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Ethnobotanical survey of anti-hepatitis b medicinal plants used by the local people in western highlands, Cameroon

Abstract

The study conducted in the West Cameroon region has led to identify plants used as adjuvants in the treatment of hepatitis B. Based on the prevalence of hepatitis, a sample of 148 people was selected in 6 sites. The majority of respondents was between 30-59 years old (57 %) and had an average level of education of Bachelor's degree (87 %). They are of Catholic religion (57 %), married (86.66 %) and acquired their knowledge by inheritance (80 %). At the end of the surveys, 29 species belonging to 16 families and 27 genera were recorded. Alliaceae were the most represented with 13 species. Herbaceous were the most used. The plants are mostly used in their fresh state (64 %) and harvested mainly during the rainy season (73 %). The surveys have led to identify 30 recipes, most of which were made with several species, water being the most common solvent. Decoction is the most common method of preparation (57 %). Phytomedicines are administered orally (*per os*). This survey contributes to the development of traditional medicine resources in Cameroon and to the implementation of initiatives that could lead to the production of improved phytomedicines in the future.

Keywords: Investigations, Hepatitis B, traditional medicine, phytomedicines, plants

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Introduction

Today, access to primary health care remains problematic in developing countries. Population growth and the inaccessibility of modern medicines in these countries contribute to the increasing demand for traditional herbal medicines.[1] Thus, 80% of these populations resort to traditional medicine based on the use of medicinal plants to treat common ailments.[2] In Africa, this demand is not only the result of the inaccessibility of modern equipment on the one hand and the high costs of conventional medicine on the other, but also of traditional medicine, which is very often considered as a first-line medicine. Moreover, the practice of herbal medicine in our traditions and customs encourages us to identify this knowledge through ethnobotanical surveys.[3] Nowadays, more than 80% of the African population use traditional medicine in case of illness.[4-9] It is therefore necessary to undertake ethnobotanical studies to identify local uses of plant species.[10,11]

In Africa and in Cameroon in particular, several studies have been conducted to list and identify plants used as adjuvants in herbal medicine.[12-23] But very few researchers in Cameroon have worked on the ethnobotanical and floristic study of plants used as adjuvants in the treatment of hepatitis B.

Hepatitis is a viral infection whose main tropism is the liver cell. Viral hepatitis B remains a worrying public health problem, especially in sub-Saharan Africa.[24] It is the tenth leading cause of death in the world with one million deaths per year. Approximately one third of the world's population has serological markers indicating past or ongoing infection with the hepatitis B virus and 350 million people are chronic carriers. The prevalence of hepatitis B in Cameroon is about 10.8%.[25,26]

The purpose of this study is to identify the plants used as adjuvants in the treatment of hepatitis B by identifying all the recipes proposed by practitioners or not of herbal medicine in the Western region.

Material and methods

Study site

The West region is composed of 8 departments and covers an area of 13,892 km^2. It comprises 36 subdivisions and 41 communes. The city of Bafoussam is the capital of the Western Region and of the Mifi Department. It is located in the part of Cameroon known as the "Western Highlands" which covers the administrative regions of the West, North-West and South-West of Cameroon. They are located on the mountain range of the same name. The average altitude of the city is 1450m. The geographical coordinates are 5°30'N and 10°25' E and the longitudes 10°21' and 10°30' East (Figure 1). The relief is mountainous with many plateaus and plains. The climate is tropical Sudanian with two main seasons: a dry season that runs from October-November to March-April, and a rainy season that begins in March-April and lasts until October-November.[27] Temperatures are generally mild. Annual temperature variations are generally between 18°C and 23°C with absolute maxima of 21°7C (March) and absolute minima around 9°5C (July). The average is generally around 20°C.

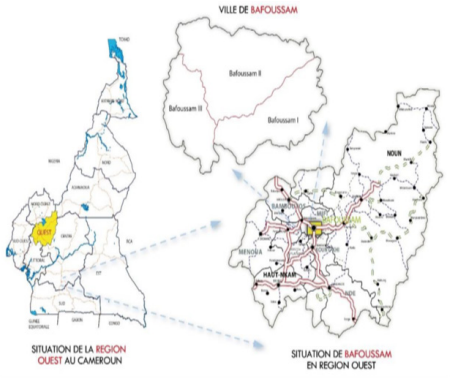

Figure 1 Sites localization.

