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Traditional knowledge of plants used against upper respiratory tract affections in the Littoral Region of Cameroon

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Traditional medicine is used by people as an alternative to orthodox drugs to treat respiratory infections. The aim of this research was to document traditional recipes used in the treatment of upper respiratory tract infections such as pharyngitis, cold, and sinusitis in peri-urban and rural areas of the Littoral Region of Cameroon. Ethnobotanical surveys were carried out using semi-structured interview model in French or Cameroonian local languages. They were distributed to 115 people. The respondents were both male and female, 20 years old and above, and belonged to seven ethnic groups. Data on plant species and the recipes used against upper respiratory tract infections were collected from the respondents. Plant parts used and methods of preparation were also provided by the respondents. The most abundant ethnic group (56 individuals) was Sawa, followed by Bassa (27) and Bamileke (23). The Lamiaceae family had the highest number of species (06), and *Ocimum gratissimum* was the most valuable species with 49 citations. Leaf was the main part used (69.94%), and decoction (39.16%) and trituration (38.11%) were the most popular preparation methods. This study has shown the essential role of traditional pharmacopoeia in the treatment of respiratory infections.

Key words: Pharyngitis, cold, ethnobotanical survey, pharmacopoeia, recipes, sinusitis.

INTRODUCTION

Medicinal plants provide valuable resources for the majority of rural and urban populations in Africa, and constitute alternative sources for the treatment of diseases (Badiaga, 2011). Indeed, several therapies involve the exploitation of the active components of medicinal plants (Kidik Pouka et al., 2015). Traditional medicine is used by approximately 80% of the world population to solve their primary health care problem

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(Fatima et al., 2015). Also, these plants provide invaluable resources for the pharmaceutical industry (Etame-Loe et al., 2018).

Respiratory diseases have spread throughout the world, particularly in Africa, and are extremely expensive to treat (Fatima et al., 2015). In Cameroon, respiratory diseases kill 14% of the population, while HIV kills 21% (Mpondo et al., 2017). The rural population has limited access to health infrastructure and conventional medicines, which are frequently expensive and toxic, and do not always represent an effective means of improving people's health (Kidik Pouka et al., 2015; Mpondo et al., 2017). In addition, seasonal variations, poverty and pollution are mostly responsible for the emergence of respiratory infections. Respiratory infections include: (1) infections of the upper respiratory tract such as colds, pharyngitis, and sinusitis. On the other hand, the infections of the lower respiratory tract include bronchitis, pneumonia, tuberculosis, and asthma (Baky, 2010; Aubry, 2020). Few studies on the use of plants to treat respiratory infections have been conducted, and the majority of them have focused on the lower respiratory tract (Focho et al., 2009; Mpondo et al., 2017). In the Littoral Region, ethnobotanical surveys on plants used against respiratory infections have been mostly carried out in markets in urban centers (Foze et al., 2021). As a result, there is a greater need for understanding of upper respiratory infections. The goal of this study was to identify plants and plant recipes used in the treatment of upper respiratory tract affections (URTA) in the Littoral Region's peri-urban and rural areas.

MATERIALS AND METHODS

Study site

Littoral Region is an administrative unit located between coordinates 4.25°N and 9.31°E. It covers an area of 20.248 km² or 4.4% of the national area. It is bounded to the north by the Western region, to the south by the Southern region and Gulf of Guinea, to the east by the Central Region, and to the west by the South-west Region. The main ethnic groups found in this region are Abo and Bankon in the sub-division of Bonalea, Bandem and Mbang in the sub-division of Nkondjock, Bassa and Bakoko in the sub-division of Douala III, and Bassas in the sub-division of Pouma. There are also other populations here such as Bafia, Bamileke, Beti, and Bamenda, who came to trade or work in the agro-industrial companies. This study was conducted in 12 villages belonging to four departments. Within these, the villages were separated by at least 3 km (Figure 1).

Ethnobotanical surveys

Ethnobotanical surveys were done from August 2020 to January 2021 in twelve villages over the four sub-divisions stated earlier. The survey method used was the Popular Pharmacopoeia, in which the respondents were asked about the popular use of medicinal plants. Data on the symptoms or physiological effects of the diseases were collected from health staff, and complemented by a literature review (Betti and Lejoly, 2010). To harmonize with the international system, the diseases cited were distinguished into major groups, according to the latest classification of diseases proposed by WHO (2008). Interviews were conducted with 115 people of both sexes. Their age was classified into three ranges: 20-40, 40-60 and 60+. Questions used for the structured interview model were formulated in French or the local languages of Cameroon. An inventory of plant species and recipes used against upper respiratory diseases like pharyngitis, cold and sinusitis was collected. Botanical specimens were collected in the field with the help of local guides. They were identified *in situ*, using reference manuals. Unidentified specimens were taken to the Laboratory of Biology of Plant Organisms at the University of Douala, and to the National Herbarium of Cameroon (HNC).

