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Ethnobotanical investigation of medicinal plants traditionally used for the management of hepatitis B in Togo

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ABSTRACT

Objectives: Hepatitis B virus infection represents a major public health concern in regions with high endemicity, especially in sub-Saharan Africa. It is the primary factor responsible for cirrhosis and liver cancer. Medicinal plants represent an alternative for combating this disease. In Togo, a lot of people still rely on medicinal plants. The purpose of this study was to document the plants employed in traditional medicine for the treatment of hepatitis B in Togo.

Methodology and Results **:** Between August 2022 and March 2023, an ethnobotanical survey was carried out among 103 traditional medicine practitioners (TMPs) in the Maritime region of Togo by direct interviews using a semi-structured questionnaire. TMPs were asked about plants that treat hepatitis B and their uses.The survey data identified 33 plant species belonging to 26 families. The Apocynaceae family was the most represented, with three species identified. The highest usual values were recorded with selected species such as *Sansevieria liberica* Hort. ex Gérôme & Labroy (0.15), *Lippia multiflora* Moldenke (0.10) and *Bridelia ferruginea* Benth (0.08). A total of eight (8) symptoms were enumerated. These included constipation, icterus, asthenia, difficulty passing stools, pain in the right hypochondrium, fever and yellow urine. Constipation and Jaundice are the most recurrent symptoms, listed by 19% and 14.88% of respondents respectively. The main method of preparation remains decoction.

*Conclusion and application of results***:** These results constitute a solid repertoire of the biodiversity of plants used in the treatment of hepatitis B in the maritime region of Togo. Studies on the viral properties of the identified recipes will provide a better understanding of their effectiveness.
Keywords : Hepatitis B, ethnobotanical survey, medicinal plants, traditional medicine, Togo.

INTRODUCTION

Hepatitis B is a viral disease with vertical transmission, sexual transmission, and parenteral contact with blood or blood products (Sabeena & Ravishankar, 2022). It can present as either an acute or chronic form, with a wide range of clinical manifestations, from being asymptomatic to severe and fatal, with symptoms including systemic intoxication, jaundice, haemorrhaging, and other signs of liver failure (Balian, 2010). Hepatitis B virus (HBV) infection represents a major public health concern in regions with high endemicity, especially in sub-Saharan Africa (WHO, 2021). The World Health Organization (WHO) in its 2016 annual report estimates that 2 billion people are infected with viral hepatitis B including 400 million chronic carriers, 60 million of whom are in Africa (WHO, 2021). In tropical Africa and southwest Asia, the prevalence of hepatitis B infection is particularly high, with chronic carriage rates reaching up to 20% of the population (WHO, 2021). In Western Europe, Australia, and North America, the prevalence is low, with chronic carriage rates ranging from 0.1% to 0.5% (WHO, 2021). A study conducted by Patassi in 2016 revealed that the prevalence of HBs Antigen is 10% in Togo, and nearly 14% of subjects who carry it have active replication of the hepatitis B virus (Patassi *et al.,* 2016). Despite this high rate of contact with the virus, only 17.4% of patients are cured, and nearly 20% require vaccination. In Togo, the average prevalence of HVB is over 11%, due to poor vaccination coverage, especially in rural areas (Kolou *et al.,* 2017). Despite these alarming statistics, the care of hepatitis B carriers in Togo is not effective, due to the country's limited resources affecting the establishment of a management center and a national control program, the high cost of treatment and late diagnosis. Faced with this situation of inadequate management of the spread of hepatitis B infection, sufferers are turning to traditional medical practitioners (TMPs) to treat their illness. These TMPs, who provide nearly 80% of the population's primary health care, offer affordable remedies to the population, who are quite satisfied with the results (Karou *et al.,* 2011). In addition to being effective and having an arsenal of improved traditional medicines (ITMs) ranging from prevention to post-treatment monitoring, these TMPs have the merit of being closer to patients and using natural resources (Karou *et al.,* 2011).These last elements explain the importance of traditional medicine and its practices in the WHO's strategic plan for population health care (OMS, 2013). Support from the WHO and regional bodies such as the WAHO (West African Health Organization) has encouraged scientific studies to focus on the use of plants in the treatment of diseases by traditional medicine (TM) through ethnobotanical surveys and biological screening in the laboratory on animal models (Karou *et al.,* 2011). A synthesis of bibliographical data on the use of plants in the treatment of liver disorders in traditional African medicine has shown the potential wealth of plants with hepatotropic action in African medicinal flora (Bitsindou *et al*., 1993). In Togo, an ethnobotanical study of plants used in the treatment of liver diseases in the maritime region of Togo conducted by Kpodar in 2016 revealed a significant biodiversity of plants used in the treatment of liver ailments (Kpodar *et al.,* 2016). However, scientific data on the biological activities and preclinical trials of potential plants and on the

