

# **Characteristics of medicinal plants used in traditional medicine for oral diseases treatment in southern Benin.**

## **ABSTRACT**

**Background of the Study:** In the oral health field, dental caries and periodontal diseases are the most frequent pathologies that affect all population to different degrees. In Benin, oral diseases constitute a serious public health problem. Care, whether curative or preventive, requires an investment that many cannot afford in developing countries like Benin. Because of oral diseases extent, appropriate solutions must be found to improve oral health in Benin. Place and Duration of Study: Data were collected through ethnobotanical surveys in the districts of Allada, Abomey-Calavi, Cotonou and Porto-Novo from May to August 2021.

**Aim:** This study aims to identify the medicinal plants used in traditional medicine to treat oral diseases.

**Methodology:** Prior to the ethnobotanical study itself, we proceeded to locate the markets where medicinal plants are sold in the study area. Then, in order to ensure a high objectivity degree of the data obtained during our study, the survey is carried out used a preestablished questionnaires. The questionnaire focused on the following main points: (1) Profile of the respondent (surname, first name, age, gender, education level and experience in the field), (2) informations on the recipe (oral uses, vernacular and scientific names, parts used, preparation method, route and mode of administration, contraindications and side effects). The medicinal plants vendors were selected based their availability displays size and frequency level of displays.

**Results:** One hundred and three (103) medicinal plants species were identified, divided into **forty-four (44)** families and ninety-one (91) genera. The most used plants are *Zanthoxylum zanthoxyloides* (11.72%), *Ocimum americanum* (4.88%), *Ocimum gratissimum* (4.39%), *Lantana camara* (2.93%), *Bridelia ferruginea* (2.93%), *Moringa oleifera* (2.44%), *Lippia multiflora* (2.44%), *Mangifera indica* (2.44%), *Dialium guineense* (2.44%), *Pseudocedrela kotschyi* (1.95%), *Justicia flava* (1.95%), *Uvaria chamae* (1.95%) and *Xylopia aethiopica* (1.95%). The most commonly plant parts used were leaves and roots. The decoction of these parts in mouthwash or gargle is most used for oral diseases treatment.

**Conclusion:** The flora of Benin contains a rich diversity of plants. Many of which are used in traditional Beninese medicine and have the potential to provide pharmacologically active natural products. In order to know the different plants used to treat oral diseases, an ethnobotanical survey was conducted in southern Benin (district of Allada, Abomey-Calavi, Cotonou and Porto-novo).

*Keywords: Medicinal plants, oral diseases, public health, ethnobotanical study, Benin.*

## **1. INTRODUCTION**

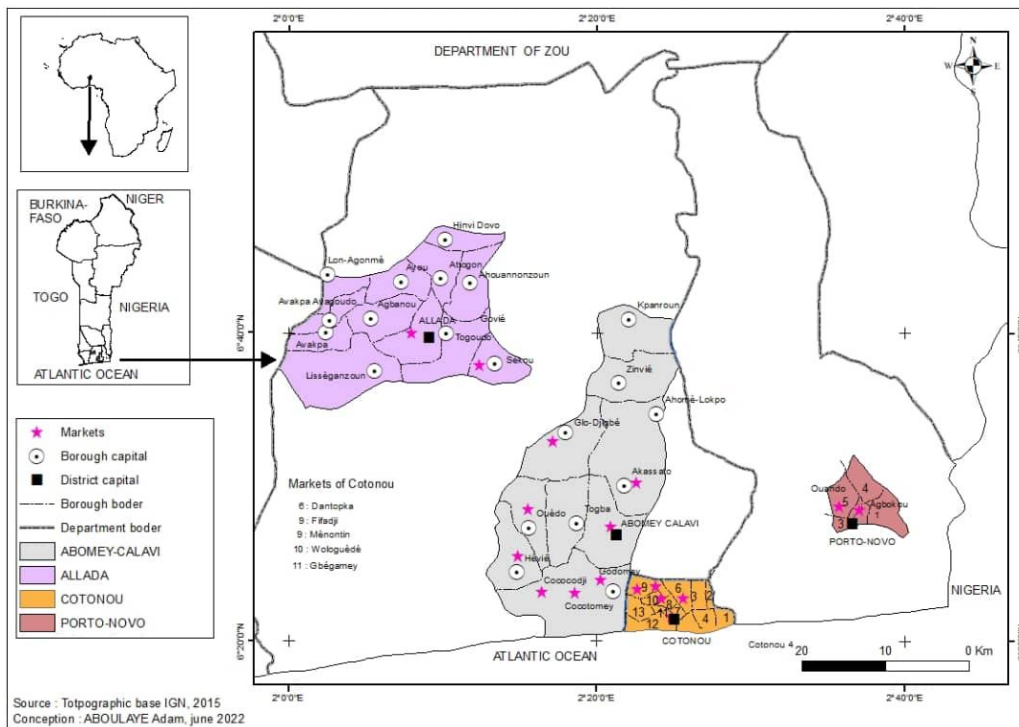
Oral diseases are a group of diseases and disorders that affect the teeth and mouth, including a craniofacial disorder, congenital anomalies, injuries and various infections. Oral diseases have a huge impact on the individual's well-being, social behaviour and physical behaviour. They are characterised by various dental and periodontal lesions that can lead to the formation of infectious foci [1]. The high frequency of oral diseases, their impact on general health and on life quality, as well as their very unequal distribution in the population, make them a major public health [2]. In oral health field, the most frequent pathologies are dental caries and periodontal diseases because of their frequency, which affect all population class to varying degrees, their consequences on the individual and society and the expense of their treatment [3]. According to the World Health Organisation, it is the fourth most common global disease after cancer, heart disease and HIV/AIDS, affecting over 3.5 billion people worldwide [4]. In Africa, between 54.28% and 73.70% of the population is affected by oral diseases [5]. **Like** in other developing countries, oral diseases are a serious public health problem in Benin. Over 50% of the population suffers from oral diseases, both in rural and urban areas [6]. These diseases are caused by risk factors common to all non-communicable diseases including the consumption of sugar, smoking, alcohol and poor hygiene practices, as well as the socio-economic factors that underpin them [7]. Both curative and preventive care require an investment that many people in developing

