**
Brown	103	73.57	**59.22**	**40.77**	0.5849	6	50	**100**	**-**
Afro	27	19.28	**51.85**	**48.14**		2	16.66	**100**	**-**
Yellow	-	-	**-**	**-**		-	-	**-**	**-**
Indian	3	2.14	**66.66**	**33.33**		-	-	**-**	**-**
NI	-	-	**-**	**-**		1	8.33	**100**	**-**

FHS: Family Health System; U: Medicinal plants user; N: No users; NI: Not informed. Qui-square (χ^2) test was used to stablish association between nominal variables; *p<0.05. MW: Minimum wage.

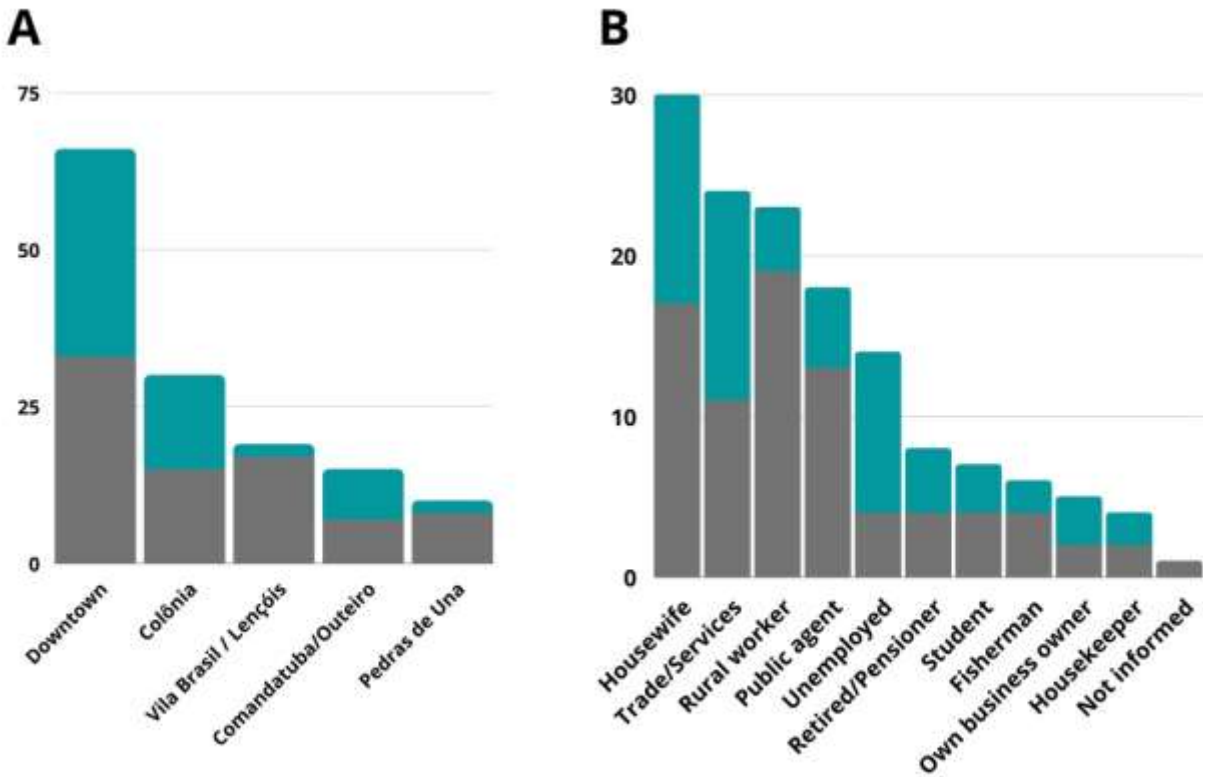

Figure 2. Distribution of respondents that declared using (gray color) or not using (green color) medicinal plants by (A) district of Una-Bahia, Brazil and (B) occupation. Chi-squared (χ^2) test was used to establish associations between nominal variables. *p<0.05.

of oral diseases; their continuity may be threatened by the interference of factors such as economic and cultural pressures (Silva et al., 2020).