Data processing and analysis

Data obtained were processed and analyzed with XLSTAT computer software version 2022.1.2.1256. A growth curve of the number of species identified was studied according to the number of people interviewed. The objective of the study is to find compatibility between the plant list obtained at the end of the surveys and all the plants used in pharmacopoeia against URTA. A graph was created in which the number of people questioned, divided into groups of ten after a random draw, was on the horizontal axis and the number of plants cited by each group was on the vertical axis. The Informer Consensus Factor (ICF) indicated the homogeneity of information provided by the study respondents. It ranged from 0 to 1, and was calculated by the formula:

$$ICF = (Nuc – Nsu) / (Nuc – 1)$$

where Ncu is the number of usage citations reported in each disease category, and Neu is the number of species used for the treatment of each disease (Ugulu et al., 2009).

RESULTS

Socio-demographic characteristics of respondents

At the end of the surveys, 115 respondents have been identified. They were 81 women and 34 men. The dominant age group was 40-60 (44%), followed by 20-40 (37%), and 60+ (19%). Three major ethnic groups were identified after the investigations: Sawa was the most represented group with 56 (48.69%) people, followed by Bassa with 27 (23.48%) people, and Bamileke with 23 (20%) people. The other ethnic groups, Bafia, Beti, and Tikar represented 7.83% of the respondents (Figure 2).

Species identified

The inventory of medicinal plants revealed 39 species belonging to 36 genera and 21 families. Lamiaceae was the most represented family with six species. Asteraceae had four species, Myrtaceae and Rutaceae recorded three species. Anacardiaceae, Araceae, Caesalpiniaceae,