countries are unable to afford. In addition, as in other health sectors, there is a shortage of staff and other necessary resources [8]. As such, in low and middle income countries, as well as in disadvantaged populations, the morbidity rate of these diseases is undeniably higher. Antibiotic use, surgeries, debridements and tooth extractions are common treatment methods. These treatments are expensive and require specialised dental workers, both of which are lacking in developing countries such as Benin. Modern oral hygiene products, such as mouthwash, contain chemical agents such as chlorhexidine and ethanol.. In this context, the search for a solution deserves to go beyond the conventional medicines used. In Africa, due to our limited financial resources, there is a tradition of oral hygiene based on toothpaste sticks and mouthwash teas use for oral diseases management. Thus, this study aims to identify the medicinal plants commonly used in oral health care in southern Benin.

## 2. MATERIAL AND METHODS

### Study area

Benin is a West Africa country bordered by Burkina Faso, Niger, Nigeria, Togo and Atlantic Ocean (Figure 1). Benin lies between the Niger River in the north and the coastal plain in the south. The present study was carried out in southern Benin. This region belongs to the Guinean-Congolese zone, contains a mosaic dense rainforest, savannahs, grasslands, mangrove swamps and fallow lands. It is located between 6°25' N and 7°30' N over an area of 17,109 km<sup>2</sup>. The climate is sub-equatorial, characterised by a bimodal rainfall regime (April-June and September-November) with two rainy seasons alternated by two dry seasons. The average rainfall is 1200 mm per year. The average annual temperature is 28 °C and the air humidity between 69% and 97% [9]. Ferrallitic soils on clayey sediments, hydromorphic soils in valleys, lowlands and alluvial plains, vertisols in the Lama depression and tropical eutrophic brown soils are the most dominant soils [10].



**Figure 1: Overview of medicinal plant markets involved in this study**

### Data collection

The study was conducted during the period from May to August 2021. Data were collected through ethnobotanical surveys in the districts of Allada, Abomey-Calavi, Cotonou and Porto-Novo. Prior to the ethnobotanical study itself, we proceeded to locate the markets where medicinal plants are sold in the study area. Then, in order to ensure a high objectivity degree of the data obtained during our study, the survey is

carried out **by using** a preestablished questionnaires. The questionnaire focused on the following main points: (1) Profile of the respondent (surname, first name, age, gender, education level and experience in the field), (2) informations on the recipe (oral uses, vernacular and scientific names, parts used, preparation method, route and mode of administration, contraindications and side effects). The medicinal plants vendors were selected based their availability displays size and frequency level of displays. Fifty-five (55) displays of medicinal plant and 17 markets (Ouando, Agbokou, Dantopka, Wologuèdè, Fifadji, Gbégamey, Mènontin, Godomey, Kpota, Cococodji, Cocotomey, Hêvié, Ouèdo, Akassato, Glo-djibgé, Allada and Sékou) were visited (Figure 1). The plants cited by the respondents were purchased and placed in an herbarium for taxonomic identification at the botanical garden of Abomey-Calavi university (Benin).

### **Data analysis**

The data collected from the surveys were processed using Excel 2007 spreadsheet software to establish the use frequencies of medicinal plan. The use frequency (F) of each plant was calculated using the formula: (Number of plant citations under consideration) / (Total number of citations for all plants).

## **3. RESULTS**

### **Social-cultural profile of respondents**

The present study enrolled 55 herbalists (51 females and 4 male). These herbalists were divided into four age groups. Table 1 analysis shows that the age range of the herbalists surveyed is between 20 and 72 years with an average age of 45. The age group of 41-50 was the most represented (43.63%). Of these, 56.36% were illiterate, 30.90% had a primary level and 12.72% had a secondary level. As regards the respondents experience in traditional medicine, they have at least ten (10) years of experience. As for the origin of the knowledge, 78.18% of the herbalists surveyed were initiated into traditional medicine practices within the family, while 21.81% acquired it through their **experiences** outside the family framework.