Unexpectedly, the association between use of medicinal plants and religious faith were not statistically significant. The proportion between the two main categories declaring medicinal plant usage – Catholics (39.29%) and evangelicals (37.14%) – was almost equal (Table 1). It could be expected that the adepts of Pentecostal religions would have a lower adherence to the use of medicinal plants since certain liturgical rites such as bathing and the cleansing use of smoke found in Candomblé, for example (Pagnocca et al., 2020) are not allowed. However, as revealed in a research based on the role of medicinal plants and faith in the family care system, these two systems act beyond the biological relationship of health care (Lima et al., 2016). As for the experts, of the 12 individuals interviewed, 11 were women (Table 1). Ethnobotanical surveys carried out in other communities from Brazil also showed, for the most part, the predominance of women (Ranjarisoa et al., 2016) and the average age of the experts was 63 years-old (29 to 100 years-old), with 91.66% being over 50 years-old and older than the FHS subjects (38.7 years-old). This difference may be explained by the fact that experts were recommended by the community health agents and that there is a belief that older people have more traditional knowledge on the healing powers of natural products. Also, the broad range of our study suggests a longer life expectancy in the region and the opportunity to pass on the information to younger generations, as seen with one of the experts, who was 29 years-old.

Interestingly, regarding the religious faith practiced, nine expert interviewees declared themselves Catholics, two Evangelicals and one said they did not have a specific belief. Although most of the interviewees professed the Catholic religion, all the evangelicals who participated in the study also reported the use of medicinal plants for the treatment of oral conditions,

suggesting that among the experts, religious belief does not influence the use of medicinal plants for healing.

Income and education level were also noteworthy among the experts. The majority of those interviewed (n=9) reported low income and poor education (66%uneducated). These facts show the trend towards social exclusion of people who meet their health needs using medicinal plants, also reported in Cameroon, Africa (Agbor and Naidoo, 2015). It is worth noting that all the experts were rural zone inhabitants and 83% were born in the cocoa region. This fact has two sides to it. On the one hand, it points out the social exclusion presented in a

historical area marked by social oppression of “Cocoa Colonels” (Tonico and Ribeiro, 2013). However, on the other hand, it has encouraged the sharing of experiences among its members and the preservation of the traditional and popular knowledge of the community (Delgado, 2016). After the decline of the cocoa culture at the end of the 20th century, cocoa remained the main agricultural crop in the Bahia region, even with the significant reduction in production. The successive crises of the product led to the municipalities going through a process of socioeconomic and productive reorganization. Thus, the current search for transformations and re-significations aims to adjust the region to another perspective in the middle of the complex process of continuous globalization (Bahia and De Moura, 2019).

Finally, expert knowledge on medicinal plants to treat oral conditions (an average of 4.82 plants recommended) was greater than that of the other respondents (an average of 2.1 plants recommended), ratifying the wider knowledge of this group on the healing potential of medicinal plants. The interviewees cited 63 medicinal plants and their usage details (supplementary file). A total of 94 plant materials were collected with the help of local people and analyzed by botanists at the State University of Santa Cruz herbarium, since some species were collected more than once to confirm popular identification. Fifty-four species received a voucher number and were recorded on the *species* Link network. Twelve species were cited more than four times and confirmed by experts as medicinal plants used to treat oral diseases. The species were: *Dysphania ambrosioides* L. (n=41); *Schinus terebinthifolius* Raddi (n=26); *Plantago major* L. (n=16); *Piper hayneanum* (Miq.) C. DC. (n=8); *Anacardium occidentale* L. (n=7); *Zingiber officinale* Roscoe (n=7); *Punica granatum* L. (n=7); *Mimosa pudica* L. (n=6); *Gossypium barbadense* L. (n=5); *Cajanus cajan* (L.) Millsp.(n=5); *Bidens pilosa* L. (n=5); and *Hypitis pectinata* (L.) Poit. (n=4). The species *Pfaffia sp*., *Stryphnodendron adstringens, P. guajava*, *Veronia condensata*, *Cnidosculus sp.,* and *B. trimera* were informed less than four times by public health users, although they were confirmed by the experts.

This is the first study to report systematized data on the use of medicinal plants for the treatment of oral diseases in Brazil’s cocoa region, in the state of Bahia.