Sampling

The sampling principle is based on the non-probability method whose technique concerns the sample size (n) based on a 95 % confidence interval and a 5 % risk of error calculated according to the Schwartz[28] formula:

$n= P(1-P)x\ \alpha^2/i^2$.

P = 10.8 % is the prevalence of hepatitis B in Cameroon; α = 1.96 is the standard deviation corresponding to the 5 % risk of error and i = 5 % is the precision. This results in a sample of 148 individuals who were interviewed.

Ethnobotanical survey

The surveys were conducted in the Commune of Bafoussam between January and April 2021. They consisted of interviews with 148 people (herbalists or not) who had used or used several times plants for the treatment of hepatitis B, using a previously established survey form. These interviews were carried out with the help of forms made of closed questions (answers by yes or no); open (answers according to the point of view of the respondent) and directed (several answers to the choice proposed to the respondent). Semi-open-ended questions were preferred in order to allow informants greater freedom of expression. The sections of this questionnaire concern the informant's profile (age, sex, religion, level of education, marital status, professional status, type of collector, origin of information), the medicinal plants used by the informant (vernacular or common names of the plants used, diseases, method(s) of preparation, part(s) used, types of plants, place of procurement of his/her plants, period of collection, method of administration, condition of the plant used, duration of treatment, dose, method of diagnosis, method of preservation, follow-up of treatment).

After the interview with these people, the indicated plants were photographed on the site for those for which it was possible or in the forests to help with the identification of the plants. Samples of fertile organs (fruits) and samples of sterile organs (leaves, bark) were collected. Once collected, the samples were identified with the help of botanical experts and the national herbarium of Cameroon. In this study, we followed the APG (2009) nomenclature for the identification of the species recorded.

Data analysis

The data obtained from the surveys were inserted into the EXCEL 2016 software and then analysed using STRATIGRAPHICS plus 5.0 software. The frequency of distribution of a species within the traditherapists community is expressed as the percentage of citations of a species in relation to the total number of people surveyed. The citation frequency of each taxon surveyed is calculated by the formula used by Gbeckley et al.[29] and Orsot:[30] FC= ∑(n/N) *100; n= number of people who cited the species; N: total number of respondents.

Results

Ethnobotanical surveys

Table 1 presents all the medicinal plants used in the treatment of hepatitis B. A total of 29 species belonging to 16 families and 27 genera with a predominance of Alliaceae (49.99%) have been identified. Herbs are the most used. Carica papaya and Allium sativum are the most frequent species.

Table 1 List of inventoried taxa and their frequency of occurrence

Families	Scientific name	Common name	TM	Genera	Nc	Fc
Alliaceae	*Allium cepa*	Oignon	Herbaceous	*Allium*	7	23.33
	Allium sativum	Ail	Herbaceous		8	26.66
Amarantaceae	*Beta vulgaris*	Bétérave	Herbaceous	*Beta*	2	6.66
Apocynaceae	*Picralima nitida*	kinkéliba	Tree	*Picralima*	3	10
Asteraceae	*Vernonia amygdalina*	Ndole	Herbaceous	*Vernonia*	1	3.33
	Calendula officinalis	calendula	Herbaceous	*Calendula*	1	3.33
	Artemisia annua	Artémésia	Herbaceous	*Artemisia*	2	6.66
	Taraxacum officinale	pissenlit	Herbaceous	*Taraxacum*	1	3.33
	Carduus marianus	Chardon marie	Herbaceous	*Carduus*	1	3.33
Brassicaceae	*Cynara scolymus*	artichaux	Herbaceous	*cynara*	3	10
	Raphanus sativus	Radis noir	Herbaceous	*Raphanus*	1	3.33
Caricaceae	*Carica papaya*	Papayer	Tree	*Carica*	11	36.66
Caesalpiniaceae	*Senna alata*	Datrier	Shrub	*Cassia*	2	6.66
Euphorbiaceae	*Euphorbia thymifolia*	Mbunmon	Herbaceous	*Euphorbia*	1	3.33
	Phyllantus amarus	Inconnu	Herbaceous	*Phyllantus*	1	3.33
Fabaceae	*Desmodium adscendens*	Inconnu	Herbaceous	*Desmodium*	1	3.33
Lamiaceae	*Salvia officinalis*	Sauge	Herbaceous	*Salvia*	2	6.66
	Thymus vulgaris	Thym	Herbaceous	*Thymus*	2	6.66
	Salvia rosmarinus	Romarin	Shrublet	*Salvia*	1	3.33
	Mentha suaveolens	menthe	Herbaceous	*Mentha*	1	3.33
	Ocimum basilicum	Basilic	Herbaceous	*Ocimum*	3	10
	Cinamomum verum	Canelle	Tree	*Cinamomum*	1	3.33
Meliaceae	*Azadirachta indica*	Neem	Tree	*Azadirachta*	2	6.66
moringaceae	*Moringua oleifera*	moringua	Tree	*Moringua*	3	10
Myrtaceae	*Syzygium aromaticatum*	Girofle	Tree	*Syzygium*	4	13.33