methodological approaches of Togo's TMPs in the treatment of hepatitis B in traditional medicine in Togo are insufficient. Toudji-Bandje's 2007 study revealed the disappearance of HBe antigen in a patient suffering from chronic hepatitis B treated with phytomedicines, indicating the existence of a treatment-related virological response (Toudji-bandje, 2007). This situation led us to wonder whether TMPs might have highly effective recipes that could help hepatitis B patients or not.

MATERIALS AND METHODS

Geographical context of the study: Togo (Figure 1) is a West African country, bounded to the north by Burkina Faso, to the east by Benin, to the west by Ghana, and to the south by the Atlantic Ocean. From north to south, Togo is subdivided into five economic regions: Savanes, Kara, Centrale, Plateaux, and Maritime. The research was conducted in the Maritime region. The Maritime region stretches from 1° 20' west longitude to 1° 50' east longitude, and from 6° 10' south latitude to 6° 60' north latitude, covering an area of 6,100 km^2, or around 10.78% of Togo's total surface area. The Maritime region is bounded to the north by the Plateaux region, to the west by Ghana, to the east by Benin, and to the south by the Atlantic Ocean. The climate is sub-equatorial, featuring a long rainy season from March to July and a short rainy season from September to November (Hoekou *et al.,* 2016).

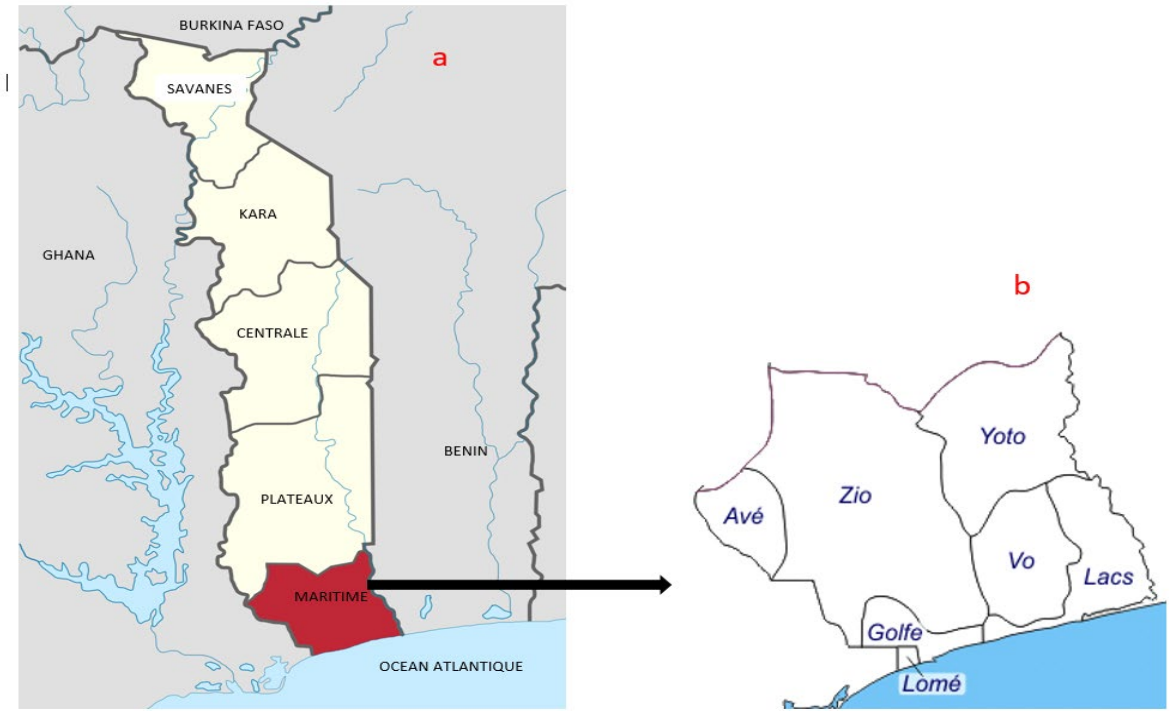

Figure 1: a) Mapping Togo b) Mapping the maritime region

Data collection: The survey was carried out among TMPs in the maritime region using a survey form between August 2022 and March 2023. Initial contact with the traditional medicine practitioners (TMPs) involved providing a brief explanation of the study objectives and the significance of the information they would provide, in order to secure their consent to participate. After obtaining their informed consent, data were collected through interviews using a specially designed semi-structured questionnaire. The

questionnaire primarily addressed the following key points: i) Respondent information: surname, given names, age, and gender; ii) Source of knowledge: acquired through family initiation or another setting, iii) Healer status: full-time or part-time practitioner, iv) Disease details: local name of the disease and the symptoms used for diagnosis, v) Plants employed for treatment: parts of the plants used, methods of preparation, and modes of administration. Following the interviews with the TMPs, plant samples were collected and identified at the Botany and Plant Ecology Laboratory of the Faculty of Sciences, University of Lomé, by comparison with specimens in the Faculty's herbarium.