Inflammation and toothache were among the most cited oral disorders (Figure 3A). It should be noted that the term "inflammation" was often used by the interviewees in a generic way and may refer to a range of oral conditions such as gingivitis, periodontitis, and abscesses. Furthermore, there was no consensus of plant species for the treatment of a given oral condition. *D. ambrosioides*, for example, was the species most recommended for inflammation (20.14%), abscess (21.42%), post extraction healing (40%), cicatrization (15.38%), and toothache (12.5%). *Schinus terebinthifolius* was mentioned for inflammation (16.54%) and cicatrization (15.38%). *Piper hayneanum* was mentioned for toothache (10.93%) and as an anesthetic (62.5%), the latter corresponding to a consensus of use among the plants cited. *Zingiber officinale* and *Punica granatum* were the most cited for sore throat (27.27%), followed by *Plantago major* (18.18%).

Aside from the indication of “inflammation”, which it is a general term; toothache appears as the main oral condition for the use of medicinal plants. However, attention should be taken when using plants, because in cases of pulpitis, many of them cause necrosis and mummification of the pulp tissue (Agbor and Naidoo, 2015) providing temporary resolution of the problem. Reinfection of the affected area may arrive with the consequent recurrence of pain. Thus, although there were no precautionary reports on the use of medicinal plants by those interviewed in this study, dentists should remain alert to the signs of adverse effects of medicinal plants on patients. The interviewees revealed leaves, roots, and bark as the most used parts of the plants (Figure 3B), confirming data found in the literature (Agbor and Naidoo, 2015; Ranjarisoa et al., 2016). Decoction (n=159), infusion (n=27), crushing/grinding (n=22), sap/oil/juice extraction (n=18), maceration (in water or alcohol) (n=5), chewing (n=4), and roasting/powdering (n=2) were informed as preparation methods by the community. Although its limitation as extraction technique such as present a large amount of water-soluble impurities and it is not appropriated for thermolabile or volatile components (Zhang et al., 2018) decoction (67%) prevailed among the informed methods of preparing plant material (Figure 3C). This is probably related to the convenience of the preparation and the usage of the product, in the case of oral mouth rinses.

Regarding how preparations of plants were used, a predominance of mouthwash, ingestion, gargle, and topical application was observed in the present study (Figure 3D). It is important to note that the term “topical” appeared as being used from various preparation forms such as juice, sap, or milk extracted from the plant or with the plant being bruised, chewed or sprayed, and in the form of tincture, decoction, or ointment (Figure 3D). It was also reported that the plants were mostly obtained from backyards, gardens, and public roads, while there were few reports of plants being obtained from forests, fairs, or markets or from healers. Brazil is large country with many cultural aspects; however, this practice seems to be shared among northeast and southern folks (Da Cunha et al., 2021). Also, this fact reinforces the need to conduct more research in the Cocoa Region, in order to deepen the studies about medicinal effects of native plants in the Brazilian Atlantic Forest as stated in the literature (Rocha et al., 2021). It is important to mentionhere that although living in the Cocoa Region and that Theobroma cacao plays an important socio-economic role in the region, the respondents did not mention any medicinal property for this plant. Recently,