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Table 1 Continued....

Pinaceae	*Pinus* sp .	Pin	Shrub	*Pinus*	1	3.33
Rutaceae	*Citrus limon*	Citron	Shrub	*Citrus*	3	10
Zingiberaceae	*Curcuma longa*	Curcuma	Herbaceous	*Curcuma*	7	23.33
	Gingiber officinalis	Djindja	Herbaceous	*Gingiber*	5	16.66

Nc: number of citation; Fc: frequency of occurrence

Socio-demographic features

Men represent 86.66% of the respondents and women 13.33%. The tradithérapeutes interviewed represent 56.68% Catholics, 23.49% Protestants, 16.20% Muslims and 3.33% of other religions.

The respondents are divided into several age groups: 0-29years (5.52%); 30-59years (56.66%); 60-90years (21.32%) and over 90years (16.15%). The modal age class of the tradithérapeutes interviewed is in the range [30-59 years].

It should also be noted that in our study, the traditherapists are literate with a minimum level of a BAC (83.33%).

Knowledge is acquired through family inheritance (80%), natural gift (10%), training (3.33%) and traditional initiation (6.66%).

The tradithérapeutes interviewed all have various occupations including trade (80%), agriculture (10%), animal husbandry (6.66%) and teaching (3.33%).

The sampling took place in 6 localities. Most of the practitioners are concentrated in the localities of Ndelleng (33.33%), Banengo (26.66%) and Tamdja (13.33%). These three localities represent more than 70% of the sample.

Most of the tradithérapeutes surveyed were married (86.66%).

The organs used are leaves (37.50%), bulbs (19.44%), bark (1.38%), stems (2.77%), the whole plant (12.5%), fruits (9.72%), flowers (1.30%) and rhizome (15.27%).

Recipes

During our ethnobotanical survey, we observed that we obtained 30 polyspecific recipes, i.e. from the association of several plants to treat hepatitis B.

The dominant method of preparation is decoction (56.66%) followed by decoction/infusion (20%), decoction/maceration (6.66%), infusion/maceration (6.66%), decoction/cataplasm (10%).

The plants are harvested in the rainy season (73.33%) and in the dry season (26.66%); manually (93.33%) and mechanically (6.66%).

The plants are used in the fresh state (63.33%) and in the dry state (33.66%) with no side effects for the patient.

The means of diagnosis given by the tradithérapeutes are: constipation, pain in the chest, pain in the abdomen, fever, yellow eyes, black lips, nails and tongue, bloody vomiting, but being in association with the hospitals, clinical examinations come to confirm its results. the list of recipes is provided in Table 2.