**Table 1: Socio-cultural data of respondents**

<b>Socio-cultural parameters</b>	<b>Frequency</b>	<b>Percentage (n=55)</b>
<b>Gender</b>		
Female	51	92.72
Male	4	7.27
<b>Age</b>		
20-30	9	16.36
31-40	18	32.72
41-50	24	43.63
51-72	4	7.27
<b>Level of study</b>		
Illiterate	31	56.36
Primary	17	30.90
Secondary	7	12.72
<b>Experience in the field</b>		

10-20	19	34.54
21-30	26	47.27
> 30	10	18.18

#### Origin of knowledge

Family legacy	43	78.18
Experience	12	21.81

### Characteristics of medicinal plants used to treat oral diseases in southern Benin

One hundred and three (103) species were identified. These medicinal plants species belong to 91 genera and 44 botanical families. Among these 44 families the most represented were: Leguminosae (15.90%), Euphorbiaceae (11.36 %), Lamiaceae (11.36%) then Annonaceae, Asteraceae, Meliaceae, Sterculiaceae and Verbenaceae (9.09%) (Figure 2A). The medicinal plant species most commonly sold by herbalists for oral diseases treatment are: *Zanthoxylum zanthoxyloides* (11.72%), *Ocimum americanum* (4.88%), *Ocimum gratissimum* (4.39%), *Lantana camara* (2.93%), *Bridelia ferruginea* (2.93%), *Moringa oleifera* (2.44%), *Lippia multiflora* (2.44%), *Mangifera indica* (2.44%), *Dialium guineense* (2.44%), *Pseudocedrela kotschyi* (1.95%), *Justicia flava* (1.95%), *Uvaria chamae* (1.95%) and *Xylopiya aethiopica* (1.95%). Regarding the parts used, the survey revealed that almost all organs are used in the oral diseases treatment. The most used parts are: leaves (27.77%), roots (22.22%), leafy stems (19.04%), bark (17.46%), stems (7.93%), fruits (2.38%), seeds (1.58%), flowers (0.79%) and tubers (0.79%) (Figure 2B). Overall, 6 preparation methods were recorded in this study. Decoction is the most used (86.66%), followed by trituration (10.47%), maceration (6.66%), crushing (4.76%), infusion (2.85%) and then poultice (0.95%) (Figure 2C). Regarding the mode of administration, gargling is the most used (94.17%) followed by dressing (4.85%) and inhalation (0.97%) (Figure 2D). Six (6) oral diseases are most frequently treated with medicinal plants: Tooth decay, gingivitis, odontology, bad breath, dental disorder and mouth ulcers (Table 2).

**Figure 2: Botanical families, parts used, preparation and administration modes of medicinal plants**

**Table 2:** Overview informations on medicinal plants used to treat oral diseases identified F = Fon, ba = Bariba, y = Yorouba, g = Goun, d = Dendi

Scientific name	Family name	Local name	Part used	Diseases treated	Preparation modes	Utilisation modes	FC (%)
<i>Zanthoxylum zanthoxyloides</i> (Lam.)	Rutaceae	Hèdo	Root, root bark	Tooth decay, gingivitis, toothache	Decoction, infusion	Mouthwash	11.22
<i>Ocimum americanum</i> L.,	Lamiaceae	Kesu kesu, bohnoroku	Leafy stem	Tooth decay, gingivitis	Trituration	Mouthwash	4.88
<i>Ocimum gratissimum</i> L.,	Lamiaceae	Tchao (f), chukula (ba)	Leafy stem	Tooth decay	Trituration	Mouthwash	4.39
<i>Lantana camara</i> L.,	Verbenaceae	Nyèya, Hlatchiayo(f)	Leafy stem	Tooth decay	Decoction	Mouthwash	2.93
<i>Bridelia ferruginea</i> Benth.,	Euphorbiaceae	Honsou kokoué (f, g); tona (ba)	Trunk bark	Tooth decay	Maceration	Mouthwash	2.93
<i>Moringa oleifera</i> Lam.,	Moringaceae / Myristicaceae	Kpatima (f)	Root, leafy stem	Toothache	Decoction	Mouthwash	2.44
<i>Lippia multiflora</i> Moldenke,	Verbenaceae	Aglala (g)	Leafy stem	Tooth decay, toothache	Pounding	Bandage	2.44
<i>Mangifera indica</i> L.,	Anacardiaceae	Manga (f), mango (ba)	Trunk bark	Tooth decay, gingivitis	Decoction	Mouthwash	2.44
<i>Dialium guineense</i> Willd.,	Leguminosae-Caesalpinioideae	Asswensswen (f, g)	Stem, root, leaves	Tooth decay, gingivitis	Decoction	Mouthwash	2.44
<i>Pseudocedrela kotschyi</i> (Schweinf.) Harms.	Meliaceae	Atindodokpwe(f)	Root, leaves, root bark, stem	Tooth decay, bad breath	Decoction	Mouthwash	1.95
<i>Justicia flava</i> (Forssk.) Vahl	Acanthaceae	Fiofioma (f).	Leafy stem	Tooth decay	Decoction	Mouthwash	1.95
<i>Uvaria chamae</i> P.Beauv.,	Annonaceae	Ayadaha (f), tijera (ba)	Root	Tooth decay	Decoction	Mouthwash	1.95
<i>Xylopia aethiopica</i>	Annonaceae	Kpédjélékoun	Seed	Tooth decay, bad breath	Decoction	Mouthwash	1.95