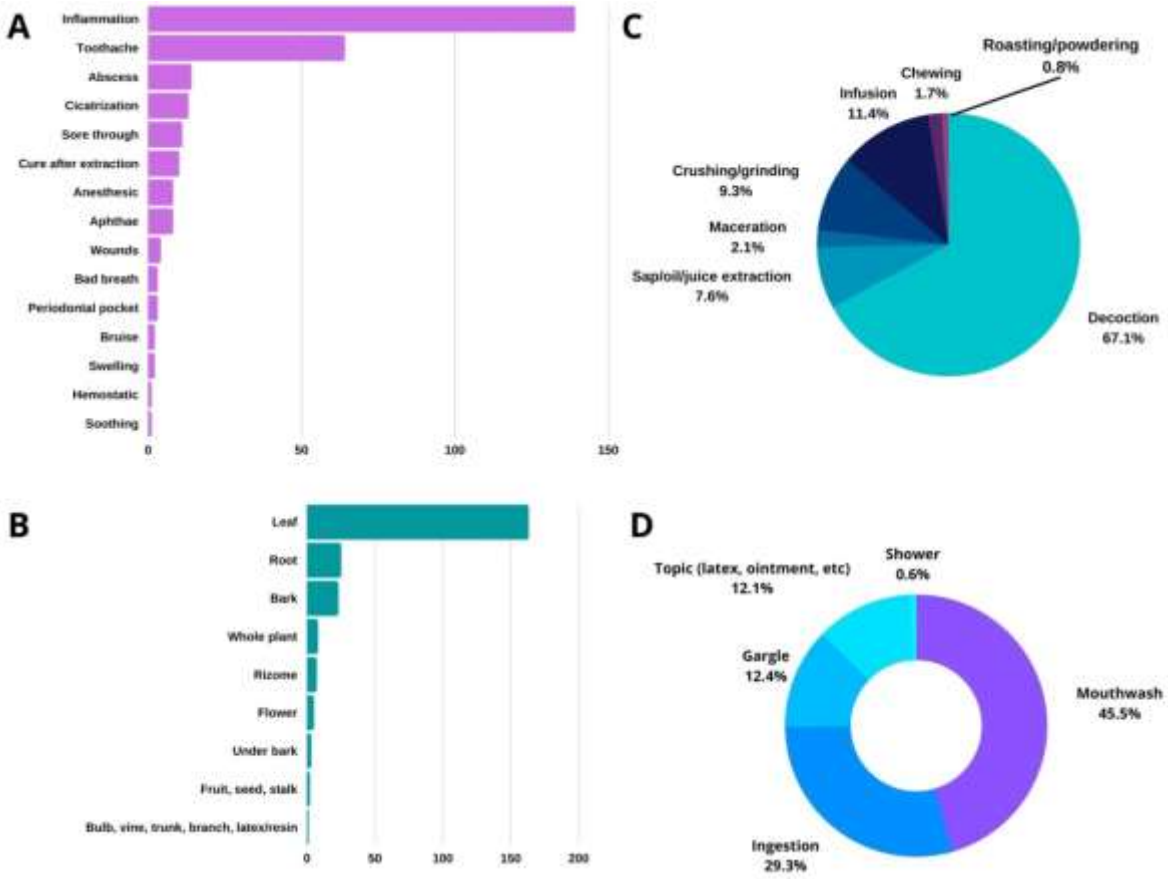

Figure 3. Ethnobotanical information related to medicinal plants used to treat oral disorders by the community of Una, Bahia, Brazil. Medicinal plant usage (A); part of the plant used (B); method of preparation (C), and instructions for use (D).

studies in the literature revealed the potentiality of seed extracts for increasing the remineralization of enamel (Irmaleny and Hidayat, 2017) and tissue recovery after tooth extraction (Kurniawati et al., 2020). As one of the global hotspots, Brazilian flora encompasses 49,976 native, cultivated, and naturalized plants (Flora do Brasil 2020, 2021). This diversity is reflected in medicinal usage by the population. Based on national and international literature, several species used to treat oral diseases are shared between communities being Cajanus cajan the most widely used for dental purposes (Agbor and Naidoo, 2015; Ranjarisoa et al., 2016).

Conclusion

In this community, traditional knowledge remains passed on from generation to generation and shows the importance of the people referred to as experts in validating the use of medicinal plants. The youngest are interested in learning and continuing the traditional knowledge related to the use of medicinal plants for treating oral conditions which opposes the global movement of erosion of this knowledge in current generations. Also, the use of native and exotic plant species in the treatment of oral diseases stands out in the Una community. Especially *P. granatum*, a naturalized plant, was one of the most cited. The predominance in the use of naturalized plants over native ones demonstrates the need to give more value the Atlantic Forest by rescuing traditional knowledge while preserving the environment.

As a view, this ethnobotanical research brought important data that will contribute to the technical-scientific development in the field of natural sciences, dentistry, and public health, indicating the development of practices and products which may offer oral health benefits to economically marginalized communities. In addition, the information generated in the study may support the regional public policies establishment regarding the use of medicinal plants and herbal medicines in dentistry, already regulated by official agencies in Brazil.

CONFLICT OF INTERESTS

The authors have not declared any conflict of interests.

REFERENCES

Abidullah S, Rauf A, Zaman W, Ullah F, Ayaz A, Batool F, Saqib S (2021). Consumption of wild food plants among tribal communities of Pak-Afghan border, near Bajaur, Pakistan. Acta Ecologica Sinica, in press. https://doi.org/10.1016/j.chnaes.2021.08.002

Arada JMG, Perez ZC (2019). Phytotherapy in dentistry: survey of products of plant origin for health oral. Brazilian Journal of Implantology and Health Sciences 1(3):35-40.