Data analysis: The data collected following the surveys were processed using Excel 2016 spreadsheet software, which enabled us to establish the frequencies of use of the species and their usual values (UV) according to the following formula. VU= ∑N/n with ∑N = number of times the species is mentioned in recipes and n = number of people surveyed. Histograms were drawn with the GraphPad Prism 5.

RESULTS

Socio-demographic data of Traditional Medicine Practitioners (TMPs) involved in hepatitis B treatment: The sociodemographic profiles of traditional healers are shown in Table 1. A total of 103 TMPs were interviewed, including 56 men and 47 women.Their ages ranged from 26 to 81, with an average age of 53.5 ± 3.75. Most of them were in the 50-70 and 30-50 age brackets, corresponding to 56.31 and 27.18% respectively. Regarding their level of education, 53.40% had attended secondary school, 38.83% of TMPs had attended elementary school and 5.83% university. Only 1.94% of TMPs surveyed were illiterate (Table 1). According to Table 1, the main sources of medical knowledge were family inheritance (73.79%) and traditional initiation (17.48%). Some TMPs mentioned several origins of their knowledge; for example, a TMP could have inherited knowledge through oral tradition in his family in addition to sharing with his peers The majority of TMPs (90.29%) practiced medicine as their main activity. The others were either craftsmen (8.73) or farmers (0.97), practicing traditional medicine as a secondary activity.

Table 1: Socio-demographic data of TMPs involved in Hepatitis B treatment in the maritime region of Togo.

Parameters		**N (%)**
Gender	Male	56 (54.37)
	Female	47 (45.63)
Age range	<30	3 (2.91)
	[30-50[	28 (27.18)
	[50-70[	58 (56.31)
	[70-90[	14 (13.59)
Level of education	Illiterate	2 (1.94)
	Primary	40 (38.83)
	Secondary	55 (53.40)
	University	6 (5.83)
Origin of knowledge	Family heritage	76 (73.79)
	Initiated by a TMP	18 (17.48)

	Others	9 (8.74)
Status of TMPs	Full-time	93 (90.29)
	Farmers/breeders	1 (0.97)
	Craftsmen	9 (8.73)
Plant collection seasons	Rainy season	48 (46.60)
	Dry season	49 (47.57)
	All seasons	05 (5.83)
Time of day	Morning	102 (99.03)
	Any time of day	1 (0.97)

Diagnosis of Hepatitis B: The various symptoms of hepatitis B as enumerated by the TMPs are described in Table 2. A total of 8 hepatitis B symptoms were mentioned. Among them, jaundice, constipation, jaundice, and difficulty passing stools were ticked off by more than 10% of respondents. Less than 10% of TMPs listed clinical signs such as pain in the right hypochondrium, fever and yellow urine. Only 15% referred the patient to the laboratory for confirmation prior to treatment. During this study, TMPs did not report any adverse effects related to the use of these remedies.