<i>Capsicum annum L.</i> ,	Solanaceae	Gbatakin (f, g).	Fruit	Gingivitis, toothache	Decoction	Mouthwash	1.46
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**Table 2:** Overview informations on medicinal plants used to treat oral diseases identified (continued) F = Fon, ba = Bariba, y = Yorouba, g = Goun, d = Dendi

Scientific name	Family name	Local name	Part used	Diseases treated	Preparation modes	Utilisation modes	FC (%)
<i>Carissa spinarum L.</i> ,	Apocynaceae	Ahazodo (f)	Root	Tooth decay	Decoction	Mouthwash	1.46
<i>Hyptis suaveolens (L.) Poit.</i> ,	Lamiaceae	Azongbidi (f), disibu (ba)	Leafy stem	Gingivitis, bad breath	Decoction	Mouthwash	1.46
<i>Piper guineense Schumach. &amp; Thonn.</i> ,	Piperaceae	Poivre de guiné (fr)lènlènkoun (f, g)	Fruit	Tooth decay	Decoction	Mouthwash	1.46
<i>Allium sativum L.</i> ,	Alliaceae	Ayo (f, g, y)	Leaves	Tooth decay	Decoction	Mouthwash	1.46
<i>Ceropegia racemosa N.E.Br</i>	Asclepiadaceae	Tchirigoun	Root	Bad breath, gingivitis	Decoction	Mouthwash	1.46
<i>Caesalpinia pulcherrima (L.) Sw.</i> ,	Leguminosae-Caesalpinioideae	Orgeuil de Chine (fr)	Leafy stem	Toothache, teething disorder	Decoction	Mouthwash	0.98
<i>Acacia nilotica (L.)</i>	Leguminosae-Mimosoideae	Bani (ba)	Leafy stem	Gingivitis,bad breath	Decoction	Mouthwash	0.98
<i>Securidaca longepedunculata Fresen.</i> ,	Polygonaceae	Kpatado	Root	Tooth decay	Decoction	Mouthwash	0.98
<i>Parkia biglobosa (Jacq.) R.Br. ex Benth.</i> ,	Leguminosae-Mimosoideae	Néré(fr)	Trunk bark	Gingivitis, canker sores	Decoction	Mouthwash	0.98
<i>Petiveria alliacea L.</i> ,	Piperaceae	Zoroma (f),	Leafy stem	Tooth decay, gingivitis	Decoction	Mouthwash	0.98
<i>Periploca nigrescens Afzel.</i> ,	Asclepiadaceae	Déssi kanwé	Leafy stem	Tooth decay, gingivitis	Decoction	Mouthwash	0.98

<i>Azadirachta indica</i> A. Juss.	Meliaceae	Quininetin (f), , neem (ba)	Trunk bark, leaves, stem	Tooth decay, bad breath	Decoction	Mouthwash	0.98
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**Table 2:** Overview informations on medicinal plants used to treat oral diseases identified (continued) F = Fon, ba = Bariba, y = Yorouba, g = Goun, d = Dendi

Scientific name	Family name	Local name	Part used	Diseases treated	Preparation modes	Utilisation modes	FC (%)
<i>Ehretia cymosa</i> Thonn. ex <i>Sehum. var</i>	Boraginaceae	Myoma (g)	Leaves	Teething disorder	Trituration	Mouthwash	0.98
<i>Trilepisium</i> <i>madagascariensis</i> De.,	Moraceae	Hunde hunde	Trunk bark, leaves, stem	Gingivitis	Decoction	Mouthwash	0.98
<i>Anacardium occidentale</i> L.,	Anacardiaceae	Akaju (f)	Trunk bark	Canker sores, tooth decay	Decoction	Mouthwash	0.98
<i>Khaya senegalensis</i> (Desr.) A.Juss.,	Meliaceae	Zunzatin (f)	Trunk bark	Tooth decay	Decoction	Mouthwash	0.98
<i>Baphia nitida</i> Lodd	Leguminosae- Papilionoideae	Sokpapkè	Leafy stem	Toothache	Trituration	Mouthwash	0.49
<i>Pteleopsis suberosa</i> Engl. & Diels,	Combretaceae	Kluklu godo	Trunk bark	Tooth decay, gingivitis	Decoction	Mouthwash	0.49
<i>Senna alata</i> (L.) Roxb.	Leguminosae- Caesalpinioideae	Amasu yovotèm (f)	Leafy stem	Tooth decay	Decoction	Mouthwash	0.49
<i>Eugenia unijlora</i> L.,	Myrtaceae	Pitanga (y, n)	Leafy stem	Toothache	Decoction	Mouthwash	0.49
<i>Tetrapleura tetraptera</i> (Schumach. & Thonn.) Taub.,	Leguminosae- Mimosoideae	Lendja (f)	Leafy stem	Tooth decay, bad breath	Decoction	Mouthwash	0.49
<i>Imperata cylindrica</i> (L.) P.Beauv.,	Poaceae	Sè (f), abosu (ba)	Root, leaves	Tooth decay	Decoction	Mouthwash	0.49
<i>Clausena anisata</i> (Willd.) Hook.f. ex Benth.,	Rutaceae	Gbozohouin (f).	Root	Gingivitis, teething disorder	Maceration	Mouthwash	0.49