Agbor AM, Naidoo S (2015). Ethnomedicinal Plants Used by Traditional Healers to Treat Oral Health Problems in Cameroon. Evidence-based Complementary and Alternative Medicine 649832. doi: 10.1155/2015/649832, 10 pages.

Bahia de Aguiar PC, De Moura Pires M (2019). A região cacaueira do sul do estado da Bahia (Brasil): crise e transformação. Cuadernos de Geografía: Revista Colombiana de Geografía 28(1):192-208.

Balogun FO, Tshabalala NT, Ashafa AOT (2016). Antidiabetic Medicinal Plants Used by the Basotho Tribe of Eastern Free State: A Review. Journal of Diabetes Research 1(3):1-13.

Baptista MN, Campos DC (2016). Delineamento experimental. Metodologias de Pesquisa em Ciências: análises quantitativa e qualitativa. LTC Editora**,** Rio de Janeiro, RJ. 2nd ed, pp. 158-176.

Bilgin Gocmen G, Yanikoglu F, Tagtekin D, Stookey GK, Schemehorn BR, Hayran O (2016). Effectiveness of some herbals on initial enamel caries lesion. Asian Pacific Journal of Tropical Biomedicine 6(10):846-850.

Ministry of Health, Brasil (2017) Revisão de diretrizes para a organização da Atenção Básica, no âmbito do Sistema Único de Saúde (SUS). Brasília. Available at: https://bvsms.saude.gov.br/bvs/saudelegis/gm/2017/prt2436_22_09_2017.html.

Carvalho CR (2017). Public tourism and sustainability policiessocio-cultural: the case of the south end Pataxó of Bahia. RevistaGeoUECE 7(12):46-68.

Da Cunha LC, Deuschle VCKN, Norbert Deuschle RA (2021). Uso de plantas medicinais e fitoterápicos entre usuários de uma clínica universitária de fisioterapia do noroeste do Rio Grande do Sul. Revista Saúde (Sta Maria) 47(1):1-11.

Delgado NA (2016) Community protocols as tools for resisting exclusion in global environmental governance. Revista de Administração de Empresas 56(4):395-410.

Flora do Brasil 2020 (2021) Rio de Janeiro Botanical Garden. Available at: http://floradobrasil.jbrj.gov.br/

IBGE – Instituto Brasileiro de Geografia e Estatística (2011). Censo demográfico 2010 : características da população e dos domicílios, Instituto Brasileiro de Geografia e Estatística. Rio de Janeiro, RJ: Ministério do Planejamento, Orçamento e Gestão, p. 270.

IBGE – Instituto Brasileiro de Geografia e Estatística (2021a) Cidades e Estados. Available at https://www.ibge.gov.br/cidades-e-estados/ba/una.html.

IBGE – Instituto Brasileiro de Geografia e Estatística (2021b) Estimativas da população residente no Brasil e unidades da federação com data de referência em 1° de julho de 2021. Available at: https://ftp.ibge.gov.br/Estimativas_de_Populacao/Estimativas_2021/estimativa_dou_2021.pdf

Irmaleny OT, Hidayat S (2017). The remineralization potential of cocoa (Theobroma cacao) bean extract to increase the enamel micro hardness. Padjadjaran Journal of Dentistry 29(2):107-112.

Kassebaum NJ, Smith AGC, Bernabé E, Fleming TD, Reynolds AE, Vos T, Murray CJL, Marcenes W, Abyu GY, Alsharif U, Asayesh H, Benzian H, Dandona L, Dandona R, Kasaeian A, Khader YS, Khang YH, Kokubo Y, Kotsakis GA, Lalloo R, Misganaw A, Montero P, Nourzadeh M, Pinho C, Qorbani M, Blancas MJ, Rios Sawhney M, Steiner C, Traebert J, Tyrovolas S, Ukwaja KN, Vollset SE (2017). Global, Regional, and National Prevalence, Incidence, and Disability-Adjusted Life Years for Oral Conditions for 195 Countries, 1990–2015: A Systematic Analysis for the Global Burden of Diseases, Injuries, and Risk Factors. Journal of Dental Research 96(4):380-387.

Kurniawati A, Saputra DR, Cholid Z, Putra HK (2020). Cacao seed (*Theobroma cacao* L.) extract gel effect on the neutrofil number after tooth extraction. ODONTO Dental Journal 7(1):60-66.