Table 2: Symptoms of hepatitis as itemized by TMPs

Symptoms	Respondents %
Constipation	23(19)
Jaundice	18(14.88)
Icterus	24(19.83)
Asthenia	12(9.92)
Difficulty with bowel movements	13(10.74)
Pain in right hypochondrium	10(8.26)
Fever	9(7.44)
Yellow urine	12(9.92)

Botanical characteristics and ethnobotanical indices of identified plants: A total of 33 plants species belonging to 26 families were identified in the present study (Table 3), (Figure 1). The Apocynaceae and Fabaceae families recorded the highest number of species, namely *Calotropis procera, Picralima nitida* and *Voacagan Africana* ; *Caesalpinia pucherima, Cassia occidentalis* and *Senna alata*. It was followed by Asteracea, Euphorbiacea, Malvaceae, Phyllanthaceae and Rutaceae with two species each. 17 families contributed with one species each. The highest usage values were recorded with selected species such as *Sansevieria liberica* (0.15), *Lippia multiflora* (0.10) and *Bridelia ferruginea* (0.08).

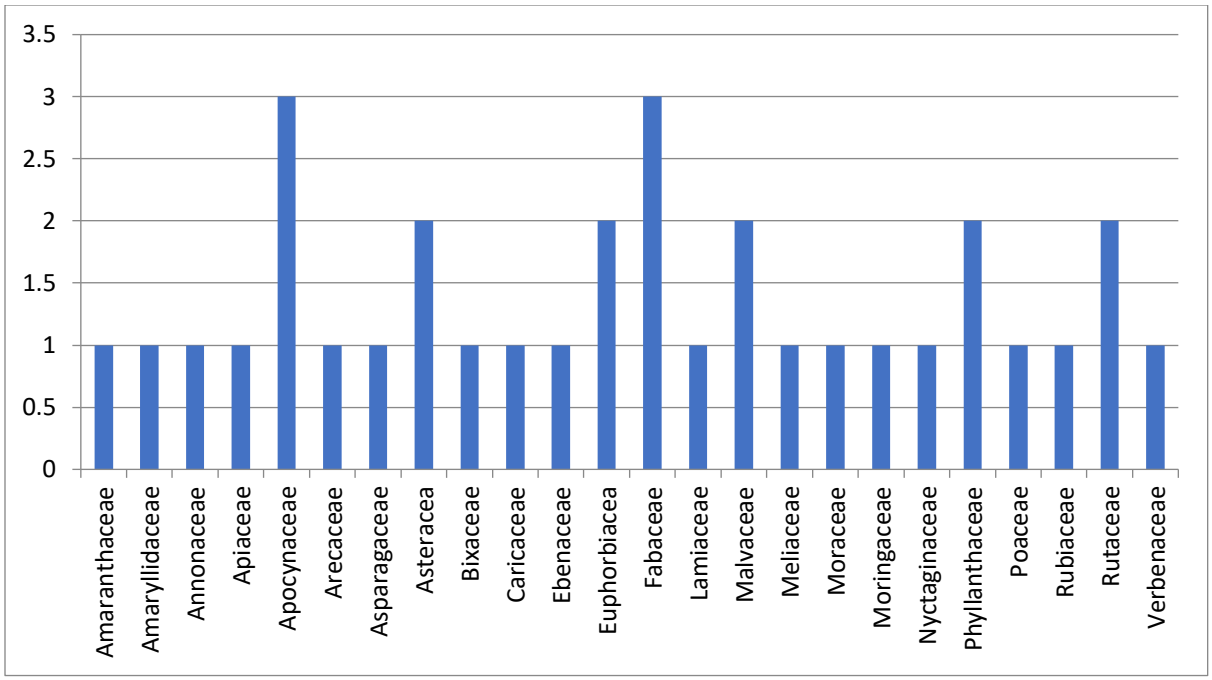

Figure 1: Botanical characterization of the plants mentioned

Herbal recipes : The ethnobotanical survey identified a total of 29 recipes for plant combinations with the same usual value (0.03), including 15 recipes for 2 plants, 10 recipes for 3 plants and 4 recipes for 5 plants.