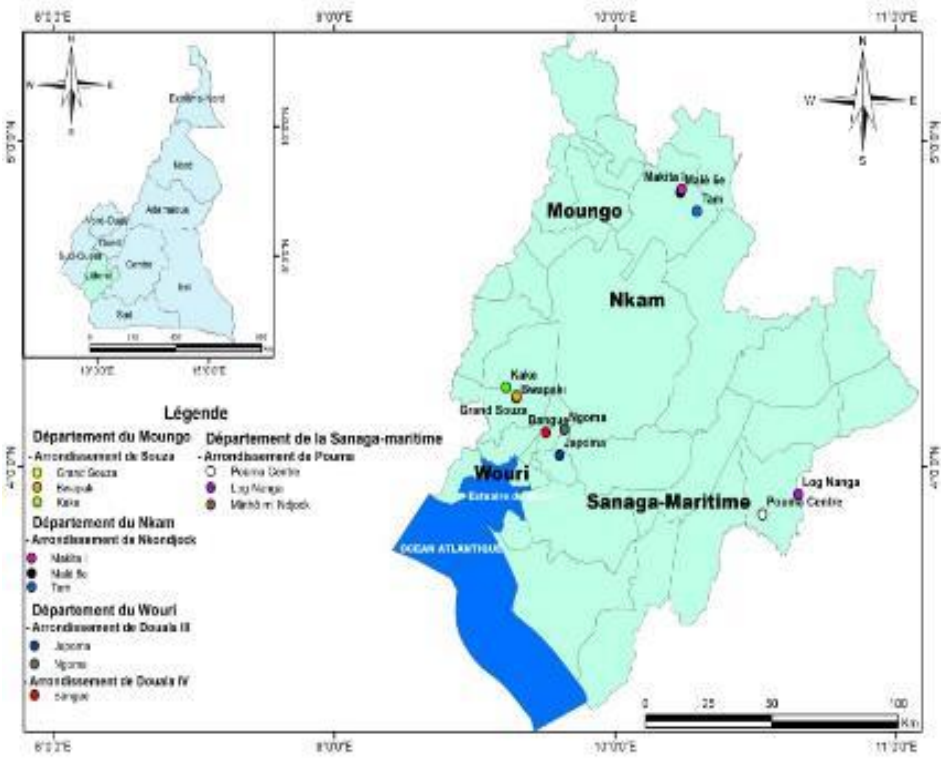

Figure 1. Map of the study area.
Source:Authors 2022

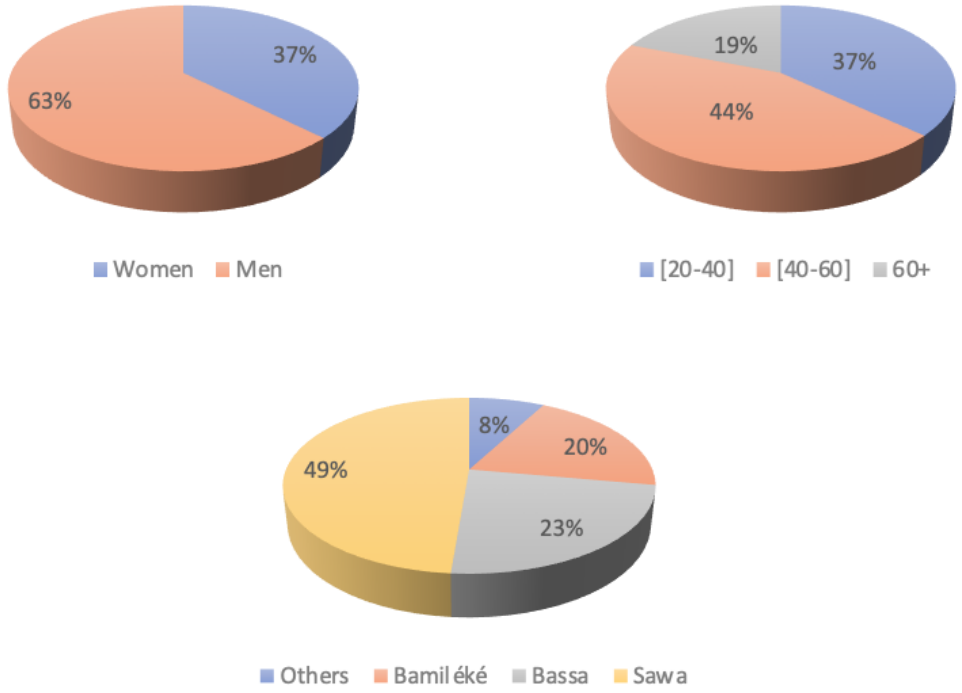

Figure 2. Characteristics of respondents.
Source:Authors 2022

Caricaceae, Costaceae, Crassulaceae, Huaceae, Musaceae, Piperaceae, Scrophulariaceae, and Malvaceae were the least represented with a single species each. *Ocimum gratissimum* had the highest number of citations (45), followed by *Cymbopogon citratus* (49 citations) and *Citrus medica* with 39 citations (Table 1).

Characterization of recipes

A total of 66 recipes were identified among the populations. Table 2 shows the recipes and their characteristics given by each respondent. It shows that the decocted and triturated leaves of *O. gratissimum* were the two recipes mostly shared by the ethnic groups, especially among Sawa (26 citations). The charred leaf of *Elaeis guineensis* and triturated leaf of *Bryophyllum pinnatum* are also recipes well-known by the Sawa group (100 and 64.5% citations, respectively). Thirty-eight (38) recipes received only one citation and are, therefore, considered unreliable.

Sawa group gave the highest number of recipes (48), followed by Bassa (27 recipes) and Bamileke (25 recipes). The calculated ICF showed over 0.5 values for the three major ethnic groups. For Sawa group, the ICF value was 0.74; for Bamileke and Bassa, the ICF value was 0.69. That means there was a relatively high agreement in the use of plants for the treatment of USRD. The ICF value was zero in the other ethnic groups. This means there was contradiction among the groups (Table 3).

The analysis of the evolution curve of the number of species according to the respondents showed a logarithmic shape; saturation was reached with 77 respondents (Figure 3).

Methods used in preparing the recipes

Ten methods were used to prepare the recipes. Decoction (39.16%) and trituration (38.11%) were the most cited preparation methods, followed by pressing (6.29%), carbonization (5.25%), or direct use (3.85%). The least used preparation methods were maceration and grinding (0.7% citations) (Figure 4).

Parts of plants used

Eight parts of plants were cited at the end of the surveys. Leaves had 195 citations (68.18%), while fruits and rhizomes recorded 17.42 and 7.32%, respectively. Flowers, buds and stems were the least cited parts, with two citations each (Figure 5).

DISCUSSION

The surveys revealed that 39 species belonged to 36 genera and were grouped into 21 families. This number is lower than the 54 species found by Focho et al. (2009) in the North-West Region, and 76 species found by Mpondo et al. (2017) in the villages of the Central Region of Cameroon. The work of these two authors focused on the respiratory system as a whole, while this work focused on only the upper part of the respiratory system.

Lamiaceae and Asteraceae were the families with the highest number of species. Similar results were found in the Doukkala Region in Morocco (Briguiche et al., 2019). Asteraceae and Lamiaceae are effective for the treatment of upper respiratory diseases. Some species identified during this study have previously been mentioned in other studies. *Allium sativum*, *Aframomum melegueta*, *Canarium schweinfurthii*, *Citrus limon*, *C. citratus*, *E. guineensis*, *Eucalyptus globulus*, *Mangifera indica*, *O. gratissimum*, *Thymus vulgaris*, and *Zingiber officinale* are used against respiratory ailments in the villages of Central Cameroon (Mpondo et al., 2017). In Morocco, *O. gratissimum*, *A. sativum* and *Z. officinale* have been cited as plants used against respiratory diseases (Fatima et al., 2015). In Kenya, *A. sativum*, *Eucalyptus* species and *Syzigium* species are used against respiratory infections (Mailu et al., 2020). In Tanzania, *B. pinnatum* and *C. limon* are used to treat respiratory diseases of bacterial origin (Innocent et al., 2022). The works of Daroui-Mokaddem (2012) showed that organic extracts of *E. globulus* also possess essential oils, compounds with pronounced antibiotic and anti-inflammatory activities such as robustaol A, robustadials and eucalyptol. Anti-inflammatory activities have been revealed in the essential oils of *C. schweinfurthii* (Mathouet et al., 2020). Essential oil of *C. limon* exhibited anti-inflammatory effects by reducing cell migration, cytokine production and protein extravasation induced by carrageena (Amorim et al., 2016). Garcia et al. (2015) demonstrated the anti-inflammatory and analgesic properties of *C. citratus*. *Z. officinale* essential oil contains fragrant compounds like zingiberene, curcumene, camphene, bisabolene, citral and linalool (Mpondo et al., 2017). *O. gratissimum* which was the commonest species cited by the respondents in the study area can be considered as the major species used in the treatment of URSD. Its essential oil is a potential source of antimicrobial, preventive and flavouring agent, with eugenol, ocimene, caryophylene, and germacrene ingredients (Dung et al., 2021).