<i>Phyllanthus amarus</i> Schumach. & Thonn.,	Euphorbiaceae	Henlenwe (f), sobaru (ba)	Leafy stem	Tooth decay	Decoction	Mouthwash	0.49
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**Table 2:** Overview informations on medicinal plants used to treat oral diseases identified (continued) F = Fon, ba = Bariba, y = Yorouba, g = Goun, d = Dendi

Scientific name	Family name	Local name	Part used	Diseases treated	Preparation modes	Utilisation modes	FC (%)
<i>Casuarina equisetifolia</i> L.,	Casuarinaceae	Filao (fr)	Trunk bark	Tooth decay, canker sores	Decoction	Mouthwash	0.49
<i>Ocimum basilicum</i> L.,	Lamiaceae	Akohun (g)	Leafy stem	Tooth decay, gingivitis	Decoction	Mouthwash	0.49
<i>Chenopodium ambrosioides</i> L.,	Chenopodiaceae	Amahun kokwe(f)	Leafy stem	Tooth decay	pounding	Bandage	0.49
<i>Monodora myristica</i> (Gaertn.) Dunal,	Annonaceae	Sasalikun (f), dukubinu (ba).	Root	Tooth decay, toothache	Decoction	Mouthwash	0.49
<i>vernonia cinerea</i> (L.) Less.,	Asteraceae	Hunsi kouse	Trunk bark, root	Toothache	Maceration	Mouthwash	0.49
<i>Jatropha curcas</i> L.,	Euphorbiaceae	Gbagidi kpotin (f, g), Bukatu (ba)	Root, stem, leaves	Tooth decay, canker sores	Decoction	Mouthwash	0.49
<i>Chromolaena odorata</i> (L.) R.M.King,	Asteraceae	agatouma	Leafy stem	Tooth decay	Decoction	Mouthwash	0.49
<i>Zingiber officinale</i>	Zingiberaceae	Dote	Tuber	Tooth decay	Decoction	Mouthwash	0.49
<i>Citrullus lanatus</i> (Thunb.) Matsum. & Nakai,	Cucurbitaceae	Goussi (f, g)	Fruit	Toothache	Decoction, infusion	Mouthwash	0.49
<i>Abrus precatorius</i> L.,	Leguminosae- Papilionoideae	Vivima (f),	Leafy stem	Tooth decay, gingivitis, teething disorder	Decoction	Mouthwash	0.49
<i>Triclisia subcordata</i> Oliv.,	Menispermaceae	Yfoglosu (g)	Leaves	Tooth decay	Decoction	Mouthwash	0.49
<i>Landolphia dulcis</i> (Sabine) Pichon,	Apocynaceae	Aboto (f)	Stem	Bad breath	Decoction	Mouthwash	0.49

<i>Newbouldia laevis</i>	Bignoniaceae	Hounmanhounmant in (f)	Stem	Bad breath	Decoction	Mouthwash	0.49
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**Table 2:** Overview informations on medicinal plants used to treat oral diseases identified (continued) F = Fon, ba = Bariba, y = Yorouba, g = Goun, d = Dendi

Scientific name	Family name	Local name	Part used	Diseases treated	Preparation modes	Utilisation modes	FC (%)
<i>Crateva adansonii</i> DC. <i>ssp. adansonii</i> ,	Capparaceae	Onton zunzen (f, g), gorigiberu (ba).	Leaves	Canker sores, teething disorder	Cataplasm	Mouthwash	0.49
<i>Cocos nucifera</i> L.,	Arecaceae	Gonkè (tin) (f);kpaakpa agbo (ba)	Trunk bark, root	Tooth decay, gingivitis	Decoction	Mouthwash	0.49
<i>Prosopis africana</i> (Guill. & Perr.) Taub.,	Leguminosae- Mimosoideae	Kakè (t);	Stem, leaves	Tooth decay, bad breath	Decoction	Mouthwash	0.49
<i>Psidium guajava</i> L.,	Myrtaceae	Kenkuntin (f)	Stem, leaves	Tooth decay, bad breath	Decoction	Mouthwash	0.49
<i>Vitellaria paradoxa</i> C.F.Gaertn. <i>ssp.</i>	Scrophulariaceae	Limutin (f)	Trunk bark	Gingivitis	Maceration	Mouthwash	0.49
<i>Olax subscorpioidea</i> Oliv.,	Oleaceae	Mitin	Leaves	Tooth decay, gingivitis	Decoction	Mouthwash	0.49
<i>Triplochiton scleroxylon</i> K.Schum.,	Sterculiaceae	Xwetin (f)	Leaves	Tooth decay, gingivitis	Decoction	Mouthwash	0.49
<i>Sarcocephalus latifolius</i> (Sm.) E.A.Bruce,	Rubiaceae	Kodo (g) gàyèru (ba)	Root	Tooth decat, gingivitis	Decoction	Mouthwash	0.49
<i>Senna siamea</i> (Lam.) H.S.Irwin & Barneby	Leguminosae- Caesalpinioideae	Acacia do	Root	Toothache	Decoction	Mouthwash	0.49
<i>Acanthospermum</i> <i>hispidum</i> DC.,	Asteraceae	Kponomi (g)	Leafy stem	Tooth decay, gingivitis	Decoction	Mouthwash	0.49
<i>Momordica charantia</i> L.,	Cucurbitaceae	Nyensinken(f)	Leafy stem	Tooth decay, gingivitis	Decoction	Mouthwash	0.49
<i>Pavetta corymbosa</i> (DC.)	Rubiaceae	Loxu (g)	Leafy stem	Toothache, gingivitis	Decoction	Mouthwash	0.49