Table 3 : Herbal recipes used to treat hepatitis

Numbers	Different recipes
1	*Bridelia ferruginea* (Root) + *Lippia multiflora* (Leaves) + *Cassia occidentalis* (Seeds)
2	*Bridelia ferruginea* (Bark) + *Lippia multiflora* (Leaves)+*Sansevieria liberica* (Root)
3	*Caesalpinia pucherima* (Leaves) + *Citrus limon* (Fruit) + *Curcuma longa* (Rhizome)+*Zingiber officinale* (Rhizome)+ *Allium sativum* (Bulb)
4	*Carica papaya* (Fruit) + *Citrus lemon* (Fruit)
5	*Cassia occidentalis* (Seeds) + *Hibiscus sabdariffa* (Leaves)
6	*Cocos nucifera* (Root) + *Citrus lemon* (Fruit)
7	*Cymbopognon citrates* (Leaves) + *Ocimum canum* (Leaves)+ *Sansevieria liberica* (Root) + *Lippia multiflora* (Leaves) + *Gomphrena celesioides* (Leaves)
8	*Cymbopognon citrates* (Leaves) + *Citrus limon* (Fruit)
9	*Euphorbia hirta* (Leaves) + *Cassia occidentalis* (Seeds) + *Sansevieria liberica* (Root)
10	*Euphorbia hirta* (Leaves) + *Annona muricata* (Leaves)
11	*Euphorbia hirta* (Leaves) + *Phyllanthus amarus* (Leaves)
12	*Euphorbia hirta* (Leaves) + *Bridelia ferruginea* (Bark)+*Lippia multiflora* (Leaves)+*Phyllanthus amarus* (Wholeplant)+*Senna alata* (Leaves)
13	*Jatropha gossypifolia* (Leaves)+ *Cymbopognon citrates* (Leaves)
14	*Jatropha gossypifolia* (Leaves) + *Citrus lemon* (Fruit)

15	*Jatropha gossypifolia* (Leaves) + *Cymbopognon citrates* (Leaves)+*Citrus lemon* (Fruit)
16	*Phyllanthus amarus* (Leaves) + *Citrus lemon* (Fruit)
17	*Phyllanthus amarus* (Leaves)+ *Boerhavia diffusa* (Leaves)+ *Cochlospermum tinctorium* (Rhizome)
18	*Phyllanthus amarus* (Leaves) + *Balanites aegytica* (Fruit)
19	*Picralima nitida* (Bark) +*Sansevieria liberica* (Root) + *Xylopia aethiopica* (Fruit)
20	*Picralima nitida* (Leaves) + *Sansevieria liberica* (Root)
21	*Sansevieria liberica* (Root) + *Euphorbia hirta* (Leaves) + *Cocus nucifera* (Root)
22	*Sansevieria liberica* (Root) + *Cocos nutifera* (Root)
23	*Sansevieria liberica* (Root) + *Phyllantus amarus* (Leaves) +*Ocimum Canum* (Leaves)+*Cymbopognon citrates* (Leaves)+*Euphorbia hirta* (Leaves)
24	*Sansevieria liberica* (Root) + *Picralima nitida* (Fruit) +*Xylopia aethiopica* (Fruit)
25	*Sansevieria liberica* (Root) + *Phyllathus amarus* (Whole plant) + *Ocimum canum* (Leaves)
26	*Sansevieria liberica* (Root)+ *Bridelia ferruginea* (Root)
27	*Sida acuta* (Leaves) + *Vernonia colorata* (Fresh leaves)
28	*Vernonia amygdalina* (Leaves) + *Sensevieria liberica* (Root)
29	*Voacagan thouarsii* (Root) + Euphorbia *hirta* (Leaves) + *Cassia occidentalis* (Leaves)

Parts of the plants used, along with their methods of preparation and administration: TMPs in the maritime region were found to use various plant parts for medicinal purposes. For the treatment of hepatitis B disease, the main parts used are leaves (52.63%), followed by fruit (13.16%), roots (10.53%) and bark (7.89%). Rhizomes, seeds, stems and whole plants were used less, accounting for 5.26%, 5.26%, 2.63% and 2.63% respectively (Figure 2). Medicinal plants were mainly prepared as infusions (50%) (Figure 3). Other forms were decoction (31.58%), maceration (7.89%), fresh material (5.26%) and juice. All herbal medicines were administered orally. The results of this study show that almost all TPMs are routinely prescribed without any knowledge of their toxicity or the possible interactions between their various components. It is therefore important to carry out a phytochemical, toxicological and pharmacological study of these medicinal plants with antiviral potential.