ICF values were above 0.5 among the three major ethnic groups. This means there is a global agreement between the various people on the plants and recipes against URSD. The evolution curve of the number of species according to households showed that increasing the number of the respondents interviewed would have

Table 1. List of plant species used by the populations against upper respiratory tract infections.

Family	Scientific names	Local names (Ethnic group)	Number of citations
Anacardiaceae	*Mangifera indica* L.	Django i pen (Sawa)	2
Araceae	*Colocasia esculenta* L.	Macabou (Bamileke)	1
Arecaceae	*Elaeis guineensis* (L.) Jacp.	Ihend (Sawa)	7
	Raphia hookeri G.Mann &H.Wendl	Ngondja (Sawa)	9
Asteraceae	*Ageratum conyzoides* L.	Katoro (Bassa)	8
	Bidens pilosa L.	Ndondokabatuedi (Sawa)	2
	Emilia coccinea (Sims.) G.Don.	Wôgolong (Bassa)	11
	Erigeron floribundus (Kunth) sch.bip	Sibabakouri (Bassa)	2
Burseraceae	*Canarium schweinfurthii* L.	/	9
	Dacryodes edulis (G. Don) H.J. Lam	Sa'a (Sawa)	1
Caesalpiniaceae	*Senna ocidentalis* L.	/	1
Caricaceae	*Carica papaya* L.	Popo (Sawa)	1
Costaceae	*Costur afer* Ker-Gawl.	Mi toumba (Bassa)	1
Crassulaceae	*Bryophyllum pinnatum* (Lam.) Oken	Edibedibe (Sawa)	22
Huaceae	*Afrostyrax lepidophyllus* Mildbr	Tenhômi (Bassa)	1
Lamiaceae	*Lippia* spp.	Ebandajika (Sawa)	2
	Mentha spicata L.	/	3
	Ocimum canum Sims.	Kotimanjo (Sawa)	5
	Ocimum gratissimum L.	Massepo (Sawa)	57
	Solenostemon monostachyus (P.Beauv.) Briq.	Imat (Sawa)	1
	Thymus vulgaris L.	/	1
Liliaceae	*Allium cepa* L.	Manga (Sawa)	2
	Allium sativum L.	Anion (Beti)	10
Musaceae	*Musa paradisiaca* L.	Dikoube (Bassa)	1
Myrtaceae	*Eucalyptus globulus* Libille.	/	5
	Psidium guajava L.	Gwaban (Bassa)	1
	Sizygium aromaticum (Linn.) Merr. & L.M. perry	/	2
Piperaceae	*Piper nigrum* L.	/	1
Poaceae	*Cymbopogon citratus* (DC.) Stapf.	Makaï (Bassa)	49
	Zea mays L.	Guru (Sawa)	1
Rutaceae	*Citrus limon (L.) Burn. F.*	Pouma (Bassa)	1
	Citrus maxima (L.) Osbeck	Pouma (Bassa)	5
	Citrus medica L.	Kepoumaki toro (Sawa)	35
Scophulariaceae	*Scoparia dulcis* L.	Dipapa di nyenguen (Sawa)	3
Solanaceae	*Nicotiana tabacum* L.	Mussono (Sawa)	4
	Solanum lycopersicum L.	Tomato (Bassa)	1
Sterculiaceae	*Kola* spp.	/	1
Zingiberaceae	*Aframomum melegueta* Rosc.	Ndong (Bassa)	1
	Zingiber officinalis Roxb.	Djindja (Bamileke)	21

Source:Authors 2022

Table 2. Quotes from popular recipes used against upper respiratory system diseases.