<i>F.N.Williams var. corymbosa,</i>							
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**Table 2:** Overview informations on medicinal plants used to treat oral diseases identified (continued) F = Fon, ba = Bariba, y = Yorouba, g = Goun, d = Dendi

Scientific name	Family name	Local name	Part used	Diseases treated	Preparation modes	Utilisation modes	FC (%)
<i>Pterocarpus erinaceus Poir.,</i>	Leguminosae-Papilionoideae	Kozo (g) kosso (d)	Trunk bark	Tooth decay, gingivitis	Decoction	Mouthwash	0.49
<i>Carica papaya L.,</i>	Caricaceae	Kpèn	Leafy stem	Tooth decay, gingivitis	Decoction	Mouthwash	0.49
<i>Raphiostylis beninensis Planch. ex Benth.,</i>	Icacinaceae	Kpakplakan (1)	Leafy stem	Toothache	Maceration	Mouthwash	0.49
<i>Philenoptera cyanescens (Sehumacb. &amp; Thonn.) Roberty,</i>	Leguminosae-Papilionoideae	Aho (f)	Root	Tooth decay, gingivitis	Decoction	Mouthwash	0.49
<i>Loganiaceae</i>		Gunswe (f)	Root	Tooth decay, gingivitis	Decoction	Mouthwash	0.49
<i>Melaleuca leucadendron L.,</i>	Myrtaceae	Kpenma	Leaves	Tooth decay, bad breath	Trituration	Mouthwash	0.49
<i>Acacia sieberiana DC. var. vil/osa,</i>	Leguminosae-Mimosoideae	Aduwe, caga (f) sagunu kpika (ba)	Trunk bark	Tooth decay, toothache	Decoction	Mouthwash	0.49
<i>Annona senegalensis Pers.</i>	Annonaceae	Nyiglwe, wenglema (f), sampuru (ba)	Leaves	Canker sores, bad breath	Trituration	Mouthwash	0.49
<i>Jatropha gossypifolia L.,</i>	Euphorbiaceae	Nyikpotin vovo (f), bukату duabinu (ba)	Leaves	Tooth decay	Decoction	Mouthwash	0.49
<i>Hymenocardia acida Tul.,</i>	Euphorbiaceae	Sokpintin, sojatin (f)	Leaves	Canker sores	Decoction	Mouthwash	0.49
<i>Paullinia pinnata L.,</i>	Sapindaceae	Seseleviken (f, g), afatoka (ba)	Leaves	Tooth decay	Decoction	Mouthwash	0.49
<i>Senna occidentalis (L.) Link,</i>	Leguminosae-Caesalpinioideae	Kinikiniba, kpayoywe(f)	Stem, leaves	Teething disorder	Trituration	Mouthwash	0.49

<i>Siphonochilus aethiopicus</i> (Schweinf.)	Zingiberaceae	Limun (f)	Root	Tooth decay, toothache	Decoction	Mouthwash	0.49
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**Table 2:** Overview informations on medicinal plants used to treat oral diseases identified (continued) F = Fon, ba = Bariba, y = Yorouba, g = Goun, d = Dendi

Scientific name	Family name	Local name	Part used	Diseases treated	Preparation modes	Utilisation modes	FC (%)
<i>Vernonia adoensis</i> <i>Sch.Bip. ex Walp.,</i>	Asteraceae	Alomaklu	Root	Tooth decay	Decoction	Mouthwash	0.49
<i>Waltheria indica L.,</i>	Sterculiaceae	Adassounsoun-ma (f, g), nangara (ba).	Leaves	Tooth decay	Decoction	Mouthwash	0.49
<i>Amaranthus dubius Mart.</i> <i>ex Thell.,</i>	Amaranthaceae		Leaves	Tooth decay	pounding	Bandage	0.49
<i>Chamaecrista rotundifolia</i> (Pers.)	Leguminosae-Caesalpinioideae		Leaves	Teething disorder	Trituration	Mouthwash	0.49
<i>Gymnosporia senegalensis</i> (Lam.) Loes.,	Celastraceae	Jaduma, howutinm(f), sasisakinè (ba).	Leaves	Canker sores	Trituration	Mouthwash	0.49
<i>Nicotiana tabacum L.,</i>	Solanaceae	Agboke, azowiwi	Leaves	Tooth decay	pounding	Bandage	0.49
<i>Heliotropium indicum L.,</i>	Boraginaceae	Koklosu denpaja, agamasiru (ba)	Leaves	Tooth decay, teething disorder	Decoction	Mouthwash	0.49
<i>Afraegle paniculata</i> (Schumach. & Thonn.) <i>Engl.,</i>	Rutaceae	Atinkeke	Trunk bark, leaves	Tooth decay, gingivitis	Decoction	Mouthwash	0.49
<i>Lannea A.Rich.,</i>	Anacardiaceae	Zuzu (f), mon (ba)	Trunk bark	Tooth decay	pounding	Bandage	0.49
<i>Ceiba pentandra (L.)</i> <i>Gaertn.,</i>	Bombacaceae	Guédéhunsou (f)	Trunk bark, leaves	Gingivitis	Decoction	Mouthwash	0.49