Table 2 Different recipes identified

Nr	Species	Families	Mode of administration	Mode of preparation	Organs
R1	*Curcuma longa*	Zingiberaceae	*Per os*	decoction	rhizome
	Senna alata	Caesalpiniaceae	*Per os*	Cataplasm,	Leaves, Flower
	Allium cepa	Alliaceae	*Per os*		Bulb
R2	*Allium sativum*	Alliaceae	*Per os*	Decoction,	Bulb,
	Syzygium aromaticatum	Myrtaceae	*Per os*	infusion	fruit
	Allium cepa	Alliaceae	*Per os*		Bulb
R3	*Salvia officinalis*	Lamiaceae	*Per os*	decoction	Whole plant
	Thymus vulgaris	Lamiaceae	*Per os*	infusion	Whole plant
	Ocimum basilicum	Lauraceae	*Per os*		Leaves
R4	*Carica papaya*	Caricaceae	*Per os*	Decoction	Leaves
	Moringua oleifera	Moringaceae	*Per os*		Leaves
R5	*Allium sativum .*	Alliaceae	*Per os*	Decoction,	Bulb,
	Curcuma longa	Zingiberaceae	*Per os*		rhizome
R6	*Raphanus sativus*	Brassicaceae	*Per os*	Cataplasm	Leaves
	Vernonia amygdalina	Asteraceae	*Per os*	Decoction	Leaves
R7	*Salvia officinalis*	Lamiaceae	*Per os*		Whole plant
	Cinamomum verum	Lauraceae	*Per os*	Decoction,	Back
	Citrus limon	Rutaceae	*Per os*	infusion	Leaves
R8	*Gingiber officinalis*	Zingiberaceae	*Per os*		rhizome
	Gingiber officinalis	Zingiberaceae	*Per os*	decoction	rhizome
	Curcuma longa	Zingiberaceae	*Per os*		rhizome
R9	*Allium sativum*	Alliaceae	*Per os*	Decoction,	Bulb,
	Beta vulgaris	Amarantaceae	*Per os*	maceration	Bulb
	Allium cepa	Alliaceae	*Per os*		Bulb
R10	*Carica papaya*	Caricaceae	*Per os*	decoction	Leaves
	Allium sativum	Alliaceae	*Per os*		Bulb,
	Curcuma longa	Zingiberaceae	*Per os*		rhizome

Table 2 continued....