Code of the respondents interviewed	No. recipe	Infection	Recipes	Associated plant	Part of the plant used	Preparation methods	Administration mode
SWA03	REC01	Pharyngitis					
SWA52	REC02	Sinusitis	*Afrostyrax lepidophyllus*	None	Bark	Maceration	Nasal
BMK01, BSA04, SWA20, SWA29	REC03	Pharyngitis Cold, Sinusitis	*Ageratum conyzoides*	None	Leave	Trituration, Decoction	Nasal, Auricular
SWA47		Pharyngitis					
BSA03, SWA04, SWA05	REC05	Cold, Sinusitis	*Ageratum conyzoïdes*	*Ocimum gratissimum*	Leave	Trituration	Nasal
BMK03	REC06	Cold	*Allium cepa*	None	Bulb	Decoction	Buccal
SWA06	REC07	Cold	*Allium cepa*	*Citrus limon* + *Allium sativum*	Bulb, Fruit	None	Buccal
SWA31	REC08	Cold, Sinusitis	*Bidens pilosa*	*Ocimum gratissimum* + *Ocimum canum*	Leave	Decoction	Vapor bath
BMK08, BMK09, BMK16, BMK23, BTI03, BSA12, SWA11, SWA14, SWA17, SWA22, SWA28, SWA29, SWA30,SWA03, SWA07, SWA08, YBS08	REC09	Pharyngitis, Cold, Sinusitis	*Bryophillum pinnatum*	None	Leave	Decoction, Trituration	Gargling, Nasal
SWA30	REC10	Sinusitis	*Bryophillum pinnatum*	*Citrus medica*	Leave	Trituration	Nasal
BSA03	REC11	Cold	*Bryophyllum pinatum*	*Scoparia dulcis*	Leave	Trituration	Buccal, Nasal
BTI04	REC12	Cold	*Bryophyllum pinnatum*	*Cymbopogon citratus*	Leave	Trituration	Nasal
BSA04, BTI03	REC13	Cold, Sinusitis	*Bryophyllum pinnatum*	*Ocimum gratissimum*	Leave	Trituration	Nasal
BMK01, BMK08, BMK17, BMK19, BMK20, BTI03, SWA08, SWA25, SWA52		Pharyngitis					
BMK03, SWA21, SWA31	REC15	Pharyngitis, Cold, Sinusitis	*Citrus limon*	None	Fruit	Pressing	Gargling, Nasal, Buccal
BTI05, BMK03, BMK05, BSA15, BTI04, SWA48, SWA56, SWA22, SWA34	REC16	Pharyngitis, Cold	*Citrus maxima*	None	Fruit	Pressing	Buccal, Nasal, Gargling
BTI02	REC17	Cold	*Citrus maxima*	*Allium sativum*	Fruit	Pressing, Grinding	Gargling
BSA08	REC18	Cold	*Citrus maxima*	*Citrus medica*	Seed	Pressing, Grinding	Buccal
BMK02, BMK14	REC19	Cold	*Citrus maxima*	*Zingiber offinalis*	Rhizome	Infusion	Buccal
BSA09	REC20	Pharyngitis Cold	*Citrus medica*		Leave	Pressing	Nasal
SWA41	REC21	Cold	*Colocasia esculenta*		Leave	None	Nasal
BSA17	REC22	Cold	*Costus afer*	*Cymbopogon citratus*	Stem	Decoction	Buccal
BMK10, BSA02, BSA10, BSA17, BSA26, SWA09, SWA10, SWA11, SWA20, SWA23, SWA32	REC23	Cold	*Cymbopogon citrates*	None	Leave	Trituration, Decoction	Buccal, Vapor bath, Nasal

Table 2. Contd.

BMK11	REC24	Cold	*Cymbopogon citratus*	*Allium sativum + Zingiber offinalis*	Leave	Decoction	Buccal
SWA26	REC25	Cold	*Cymbopogon citrates*	*Carica papaya*	Leave	Decoction, Trituration	Buccal
SWA47, SWA49	REC26	Cold	*Cymbopogon citrates*	*Citrus maxima*	Leave	Decoction	Buccal
BTI02	REC27	Cold	*Cymbopogon citratus*	*Citrus maxima + Allium sativum*	Leave	Decoction	Buccal
BSA07	REC28	Cold	*Cymbopogon citratus*	*Citrus maxima + Ocimum gratissimum*	Leave	Decoction	Buccal
SWA52	REC29	Cold	*Cymbopogon citratus*	*Citrus maxima + Zingiber officinalis*	Leave	Decoction	Buccal
BMK15, BSA22, BSA24, SWA25	REC30	Cold	*Cymbopogon citratus*	*Citrus medica*	Leave	Decoction	Buccal
SWA02	REC31	Cold	*Cymbopogon citratus*	*Citrus medica + Allium sativum*	Leave	Decoction	Buccal
BSA18	REC32	Cold	*Cymbopogon citratus*	*Citrus medica + Ocimum gratissimum*	Leave	Decoction	Buccal
BMK22	REC33	Cold	*Cymbopogon citrates*	*Citrus medica + Zingiber officinalis*	Leave	Decoction	Vapor bath, Buccal
SWA27	REC34	Cold	*Cymbopogon citratus*	*Dacryodes edulis + Ocimum gratissimum*	Leave	Decoction	Buccal
SWA15	REC35	Cold	*Cymbopogon citratus*	*Dacryodes edulis + Ocimum canum + Ocimum gratissimum*	Leave	Decoction	Vapor bath
BSA12	REC36	Cold	*Cymbopogon citrates*	*Lippia sp.*	Leave	Decoction	Buccal
SWA39, BMK05, BSA01, BSA03, BSA23	REC37	Cold	*Cymbopogon citratus*	*Ocimum gratissimum*	Leave	Grinding, Decoction	Nasal, Buccal
BDA03	REC38	Cold	*Cymbopogon citratus*	*Psidium guajava + Mangifera indica*	Leave	Decoction	Buccal
BMK18, BMK20	REC39	Cold	*Cymbopogon citratus*	*Zingiber officinalis*	Leave	Decoction	Buccal
BDA02, BMK17, SWA04, SWA36, SWA48, SWA53	REC40	Pharyngitis, Cold	*Elaeis guineensis*	None	Leave, Fruit, Stem	Carbonization, Pressing	Buccal, Nasal
BDA01, BMK07, BMK09, BMK12, BMK13, BSA11, BSA15, SWA38, SWA44, SWA55	REC41	Cold, Sinusitis	*Emilia coccinea*	None	Leave	Trituration	Nasal
BSA14	REC42	Cold	*Emilia coccinea*	*Ocimum gratissimum*	Leave	Trituration	Nasal
SWA53, SWA01		Pharyngitis					
BMK10, SWA06, SWA08	REC44	Cold, Sinusitis	*Eucalyptus globules*	None	Leave	Infusion, Decoction, Maceration	Buccal
BMK09	REC45	Cold	*Eucalyptus globulus*	*Zingiber officinalis + Citrus medica*	Leave	Decoction	Buccal
SWA26		Pharyngitis					
BMK01, SWA08, SWA18	REC47	Cold	*Mentha spicata*	None	Leave	Decoction	Buccal, Vapor bath
BSA02, BMK10, BSA10, BSA17, BSA26, SWA09, SWA10, SWA11, SWA20, SWA23, SWA32	REC48		*Musa paradisiaca*	None	Leave	None	Buccal
SWA16, BMK06	REC49	Cold	*Nicotiana tabacum*		Leave	Spray	Nasal, Buccal