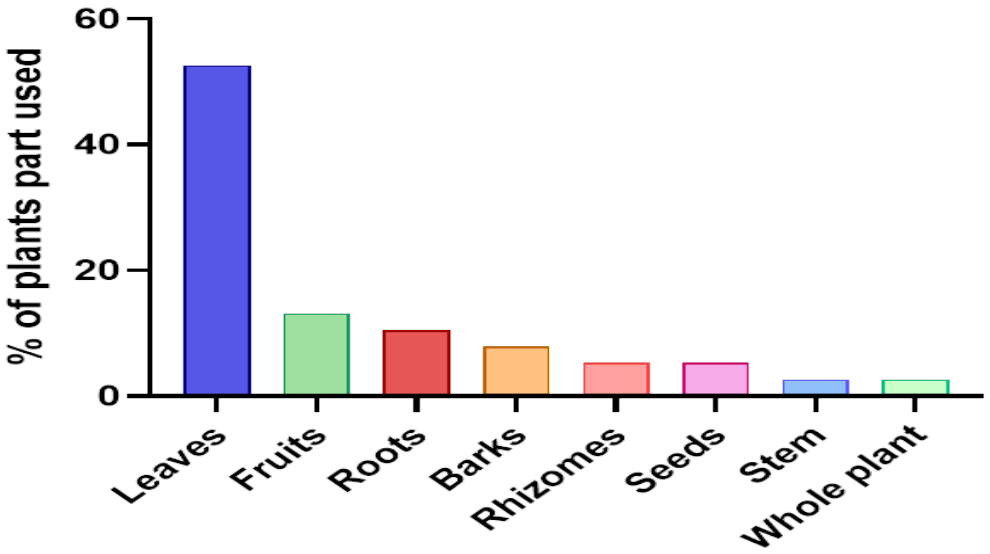

Figure 2: Plants part used in the management of the hepatitis B

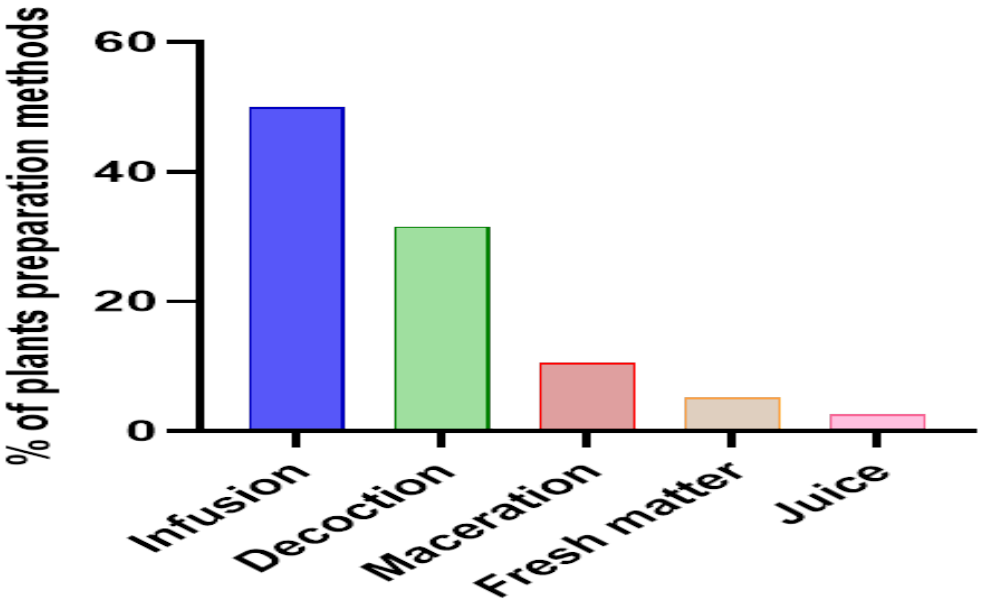

Figure 3: Plant preparation methods

Table 4: Presentation of species and their use characteristics

Scientific names	Family	ΣN	UV	Local name	Languages	Parts used	Mode of preparation
Gomphrena celosioides Mart.	Amaranthaceae	2	0.02	Papatahe	Ewe	Leaves	Infusion
Allium sativum L.	Amaryllidaceae	1	0.01	Ayo	Ewe	Fruit	Maceration (in Olive oil)
*Xylopia aethiopica (*Dunal) A.Rich.	Annonaceae	1	0.01	Esso	Ewe	Seeds	Decoction
*Petroselinum crispum (*Mill.) Fuss	Apiaceae	1	0.01	Persil	French	Leaves	Infusion
*Calotropis procera (*Vern: AK*)*	Apocynaceae	1	0.01	Wangashigbe	Ewe	Leaves	Fresh matter
Picralima nitida(Stapf) Th.et H.Dur.		2	0.02	Ayokpe	Ewe	Fruit/barks	Decoction
Voacagan Africana Staph.		3	0.03	Lande	Ivory Coast	Roots	Decoction
Cocos nucifera L.	Arecaceae	1	0.01	Néti	Ewe	Roots	Decoction
Acanthospermum hispidum DC.	Asteracea	3	0.03	Ahlangovi	Ewe	Leaves/stem	Decoction/ infusion
Vernonia amygdalina Delile		1	0.01	Aloma	Ewe	Leaves	Infusion
Adansonia digitata L.	Malvaceae	1	0.01	Adidoti	Ewe	Fruit	Fresh matter/Maceration
Sida acuta Burm. F.		1	0.01	Afideme	Ewe	Leaves	Infusion
Carica papaya L.	Caricaceae	3	0.03	Adouba	Ewe	Leaves /Fruit	Infusion/Decoction/Maceration
Myrianthus arboreus P. Beauv.	Moraceae	1	0.01	Ahlihle	Ewe	Leaves	Infusion