<i>Capparis tomentosa</i> Lam.,	Capparaceae	Koto (d)	Root	Teething disorder	Maceration	Mouthwash	0.49
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**Table 2:** Overview informations on medicinal plants used to treat oral diseases identified (continued) F = Fon, ba = Bariba, y = Yorouba, g = Goun, d = Dendi

Scientific name	Family name	Local name	Part used	Diseases treated	Preparation modes	Utilisation modes	FC (%)
<i>Tamarindus indica</i> L.,	Caesalpinioideae	Bokoso, mupèn (f)	Leaves	Toothache	Decoction	Mouthwash	0.49
<i>Diospyros mespiliformis</i> Hochst.	Ebenaceae	Ken, kenwi (f), wonyibu, wibi (ba)	Leaves	Tooth decay	Decoction	Mouthwash	0.49
<i>Indigofera tinetoria</i> L. var. <i>tinetoria</i> ,	Papilionoideae	Agonjema (f)	Root	Toothache, teething disorder	Decoction	Mouthwash	0.49
<i>Pterocarpus erinaceus</i> Poir.,	Papilionoideae	Kozo, gbèngètin (f)	Trunk bark	Tooth decay	Decoction	Mouthwash	0.49
<i>Hyptis spicigera</i> Lam.	Lamiaceae		Leaves	Tooth decay	Decoction	Mouthwash	0.49
<i>Trichilia emetica</i> Vahl,	Meliaceae	Civi,tchivi (f)	Root	Toothache	Decoction	Mouthwash	0.49
<i>Acacia seyal</i> Delile var. <i>seyal</i> ,	Leguminosae- Mimosoideae	Menè (d)	Trunk bark, leaves	Tooth decay, canker sores	Decoction	Mouthwash	0.49
<i>Ximenia americana</i> L.,	Oleaceae	Klivovwe (f), so munoro (ba)	Root, trunk bark, leaves	Tooth decay	Infusion	Mouthwash	0.49
<i>Cymbopogon giganteus</i> (Hochst.) Chiov.,	Poaceae	Gbezen (f)	Leaves	Toothache	Decoction	Mouthwash	0.49
<i>Zea mays</i> L.,	Poaceae	Gbadé (f)	Flower	Tooth decay	Trituration	Mouthwash	0.49
<i>Sterculia setigera</i> Delile,	Sterculiaceae	Nyinnyinfou (f, g)	Leafy stem	gingivitis, teething disorder	Decoction	Mouthwash	0.49
<i>Waltheria indica</i> L.,	Sterculiaceae	Adassounsoun(f, g)	Root	Tooth decay, gingivits, toothache	Decoction	Mouthwash	0.49

<i>Stachytarpheta indica</i> (L.) Vahl,	Verbenaceae		Stem, leaves	Toothache	Decoction	Mouthwash	0.49
<i>Vitex doniana</i> Sweet,	Verbenaceae	Fontin, koto (f)	Root	Tooth decay	Maceration	Mouthwash	0.49
<i>Mimosa pigra</i> L.,	Leguminosae- Mimosoideae	Ènwa agogo (y)	Root	Tooth decay	Decoction	Mouthwash	0.49

#### 4. Discussion

This ethnobotanical study collected information on medicinal plants commonly used in oral health care in four districts in southern Benin, namely Allada, Abomey-Calavi, Cotonou and Porto-Novo. In this study, the choice of traditional herbalists is based on their experiences and their rich knowledge in the medicinal uses of plant species acquired through generations. The results of this survey show that a large number of plants are traditionally used in the treatment of oral diseases in Benin. About 92 % of herbalists are women. This shows that the medicinal plants trade is dominated by women in southern Benin. This result confirms those obtained by Agbankpé et al. [11] and Dougnon et al. [12] in which the practice of traditional medicine is much more reserved for older women in southern Benin. These results are also contrary to the findings of Najem et al. [13] who proved that traditional medicine is more practiced by the male gender in Morocco. Similarly, it contradicts the findings of Mutie et al. [14] in Kenya who showed that 66.67% of herbal medicine traders are male. It should be noted that in Benin, it is the men who pick the medicinal plants mainly in the forests. They then sell them to women who set up shop in the markets. Also, in some countries like Morocco, women work less than men because of their culture. Furthermore, most of the respondents notably 43.63% belong to the age group of 41-50 years, 32.72% are in the age group of 31-40 years, 16.36% are below 30 years and 7.27% are above 50 years. This shows a clear trend of rejuvenation of the herbalist profession and the return of the society to the use of traditional herbal medicine with a good transmission of popular knowledge from the elderly to the young. Also, the current study shows an increasing involvement of young people in the medicinal plant trade, which could be due to the lack of employment but not necessarily to their expertise in plant knowledge. These results are close to those obtained by Fatiha et al. [15] who showed that trading and traditional herbal medicine are day by day activities carried out by the youth. Illiterates represent 56.36% of the respondents. Although people are becoming aware of the side effects of pharmaceutical treatments based on chemical molecules, the lack of formal training may be a contributing factor to poor handling of medicinal plants. The use and trade of medicinal plants is no longer restricted to traditional healers but has entered the informal and increasingly formal commercial sector. This presents a health hazard due to the lack of education. Regarding the origin of medicinal plants knowledge, family heritage predominates (78.18%). Agbankpé et al. [11] noted, following a survey in South Benin that 87.86% of respondents had inherited this practice from their ancestors. Our survey allowed us to observe that knowledge of a recipe in traditional medicine is above all a family secret that is transmitted from generation to generation through customs and oral tradition without distinction of gender or age. Indeed, the elderly are believed to provide the most reliable information and have some confidence that they hold much of the ancestral knowledge that has been transmitted orally [16]. This same observation has also been made by other researchers ([17]; [18]). Our results also indicate that 47.27% of the respondents have been practicing the herbalist profession for a long period (21 to 30 years), 34.54% have been practicing the same profession for 10 to 20 years, and 18.18% have more than 30 years of experience as an herbalist. This is a positive indicator, as the profession requires longer experience, especially in plant identification, diagnosis and patient therapy. These results are close to those of Haouari et al. [19] who demonstrated the importance of experience in traditional herbal medicine.