Table 2. Contd.

SWA27	REC50	Cold, Sinusitis	*Nicotina tabacum*	*Elaeis guineensis*	Leave	Spray	Nasal
SWA15, SWA26	REC51	Sinusitis	*Ocimum canum*	None	Leave	Trituration	Nasal
BDA04, BTI01, BMK08, BMK13, BMK22, BSA07, BSA09, BSA10, BSA13, BSA19, BSA20, BSA25, BSA27, SWA37, SWA40, SWA42, SWA45, SWA46, SWA49, SWA50, SWA51, SWA54, SWA04, SWA10, SWA11, SWA12, SWA13, SWA17, SWA19, SWA20, SWA23, SWA24, SWA26, SWA29, SWA33, SWA35	REC52	Pharyngitis, Cold, Sinusitis	*Ocimum gratissimum*	None	Leave	Trituration, Decoction	Nasal Buccal
BSA16	REC53	Cold	*Ocimum gratissimum*	*Allium sativum* + *Zingiber officinalis*	Leave	Decoction	Vapor bath/Buccal
SWA01	REC54	Cold	*Ocimum gratissimum*	*Citrus medica*	Leave	Trituration	Buccal
BMK11		Pharyngitis					
SWA03, SWA14, SWA19, SWA24, SWA27, SWA28, SWA31, SWA35		Pharyngitis					
SWA10		Pharyngitis					
BSA22, SWA25	REC58	Pharyngitis, Cold	*Scoparia dulcis*	None	Leave	Trituration	Nasal, Buccal
BFA01, SWA05	REC59	Cold	*Sizygium aromaticum*	None	Floral bud	Decoction	Vapor bath
BSA06	REC60	Sinusitis	*Solanum lycopersicum*	None	Leave	Trituration	Nasal
SWA18	REC61	Cold	*Solenostemon monostachyus*	None	Leave	Trituration	Nasal
BSA07		Pharyngitis					
SWA15		Pharyngitis					
BFA01, BMK14, BSA17, BSA20, SWA10, SWA32	REC64	Pharyngitis, Cold	*Zingiber officinalis*	None	Rhizome	Decoction	Gargling, Buccal
BMK07, BSA24	REC65	Cold	*Zingiber officinalis*	*Allium sativum*	Rhizome	Decoction	Buccal
BMK09, BSA08	REC66	Cold	*Zingiber officinalis*	*Citrus medica*	Rhizome	Decoction, Infusion	Buccal

Source:Authors 2022

no consequences on the extension of the list of species. In fact, the saturation point was achieved with 77 people. In the Dja Reserve, the saturation point was reached with 60 households for back pain (Betti and Lejoly, 2010). Results showed that Sawa group provided the highest number of recipes. That means that knowledge of the recipes is better shared within this group than Bassa and Bamileke. This could mean that this knowledge is more available among tradi- practitioners and the holders of ancestral knowledge.

Plant parts most commonly used by the populations in the studied area were leaves and fruits. Indeed, the accumulation of flavonoids with anti-inflammatory properties occurred in the leaves, flowers, and fruits. These findings support the findings of Mpondo et al. (2017), who stated that the pool of metabolites responsible for plant

Table 3. Distribution of information obtained by ethnic group.

Ethnic groups	Number of recipes	Number of species	Number of citations	ICF
Others	13	16	20	0
Bamiléké	25	18	56	0.69
Bassa	27	18	66	0.74
Sawa	48	45	145	0.69

Source:Authors 2022

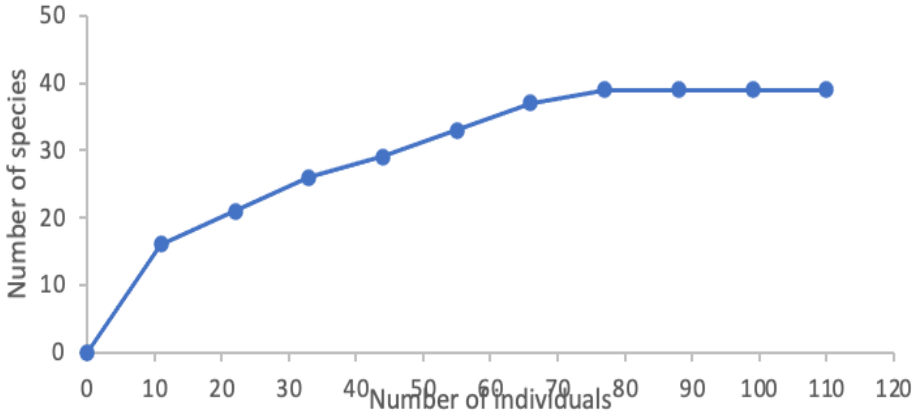

Figure 3. Evolution of the number of plants indicated according to the number of respondents interviewed.
Source:Authors 2022