	Moringua oleifera	moringaceae	*Per os*		Leaves
R11	*Allium cepa*	Alliaceae	*Per os*	decoction	Bulb
	Carica papaya	Caricaceae	*Per os*		Leaves
R12	*Curcuma longa*	Zingiberaceae	*Per os*	decoction	rhizome
	Beta vulgaris	Amarantaceae	*Per os*	maceration	Bulb
R13	*Allium sativum .*	Alliaceae	*Per os*	Decoction,	Bulb, Leaves
	Carica papaya	Caricaceae	*Per os*		Leaves
	Raphanus sativus	Brassicaceae	*Per os*		Whole plant
R14	*Thymus vulgaris*	Lamiaceae	*Per os*	infusion	Whole plant
	Pinus sp .	Pinaceae	*Per os*	decoction	Fruit
R15	*Carica papaya*	Caricaceae	*Per os*	decoction	Leaves
	Curcuma longa	Zingiberaceae	*Per os*		rhizome
R16	*Syzygium aromaticatum*	Myrtaceae	*Per os*	infusion	Fruit
	Carica papaya	Caricaceae	*Per os*	decoction	Leaves
	Allium cepa	Alliaceae	*Per os*		Bulb
R17	*Azadirachta indica*	Meliaceae	*Per os*	decoction	Leaves
	Moringua oleifera	Moringaceae	*Per os*	,	Leaves
	Calendula officinalis	Asteraceae	*Per os*		Leaves
R18	*Artemisia annua*	Asteraceae	*Per os*	Decoction,	Leaves
	Picralima nitida	Apocynaceae	*Per os*		Fruit
	Carica papaya	Caricaceae	*Per os*		Leaves
R19	*Euphorbia thymifolia*	Euphorbiaceae	*Per os*	decoction	Whole plant
	Salvia rosmarinus	Lamiaceae	*Per os*		Whole plant
	Desmodium adscendens	Fabaceae	*Per os*		Whole plant
R20	*Allium cepa*	Alliaceae	*Per os*	Decoction	Bulb
	Carica papaya	Caricaceae	*Per os*		Leaves
R21	*Taraxacum sp*	Asteraceae	*Per os*	decoction	Whole plant
	Citrus limon	Rutaceae	*Per os*		Leaves
	Raphanus sativus	Brassicaceae	*Per os*		Leaves
	Syzygium aromaticatum	Myrtaceae	*Per os*		Fruit
R22	*Allium sativum*	Alliaceae	*Per os*		Bulb,
	Mentha suaveolens	Lamiaceae	*Per os*	Infusion, maceration	Stem, Leaves
R23	*Azadirachta indica*	Meliaceae	*Per os*	decoction	Leaves
	Allium cepa	Alliaceae	*Per os*		Bulb
	Picralima nitida	Apocynaceae	*Per os*		Fruit
R24	*Carica papaya*	Caricaceae	*Per os*	Decoction	Leaves
	Allium sativum.	Alliaceae	*Per os*		Bulb
R25	*Gingiber officinalis*	Zingiberaceae	*Per os*	decoction	rhizome
	Syzygium aromaticatum	Myrtaceae	*Per os*		Fruit
R26	*Curcuma longa*	Zingiberaceae	*Per os*	decoction	rhizome
	Picralima nitida	Apocynaceae	*Per os*		Fruit
R27	*Allium sativum*	Alliaceae	*Per os*	Decoction,	Bulb,
	Ocimum basilicum	Lauraceae	*Per os*		Leaves
	Gingiber officinalis	Zingiberaceae	*Per os*		rhizome
	Carduus marianus	Asteraceae	*Per os*		Leaves
R28	*Citrus limon*	Rutaceae	*Per os*	Decoction, infusion	Leaves
	Phyllantus amarus	Euphorbiaceae	*Per os*		Leaves
	Carica papaya	Caricaceae	*Per os*		Leaves
R29	*Ocimum basilicum*	Lauraceae	*Per os*	Infusion,	Leaves
	Artemisia annua	Asteraceae	*Per os*	Maceration	Leaves
	Carica papaya	Caricaceae	*Per os*		Fruit
	Raphanus sativus	Brassicaceae	*Per os*		Leaves
R30	*Senna alata*	Caesalpiniaceae	*Per os*	Cataplasm	Stem
	Desmodium adscendens	Fabaceae	*Per os*	decoction	Leaves
	Gingiber officinalis	Zingiberaceae	*Per os*		rhizome

Per os: oral route

Discussion

Of the 148 traditional healers surveyed, men represent more than 80% of traditional healers and women are less represented. These results are in line with those of Lakouéténé et al.[15] where 71% men were surveyed and contrary to the results of Hama et al.[31] where fewer men (38%) were involved. This can be explained by the fact that in Africa, traditional society is patriarchal, i.e., inheritance (material goods, knowledge, etc.) is more likely to be passed on to sons.

The age range of tradithérapists is between 30-59 years old and curiously represents a young population. However, older therapists have greater knowledge of plants.[32,33]

The tradithérapeutes interviewed are all educated, which is contrary to the results of the work of Hama et al.[31] in Niger which show that respectively 69.74% and 64% of the people surveyed have not been educated. Our results can be explained by mentalities that are changing and becoming more open.

The most recurrent means of acquisition is through inheritance; indeed, the virtues of plants are ancestral knowledge that is passed down from generation to generation.

Most of the tradithérapeutes we met are married; marriage is sacred and makes tradithérapeutes more responsible as parents.[34,35]

The harvesting technique is manual (93.33%) because the study site is in the process of development and therefore the methods in agriculture are still archaic. Similarly, the harvesting period is during the rainy season (73.33%) because most of the species mentioned bloom and reach maturity in this season. The most used part is the leaf (37.50%), these results are close to those of Sangare et al.[36] and Adjanohoun & Aké Assi[37] who reported that the leaves were solicited in the majority in 59% of traditional treatments. However, they differ from those of Thirumalai et al.[38] who in a similar study in India found that the most solicited part of the plant was the leafy stem.