CochlospermumtinctCochlospermum tinctorium Perr.	Bixaceae	1	0.01	Kadjin	Ewe	Rhizome	Decoction
*Sansevieria liberica*Hort. ex Gérôme &Labroy	Asparagaceae	15	0.14	Yodobo	Ewe	Roots	Decoction
Diospyrosmes piliformis Hochst. ex. A. DC	Ebenaceae	1	0.01	Gabuang	Moba	Leaves	Infusion
Euphorbia hirta L.	Euphorbiacea	6	0.06	Anosika	Ewe	Leaves	Infusion
Jatropha gossipifolia L.		5	0.05	Babatidjin	Ewe	Leaves	Infusion
Caesalpinia pucherima (L.) Sw.	Fabaceae	1	0.01	Orgueil de chine	French	Leaves	Solution
Cassia occidentalis L.		7	0.07	Besissan	Ewe	Seeds	Decoction/ Infusion
Senna alata L.		3	0.03	Madonhome	Ewe	Leaves	Infusion

Ocimum canum Sims.	Lamiaceae	5	0.05	Ahame	Ewe	Leaves	Infusion
Azadirachta indica A. Juss	Meliaceae	2	0.02	Kiniti	Ewe	Leaves	Infusion
Moringa oleifera L.	Moringaceae	3	0.03	Yovoviti	Ewe	Leaves	Infusion
Boerhavia diffusa L.	Nyctaginaceae	1	001	Katson-agni	Ewe	Rhizome	Decoction
Bridelia ferruginea Benth.	Phyllanthaceae	8	0.08	Akamati	Ewe	Root/Bark	Decoction
Phyllantus amarus Schumach.&Thonn.		7	0.07	Ehlinvi	Ewe	Leaves/Whole plant	Infusion
Cymbopognon citrates (DC.)Stapf	Poaceae	3	0.03	Etigbé	Ewe	Leaves	Infusion
Sarcocephalu slatifolus (Sm.) E.A.Bruce	Rubiaceae	1	0.01	Nimon	Ewe	Bark	Decoction
*Citrus lemon (*L.) Burm.f.	Rutaceae	1	0.01	Donti	Ewe	fruit	Juice
Zanthoxylum Zanthoxyloides LAM.		1	0.01	Ehe	Ewe	Leaves	Infusion
Lippia multiflora Moldenke	Verbenaceae	10	0.09	Avudoati	Ewe	Leaves	Infusion