Lauer-Leite MRLMID, Novais JS (2021). Distribution of traditional ecological knowledge about medicinal plants in an Amazonian community. Revista Etnobiología 19(1):29-40.

Lima CAB, Lima ÂRA, Mendonça CV, Lopes CV, Heck, RM (2016). O uso das plantas medicinais e o papel da fé no cuidado familiar. Revista Gaúcha de Enfermagem 37(esp):e68285.

Noy C (2008). Sampling Knowledge:The Hermeneutics of Snowball Sampling in Qualitative Research. International Journal of Social Research Methodology 11(4): 327-344.

Oyebode O, Kandala N-B, Chilton PJ, Lilford RJ (2016). Use of traditional medicine in middle-income countries: a WHO-SAGE study. Health Policy and Planning 31(8):984-991.

Pagnocca TS, Zank S, Hanazaki N (2020). “The plants have axé”: investigating the use of plants in Afro-Brazilian religions of Santa Catarina Island. Journal of Ethnobiology and Ethnomedicine 16(1):20.

Pena SD J, Santos FR, Tarazona-Santos E (2020). Genetic admixture in Brazil, American Journal of Medical Genetics Part C: Seminars in Medical Genetics 184(4):928-938.

Peres MA, Macpherson LMD, Weyant RJ, Daly B, Venturelli R, Mathur MR, Listl S, Celeste RK, Guarnizo-Herreño CC, Kearns C, Benzian H, Allison P, Watt RG (2019). Oral diseases: a global public health challenge. The Lancet 394(10194):249-260.

Pitts NB, Zero DT, Marsh PD, Ekstrand K, Weintraub JA, Ramos-Gomez F, Tagami J, Twetman S, Tsakos G, Ismail A (2017). Dental caries. Nature Reviews Disease Primers 3(1):17030.

R Core Team (2017) ‘R: A language and environment for statistical computing’. R Foundation for Statistical Computing: Vienna, Austria.

Ranjarisoa LN, Razanamihaja N, Rafatro H (2016). Use of plants in oral health care by the population of Mahajanga, Madagascar. Journal of Ethnopharmacology 193:179-194.

Rocha LPB, Alves JVO, Aguiar IFS, Silva FH, Silva RL, Arruda LG, Nascimento Filho EJ, Barbosa BVDR, Amorim LC, Silva PM, Silva MV (2021). Uso de plantas medicinais: Histórico e relevância. Research, Society and Development 10(10):e44101018282.

Santos AAP (2019) Atlas Socioeconômico Litoral Sul da Bahia. Gasparetto Pesquisa e Estatística, Itabuna, BA. 1a ed., pp.127. https://drive.google.com/file/d/1PpgF3THz0wGfs-6zZ6I-YA6DMGRENUOx/view.

Sharma N, Chakrabarti S, Grover S (2016). Gender differences in caregiving among family - caregivers of people with mental illnesses. World Journal of Psychiatry 6(1):7.

Silva LE, Amaral W, Silva MM, Oliveira AL (2020). Conservation of genetic resources: a study with medicinal plants on the coast of Paraná-Brazil. Ambiente and Sociedade 23:e02991.

Souza GS, Costa EA, Barros RD, Pereira MT, Barreto JL, Guerra Junior AA, Acurcio FA, Guibu IA, Álvares J, Costa KS, Karnikowski MGO, Soeiro OM, Leite SN (2017). Characterization of the institutionalization of pharmaceutical services in Brazilian primary health care. Revista de Saúde Pública 51(suppl.2):7s.

Souza ID, Pereira JA, Silva EM (2018). Between State, society and family: the care of female caregivers. Revista Brasileira de Enfermagem 71(suppl 6):2720-2727.

Tonico JS, Ribeiro MDA (2013). Crisscrossing history and language: colonelism and newspapers. Entretextos 13(2):108-127.

Zaman W, Ye J, Saqib S, Liu Y, Shan Z, Hao D, Chen Z, Xiao P (2021). Predicting potential medicinal plants with phylogenetic topology: Inspiration from the research of traditional Chinese medicine. Journal of Ethnopharmacology 281:114515.

Zhang QW, Lin LG, Ye WC (2018). Techniques for extraction and isolation of natural products: a comprehensive review. Chinese Medicine 13(1):20.