This is understandable because the pathology concerned and the geographical area of study differ. Our results can be explained by the fact that photosynthesis takes place at this level and therefore the active principles are more present there, on the one hand, and on the other hand, its use can also be justified by the fact that the leaves are easily accessible.

The species used in our survey are mostly fresh because the active ingredient is easier to extract than in the dry state. However, the best way to preserve the raw material is in a dry state.

The dominant preparation method is decoction which is close to the results of Sangare et al.[36] where decoction (39.5%) is the most used mode. This result is close to that of Fah et al.[39] who indicate that recipes are mainly prepared by decoction. Decoction is one of the easiest methods for extracting active ingredients from a plant. In this study, the extracts used to treat viral hepatitis are exclusively administered orally.

The use of plants is being standardized because the dosage shows that the quantities given are measured, even if it is still embryonic, contrary to previous surveys which revealed that the various drugs were administered without taking into account the problems of toxicity, which sometimes distorted the therapeutic results and caused accidents. Several studies conducted on traditional treatments have reported similar problems.[40-43]

The study made in the framework of the treatment of hepatitis B from plants has allowed obtaining 29 species belonging to 16 botanical families, thanks to the knowledge of 30 informants. The families that were most cited were Alliaceae, Zingiberaceae and Caricaceae.[44-46]

The most represented species are Carica papaya with a frequency of 37%, Allium sativum with a frequency of 27%, Allium cepa with a frequency of 24% and Curcuma longa with a frequency of 24%. The plants used are mostly herbaceous A careful analysis of the 30 recipes obtained shows us that 43% of the most used parts are the leaves and are 80% prepared by decoction and administered exclusively by oral way.

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Conflicts of interest

We declare that there is no conflict of interest of any kind.

References

1. Augustino P, Gillah PR. Medicinal plants in urban districts of tanzania: plants, gender roles & sustainable use. *International forest review*. 2005;7(1):44–58.
2. OMS. WHO Strategy for Traditional Medicine 2002–2005, Geneva. 2002;78.
3. Fleurentin J, Weniger B, Bourdy D. *Therapeutic traditions and the medicine of tomorrow: the challenges of ethnopharmacology, Ouest-France, Rennes*. 2011.
4. Akéréle O. Traditional medicine: Let's not waste nature's bounty. *World Health Forum*. 1993;14:422–442.
5. Sofowora A. *Medicinal Plants and Traditional Medicine of Africa. Karthala; Swiss Academy of Natural Sciences, Paris: Bern*. 2010.
6. Ahyi AMR. Traditional medicine, African pharmacopoeia and sustainable development: Cultural, scientific, socio-economic, and ecological motivations. *In Proceedings of the International Seminar on the Development of Ethical Phytomedicines.* 1997:34–144.
7. Adjanohoun E, Sinsin B, Akouegninou A, et al. Sustainable use of medicinal and aromatic plants in Benin (phase 1): prospecting based on data collection in markets and at harvesting sites. *Cenprebaf, Cotonou, Benin*. 1999;143.
8. Sinsin B, Tèhou AC, Daouda I, et al. Abundance & species richness of large mammals in Pendjari National Park in Benin. *Mammalia*. 2002;66:369–380.
9. Fyhrquist P. Traditional medicinal uses & biological activities of some plants extract of African Combretum Loefl.; Terminalia L. & Pteleopsis Engl. Species (Combretaceae). *Ph.D. Dissertation, University of Helsinki, Finl*. 2007;185.
10. Betti JL. An ethnobotanical study of medicinal plants among the Baka Pygmies in the Dja Biosphere reserve (Cameroun). *Afr Stud Monogr*. 2004;25(1):1–27.
11. Betti JL. *Traditional uses and vulnerability of medicinal plants in the Dja Biosphere Reserve, Cameroon. Doctoral thesis, Université Libre de Bruxelles, Belgium*. 2001;87.
12. Mapi J. *Contribution to the ethnobotanical study and chemical analyses of some plants used in traditional medicine in the Nkongsamba region (Moungo). Doctoral thesis, University of Yaoundé*. 1988.
13. Mbenkum T, Duncan. *Final report to the world–wide fund for nature*. Survey, U.K. 1989.
14. Mehdioui R, Kahouadji A. Etude ethnobotanique auprès de la population riveraine de la forêt d'Amsittène: cas de la Commune d'Imi n'Tlit (Province d'Essaouira). *Bulletin de l'Institut Scientifique*. 2007;29:11–20.
15. Lakouéténé DPB, Ndolngar G, Berké B, et al. *Enquête ethnobotanique des plantes utilisées dans le traitement du paludisme à Bangui*. Bull. Soc. Pharm. Bordeaux. 2009;148:123–138.
16. Ndah NR, Egbe AE, Bechem E, et al. Ethnobotanical study of commonly used medicinal plants of the Takamanda Rainforest South West, Cameroon. *African Journal of Plant Science*. 2013;7(1):21–34.