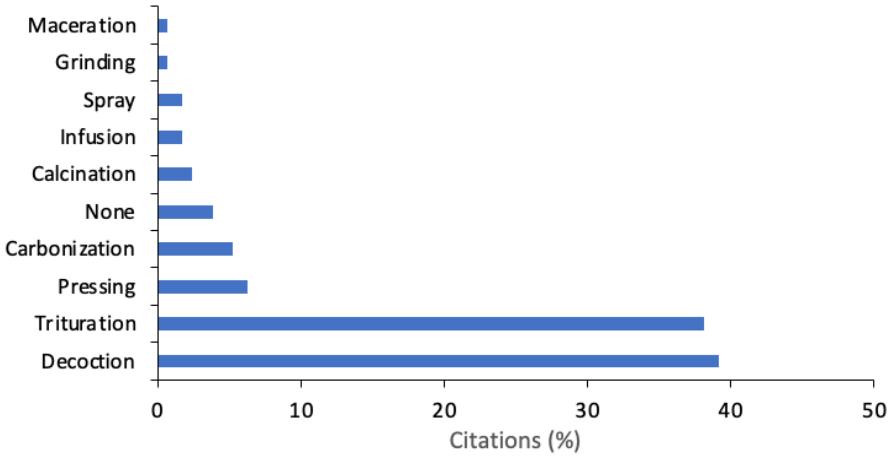

Figure 4. Percentage of preparations methods cited.
Source:Authors 2022

healing properties was in the barks, leaves, and fruits. The most frequently mentioned preparation method in this study was decoction. This is consistent with the findings of other studies conducted in Cameroon and Tanzania (Mpondo et al., 2017; Innocent et al., 2022). Decoction is still the quickest way to extract active

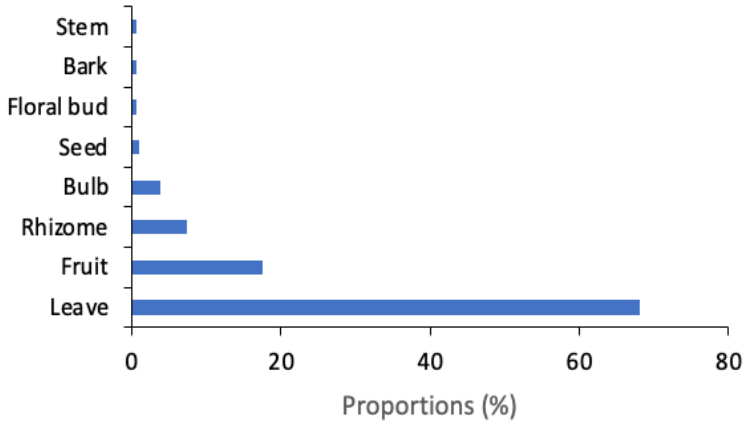

Figure 5. Proportions of parts of the plants used cited.
Source: Authors 2022

ingredients from plants (Ngene et al., 2015).

Conclusion

According to the findings of this study, the Lamiaceae family has the greatest number of species used in the treatment of upper respiratory system diseases. The populations are also familiar with the plants used and their recipes. The plant part with the highest number of citations is the leaves. This means that the overall pressure on the plant is low. Extensive research could be conducted on the most frequently cited species to identify their secondary metabolites.

CONFLICT OF INTERESTS

The authors have not declared any conflict of interests.

REFERENCES

Amorim JL, Simas DLR, Pinheiro MMG, Moreno DSA, Alviano CS, da Silva AJR, Fernandes PD (2016). Anti-Inflammatory Properties and Chemical Characterization of the Essential Oils of Four Citrus Species. Plos One 11(4):1-18. DOI: 10.1371/ journal.pone.0153643.

Aubry P (2020). *Acute respiratory infections*. Ph.D. Thesis. René Labusquière Center, Institute of Tropical Medicine, University of Bordeaux, France.

Badiaga M (2011). Ethnobotanical, phytochemical study and biological activities of *Nauclea latifolia* smith, an African medicinal plant harvested in Mali. Ph.D. Thesis, Blaise Pascal University - Clermont Ferrand II, France.

Baky Sa (2010). The study of acute respiratory infections in children under 5 years in the regions of Kayes, Sikasso, Segou and Mopti. Medicinal Thesis dissertation. University of Bamako, Mali

Betti JL, Lejoly (2010). Contribution to the knowledge of medicinal plants of the Dja Biosphere Reserve in Cameroon: plants used in the treatment of back pain. International Journal of Biological and Chemical Sciences 4(1):193-200.

Briguiche H, Zidane L (2019). Floristic and ethnobotanical study of medicinal plants used in the treatment of diseases of the respiratory system in the Doukkala region. Bulletin of the Scientific Institute, Rabat, Life Science pp. 33- 41.