DISCUSSION

The study aimed at identifying the plants used in the treatment of hepatitis B by TMPs in the maritime region of Togo. The survey of 103 TMPs in the region showed that medical practice is dedicated to the elderly. Ethnobotanical studies have been carried out in the region, such as the kpodar study in 2016, which looked at the plants used to treat liver disease (Kpodar *et al.,* 2016). This study represents the first of its kind on hepatitis B conducted in the region. The ethnobotanical survey was conducted among the region's TMPs, the majority of whom were older men. This profile of TMPs in Togo's Maritime region aligns with findings from most gender studies, confirming that traditional medicine is predominantly practiced by middle-aged men (Kpodar *et al.,* 2016). It was found that knowledge is often passed down through oral tradition or initiation by an older healer from generation to generation, requiring a minimum of trust. The results of this study corroborate this observation, as some 73% of respondents had acquired at least one medical practice within the family, and over 17% had been initiated with an elderly healer. The study showed a good diversity of 33 plant species belonging to 26 families. This biodiversity is higher than that recorded by N'guessan, 19 species grouped into 13 families (N'Guessan *et al.,* 2009), and lower than the 49 species belonging to 31 families for the treatment of diabetes and hypertension by Karou in 2011 (Karou *et al.,* 2011).The most represented family in this study was the Apocynaceae, while in Kpodar's 2016 study it was the Caesalpiniaceae. Symptoms as listed by TMPs were also mentioned in Kpodar's 2016 study of plants used in the maritime region to treat liver ailments (Kpodar *et al.,* 2016). With regard to the various uses, the results of this study corroborate those of Adetutu in 2013, who demonstrated the beneficial effects of *Bridelia ferruginea* extracts on the liver (Adetutu & Olorunnisola, 2013).The most used organs for the treatment of Hepatitis B were leaves followed by fruits and roots. This result corroborates those found by Gbekley et *al.,* (2015), Kpodar *et al.,* (2016) and Effoe *et al.,* (2020) who found that leaves were the most used organs (Gbekley *et al.,* 2018; Kpodar *et al.,* 2016; Ossibi *et al.,* 2016). In view of these results, the most widespread preparation method is infusion followed by decoction. This result is not the same as the findings of Kpodar *et al.,* (2016), who found that the most widely used preparation method, was decoction (over 80%) (Kpodar *et al.,* 2016). The vernacular names of the medicinal plants marketed in this study are most often in the Ewe language, sometimes in the Moba language. The most frequently mentioned plants have proven biological properties that corroborate the data found in the field during the survey. In addition to the ailments targeted in this study, the most frequently cataloged plants are also used to treat other pathologies. Bark, leaves, trunks, roots and large branches of *Senseviera liberica* are much sought-after in traditional medicine for their use in the treatment of inflammation .The aqueous extract of *Lippia multiflora* induced hepatoprotective activity by lowering total bilirubin levels, SGPT, SGOT and PAL activities, and reducing liver damage (Chinasa *et al.,* 2011b). Sangare *et al.* (2012b) studied the effect of the aqueous extract of *Gomphena celosoides* compared to silymarin, a known hepatoprotective substance. The results of this study showed that preventive treatment of animals with the aqueous extract of *Gomphena celosoides* reduced serum transaminases, alkalinity, and cholesterol levels. The results of the study showed that *G. celosoides* acts like silymarin (Sangare *et al.,* 2012). Extracts from the leaves and roots of the *Bridelia ferruginea* plant have hypoglycemic properties, while those from the bark have anti-ulcer, anti-inflammatory and antibacterial properties (Sangare *et al.,* 2012). Toxicity studies have mainly been carried out on rats or cell lines.

For some plants the results showed no adverse effects. This was particularly the case for *Bridelia ferruginea*, *Carica papaya*, *Cymbopogon citratus*, *Euphorbia hirta* and *Phyllanthus samarus*. Significant toxic effects were observed for *Senna occidentalis*. A hydroalcoholic extract of the aerial part of the plant has been shown to be highly toxic to mouse fibroblasts (Kpodar *et al.,* 2016). Toxicity studies need to be carried out before these plants can be used safely.

CONCLUSIONS AND APPLICATIONS OF RESULTS

The present study brings out information on the effectiveness of different medicinal plants used in the treatment of Hepatitis B in Togo. The region's TMPs share many similarities in the use of plant species. However, many of the plants mentioned by the TPMs, although they have been shown to be hepatoprotective, have not yet been tested for their antiviral activity against the hepatitis B virus. These plants provide a starting point for biological screening in the laboratory. In vitro and in vivo antiviral studies using these plants on the hepatitis B virus will help to elucidate their antiviral properties.

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CONFLICTS OF INTEREST:

The authors declare that they have no competing interests he authors declare that they have no competing interests.

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