17. Tsague Megne–A IM. Etude floristique et ethnobotanique des plantes antipaludéennes du département de la vina (Ngaoundere–cameroun). *Mémoire de DIPES II, Université de Ngaoundéré, ENS de Bertoua*. 2019;63.

18. Epouopa EA. Floristic and ethnobotanical study of plants involved in the treatment of typhoid fever and malaria in the city of Bertoua and its surrounding area. DIPES II thesis, University of Ngaoundéré, ENS of Bertoua. 2019;66.

19. Kapnang FTO. Floristic and ethnobotanical study of typhoid fever treatment in the Koung-khi Department (West Cameroon). DIPES II thesis, University of Ngaoundéré, ENS of Bertoua. 2021;65.

20. Magny Tchounkeu H. *Floristic and ethnobotanical study of hepatitis B treatment in the locality of Bafoussam (West Cameroon). DIPES II thesis, University of Ngaoundéré, ENS of Bertoua*. 2021;57.

21. Noubissi T. Floristic and ethnobotanical study of plants used in the treatment of male infertility in the Moungo department (Littoral Region, Cameroon). DIPES II thesis, University of Ngaoundéré, ENS of Bertoua. 2021;47.

22. Tamotsop Magoufo E. *Floristic and ethnobotanical study of plants used in the treatment of diabetes in the locality of Mbouda (Cameroon).* DIPES II thesis, University of Ngaoundéré, ENS of Bertoua. 2021;57.

23. Chimi DC, Inimbock SL, Kabelong BL–P–R, et al. Availability of medicinal forest plant species used as adjuvant in COVID–19 treatment in the periphery of the Deng–Deng forest, Cameroon. *Journal of Medicinal Plants Studies*. 2022;10(1):98–106.

24. Marcellin P, Zarski JP. *Hepatitis B and Delta viruses. In: Briand P., ed. Bloodborne viruses. Monrouge–London–Rome: John Libbey Eurotext*. 1996;53–75.

25. Noah ND, Njouom R, Bonny A, et al. HBs antigene prevalence in blood donors & the risk of transfusion of hepatitis B at the central hospital of Yaounde, Cameroon. *Open journal of gastroenterology*. 2011;1(2):23–27.

26. Foupouapouognigni Y, Sadeuh MSA, Betsem AEB. Hepatitis B and C virus infections in the three Pygmy groups in Cameroon. *Journal of Clinical Microbiology*. 2011;49(2):737–740.

27. Champaud J. *Towns and countryside of Western Cameroon*. IRD Editions. 1983.

28. Schwartz D. *Statistical methods for use by physicians and biologists*. Paris: Flammarion Médecins Sciences. 1993;314.

29. Gbekley EH, Karou DS, Gnoula C, et al. Ethnobotanical knowledge and uses of Combretum micranthum in traditional pharmacopoeia in Southwest Tahoua (Niger, West Africa). *International Journal of Biological and Chemical Sciences*. 2019;13(4):2173–2191.

30. Orsot BAMB. Ethnobotanical study of medicinal plants used in the treatment of waterborne diseases by the Abbey people of the Agboville department (Ivory Coast) and evaluation of the antifungal activity of extracts from four plants against Sclerotium rolfsii, a phytopathogen. Doctoral thesis in botany, Felix Houphouetboigny University, Ivory Coast. 2016;168.