One hundred and three different plant species are used in oral diseases treatment according to our study. This corresponds to 3.67% of Benin's total flora, estimated at 2807 species [20]. The most represented plant families are: Leguminosae, Euphorbiaceae, and Lamiaceae. Ahouanse [21] noted the predominance of Leguminosae in oral diseases treatment through an ethnobotanical study of plants for oral use in the district of Kétou in Benin. Our study identified *Zanthoxylum zanthoxyloides* as the most used plant for oral diseases treatment. These results are close to those obtained by Dangboe [6]. Indeed, this species seems to contain chemical active principles with antimicrobial activity against bacteria

responsible for several oral diseases [22]; [23]. Different oral diseases treatable by herbal medicine are common in traditional health practices namely: dental caries, toothache, gingivitis, ulcerative gingivitis, canker sores, swollen tonsil, oral thrush, tonsillitis and black tongue [24]. This study shows that the major oral diseases frequently treated by medicinal plants in southern Benin are dental caries (43.87%), gingivitis (20.64%) and odontology (14.19%). Indeed, the main oral diseases, namely caries and periodontal diseases constitute a health problem in the world. They affect all segments of the population and remain a cause of morbidity closely linked to the difficulty of access to care and to socio-economic, cultural and environmental problems. All parts of the different plant are used against a variety of diseases. For the treatment of oral diseases, the part of the plant to be used depends on the traditional recipe advocated. Therefore, traditional medicine practitioners seem to have acquired knowledge about the properties of each part, allowing them to know which one is the most effective. Sometimes more than one organ of the same plant species, especially a combination of parts, is used in the preparation of different therapies [25]. However, in this study, the commonly used plant parts were found to be the aerial parts of the plant especially the leafy leaves and stems for oral diseases treatment (46.81%). This is close to the literature provided by [25] who showed that leaves are the seat of photosynthesis and synthesize exudates containing biooxidative secondary metabolites that protect the plant from external aggressions. As such, they contain many chemical groups responsible for the biological properties which have medicinal value for humans. They are also easy to collect and do not pose a threat to the plant ([26]; [27]; [28]). In order to treat oral diseases, and depending on the plants part and the pathology treated, traditional practitioners use different modes of preparation and administration. As some preparation methods allow higher concentrations of active components to be extracted than others, the best way to use a plant is the one that preserves its properties while allowing the extraction of all active components. The southern Benin community uses different methods of preparing medicines such as decoction, trituration, maceration, pounding, infusion and poultice for the treatment of oral diseases. The most frequently used method is decoction. Indeed, decoction allows to collect the most active principles and attenuates or cancels the toxic effect of certain recipes. These results confirm the findings of ethnobotanical studies conducted on medicinal plants by several authors ([29]; [14]; [30]). Finally, regarding administration method, gargling is the most used route for the treatment of oral diseases. According to herbalists, gargling allows traditional remedies to reach the entire oral cavity. These results are supported by Najem et al., [14] who demonstrated the effect of gargling in the treatment of oral diseases from medicinal plants.

#### 4. CONCLUSION

The flora of Benin contains a rich diversity of plants. Many of which are used in traditional Beninese medicine and have the potential to provide pharmacologically active natural products. In order to know the different plants used to treat oral diseases, an ethnobotanical survey was conducted in southern Benin (district of Allada, Abomey-Calavi, Cotonou and Porto-novo) It identified one hundred and three (103) species of medicinal plants commonly used in the treatment of oral diseases. Among these species, *Zanthoxylum zanthoxyloides* is the most used. These plants are divided into forty-four (44) families and ninety-one (91) genera. The family Leguminosae is the most represented (15.21%). The plants parts most used in the traditional treatment of oral diseases are the aerial parts (leaves and stems). Decoction is the mode of preparation most often used in mouthwash or gargle for the treatment of oral diseases.

#### **Consent**

As per international standard or university standard, respondents' written consent has been collected and preserved by the author(s).

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