Daroui-Mokaddem H (2012). Phytochemical and bioloical study of *Eucalyptus globulus* (Myrtaceae), *Smyrnium olusatrum* (Apiaceae), *Asteriscus maritimus* and *Chrysanthemum trifurcatum* (Msterarceae). Ph.D Thesis, University of Badji mokhtar-annaba, Algeria.

Dung PNT, Dao PT, Le TT, Tran HT, Dinh HTT, Pham QL, Tran QT, Pham MQ (2021). Extraction and analysis of chemical composition of *Ocimum gratissimum* L. essential oil in the north of Vietnam. IOP Conference Series: Materials Science and Engineering 1092(1):012092). Doi: 10.1088/1757-899X/1092/1/012092.

Etame-Loe G, Ngoule CC, Mbome B, Kidik Pouka C, Ngene JP, Yinyang J, Okalla Ebongue C, Ngaba GP, Dibong SD (2018). Contribution to the study of medicinal plants and their traditional uses in the department of Lom and Djerem (East, Cameroon). Journal of Animal and Plant Sciences 35(1):5560-5578.

Fatima EH, Akka FB, Dahmani J, Belahbib N, Zidane L (2015). Ethnobotanical study of medicinal plants used in the treatment of respiratory system infections in the Moroccan central plateau. Journal of Animal and Plant Sciences 25(2):3886-3897.

Focho DA, Ndam WT, Fonge BA (2009). Medicinal plants of Aguambu Bamumbu in the Lebialem highlands, Southwest Province of Cameroon. African Journal of Pharmacy and Pharmacology 3(1):1-13.

Foze Ngouondjou T, Mvogo Ottou PB, Etame-Loe G, Ngotta Biyong JB, Ndengue JDM, Tamo A, Wansi JD, Priso RJ, Dibong SD (2019). Ethnobotany and floral characterization of plants used in three major ethnic groups in Cameroon to treat sinusitis. Saudi Journal of Medical and Pharmaceutical Sciences 5(12):1067-1082. DOI: 10.36348/sjmps.2019.v05i12.009.

Foze Ngouondjou T, Mvogo Ottou PB, Ngotta Biyong JB, Ndjib RC, Bemadoum Mbezo F, Tankeu SE, Lamy Lamy GM, Betti JL, Priso RJ (2021). Importance of *Massularia africana* (Myrtaceae), *Piptadeniastrum africanum* (Fabaceae) and *Costus afer* (Zingiberaceae), three plants of the Cameroonian traditional medicine used in the treatment of sinusitis by the village populations of Bomb-Lissom and the medicinal plants sellers of the Douala goat market. American Scientific Research Journal for Engineering, Technology, and Sciences 78(1):109-130.

Garcia R, Ferreira JP, Costa G, Santos T, Branco F, Caramona M, de Carvalho R, Dinis AM, Batista MT, Castel-Branco M, Figueiredo IV (2015). Evaluation of Anti-inflammatory and Analgesic Activities of

Cymbopogon citratus in vivo-Polyphenols Contribution. Research Journal of Medicinal Plant 9(1):1-13.
Innocent E, Marealle AI, Imming P, Moeller L (2022). An Annotated Inventory of Tanzanian Medicinal Plants Traditionally Used for the Treatment of Respiratory Bacterial Infections. Plants 931:1-11. https://doi.org/10.3390/ plants11070931.
Kidik Pouka MC, Ngene JP, Ngoule CC, Mvogo Ottou PB, Ndjib RC, Dibong SD, Mpondo Mpondo E (2015). Characterization of flavonoid medicinal plants in the markets of Douala (Cameroon). International Journal of Biological and Chemical Sciences 9(3):1494-1516. DOI: 10.4314/ijbcs.v9i3.32
Mailu JK, Nguta JM, Mbaria JM, Okumu MO (2020). Medicinal plants used in managing diseases of the respiratory system among the Luo community: an appraisal of Kisumu East Sub-County, Kenya. Chinese Medicine 95(15):1-27. https://doi.org/10.1186/s13020-020-00374-2.
Mathouet H, Sima Obiang C, Mbogho Abogo J, Bourobou Bourobou HP, Ondo JP (2020). Study of Anti-Inflammatory Activity in vitro of four Essential Oils from Gabon. Scholars Academic Journal of Pharmacy 9(1):1-4. DOI: 10.36347/sajp.2020.v09i01.001.
Mpondo Mpondo E, Vandi D, Ngouondjo Foze T, Mvogo Ottou PB, Embollo Enyegue E, Dibong SD (2017). Contribution of the populations of the villages of central Cameroon to the traditional treatments of the affections of the respiratory tract. Journal of Animal and Plant Sciences 32(3):5223-5242.
Ngene JP, Ngoule CC, Kidik Pouka CM, Mvogo Ottou PB, Ndjib RC, Dibong SD, Mpondo Mpondo E (2015). Importance in traditional pharmacopeia of flavonoid plants selled in the eastern Douala markets (Cameroon). Journal of Applied Biosciences 88:8194-8210.
Ugulu I, Baslar S, Yorek N, Dogan Y (2009). The investigation and quantitative ethnobotanical evaluation of medicinal plants used around Izmir province, Turkey. Journal of Medicinal Plant Research 3(5):345-367.