31. Hama O, Kamou H, Ali A, et al. Connaissances ethnobotaniques et usages de *Combretum micranthum* dans la pharmacopée traditionnelle au Sud–ouest de Tahoua (Niger, Afrique de l'Ouest). *International Journal of Biological and Chemical Sciences*. 2019;13(4):2173–2191.

32. Bio A, Toyi SM, Yoka J, et al. Contribution aux connaissances des principales plantes antihypertensives utilisées en médecine traditionnelle à Bassila (Bénin, Afrique de l'Ouest). Revue CAMES–Série Pharm. Médecine Traditionnelle. Africaine. 2015;17(2):8–18.

33. Olou BA, Bio A, Deleke Koko EIK, et al. Connaissances ethnobotaniques et valorisation de deux plantes antihypertensives (*Carissa edulis* L. et *Crateva adansonii* DC) au Sud et au Centre du Bénin (Afrique de l'Ouest). *International Journal of Biological and Chemical Sciences*. 2018;12(6):2602–2614.

34. Ouakrouch A. *Ethnobotanical survey of medicinal plants used in the traditional treatment of type II diabetes in Marrakech. Doctoral thesis in medicine, Cadi Ayyad University, Morocco*. 2015;126.

35. Zahira B. Contribution à l'étude ethnobotanique des plantes médicinales de la région d'Azail. *Mémoire en vue d'obtention du diplôme de Master, Algérie*. 2017;75.

36. Sangare MM, Sina H, Dougnon J, et al. Etude ethnobotanique des plantes hépatotropes et de l'usage traditionnel de *Gomphrena celosioides* Mart. (Amaranthaceae) au Bénin. *International Journal of Biological and Chemical Sciences.* 2012;6(6):50085021.

37. Adjanohoun EJ, Aké Assi L. Contribution au recensement des plantes médicinales de Côte d'Ivoire. Université d'Abidjan, *Centre National de Floristique(CNF).* 1979;358.

38. Thirumalai T, Beverly CD, Sathiyaraj K, et al. Ethnobotanical Study of anti–diabetic medicinal plants used by the local people in javadhu hills Tamilnadu, India. *Asian Pacific Journal of Tropical Biomedicine*. 2012;2(2):S910–S913.

39. Fah L, Klotoé JR, Dougnon V, et al. Etude ethnobotanique des plantes utilisées dans le traitement du diabète chez les femmes enceintes à Cotonou et à Abomey – Calavi. *Journal of Animal & Plant Sciences*. 2013;18(1):2647–2658.

40. Guillemois E. *Plants used in traditional medicine in Benin to treat malaria. Doctoral thesis in pharmacy, University of Rennes I*. 2004;97.

41. Pousset JL. *Medicinal Plants of Africa. How to Recognize and Use Them? Secum/edisud, Paris ACCT.* 2004;284.

42. Yemoa AL, Gbenou JD, Johnson RC, et al. Identification et étude phytochimique de plantes utilisées dans le traitement traditionnel de l'ulcère de Buruli au Bénin. *Ethnopharmacologia*. 2008;42:48–55.

43. N'Guessan K, Kadja B, Zirihi GN, et al. Screening phytochimique de quelques plantes médicinales ivoiriennes utilisées en pays Kroubou (Agboville, Côte d'Ivoire). *Science et Nature*. 2009;6(1):1–15.

44. Anonyme. *The Medical Encyclopedia. The History of Medicine and Surgery, the Future of Medicine, the Nobel Prizes. Published by Service S.A.: Geneva (Switzerland)*. 1974;397.

45. APG III. An update of the Angiosperm Phylogeny Group classification for the orders and families of flowering plants. *Botanical Journal of the Linnean Society*. 2009;161(2):105–121.

46. Tankam Tankam CP. Floristic and ethnobotanical study of antimalarial and anti COVID-resistant plants in the city of Douala (Littoral Region, Cameroon). *Dipes II thesis, Higher Teacher Training College of Bertoua, Cameroon*. 2021;87.