ESI Preprints **Not Peer-reviewed**

Endogenous Knowledge of the Attie People on Anti-schistosomiasis Medicinal Plants in the Adzope Health District, Côte d'Ivoire

Bene Kouadio
Ouedje Eppoue Romuald
Koffi Akessé Georges
Faculty of Natural Sciences,
Nangui Abrogoua University, Abidjan, Côte d'Ivoire
Tra Bi Boli Francis
Faculty of Biosciences,
Félix Houphouët-Boigny University, Abidjan, Côte d'Ivoire
Sylla Youssouf
Fah Monh Alice
Moyabi Any Georges Armel
Koukakou Donthy Kouakoubah Richard
Kone Mamidou Witabouna
Faculty of Natural Sciences,
Nangui Abrogoua University, Abidjan, Côte d'Ivoire

Doi: 10.19044/esipreprint.12.2022.p81

Approved: 03 December 2022
Posted: 05 December 2022

Cite As:
Bene K., Ouedje E.R., Koffi A.G., Tra Bi. B.F., Sylla Y., Fah M.A., Moyabi A.G.A., Koukakou D.K.R. & Kone M.W. (2022). *Endogenous Knowledge of the Attie People on Anti-schistosomiasis Medicinal Plants in the Adzope Health District, Côte d'Ivoire*. ESI Preprints. https://doi.org/10.19044/esipreprint.12.2022.p81

Abstract

Schistosomiasis or bilharziasis is a parasitic disease caused by flatworms or plathelminthes: bilharzias or schistosomes that live in the venous vascular system. This disease is a major public health problem in countries located in the tropics and subtropics. The general objective of this work was to contribute to the eradication of schistosomiasis in Côte d'Ivoire by highlighting the endogenous knowledge of the Attie people on the medicinal plants used for the treatment of schistosomiasis in the Health District of Adzope. An ethnobotanical survey was conducted among

practitioners of traditional medicine (TMP), using a semi-structured interview associated with the show-and-tell technique. A total of 33 medicinal species have been listed. They are divided into 31 genus and 21 botanical families with a predominance of Annonaceae, Asteraceae, Euphorbiaceae and Fabaceae, each with three species. The most cited species are *Combretum paniculatum* (CF = 14.79%) and *Mareya micrantha* (CF = 10.56%). The leaves are the most used organs; the decoction is the main mode of preparation of the recipes which are generally administered orally. The results of this study constitute a valuable database for further research in pharmacology and phytochemistry.

Keywords: Endogenous knowledge, medicinal plants, schistosomiasis, Attie, Adzope, Côte d'Ivoire

Introduction

Schistosomiasis or bilharziasis is a neglected tropical disease (NTD) caused by worms of the genus Schistosoma. Six (6) species of the genus *Schistosoma* are pathogenic for humans. They are *Schistosoma guineensis, S. haematobium, S. intercalatum, S. japonicum, S. mansoni and S. mekongi* (WHO, 2021). It is the second parasitic endemic in the world after malaria (Zoni *et al.*, 2016). Schistosomiasis has major health and socio-economic repercussions in developing countries, where it constitutes a major public health problem (Tchuenté *et al.*, 2013) and causes a brake in the achievement of the Sustainable Development Goals, particularly that of "enable everyone to live in good health and promote the well-being of all at all ages". In Côte d'Ivoire, the results of parasitological surveys have shown that urinary and intestinal schistosomiasis remain endemic with unfavorable hygiene and sanitation conditions despite control efforts (Assaré *et al.*, 2014). The Health District of Adzope is one of the most affected zones by schistosomiasis, with a prevalence of 19.8% (MSHP, 2020). The treatment of this disease, in the absence of a vaccine, is essentially based on chemoprevention (CP), which consists of distributing on a large scale, at regular intervals and to entire groups of the population, safe drugs of proven quality, alone or in combination. (Aubry and Gaüzère, 2020). For the past thirty years, the most widely used drug has been Praziquantel (PZQ) because it has many advantages. In addition to being effective against all species of schistosomes with very few side effects, this drug can be administered orally in a single dose and is inexpensive (Dissous *et al.*, 2009). However, evidence of emerging drug resistance and low efficacy of PZQ has been reported in Egypt and Senegal (Cioli *et al.*, 2008). In addition, coverage of schistosomiasis chemoprevention interventions, previously insufficient, has dropped significantly due to the effects of the Covid-19 pandemic (WHO,

2021). The WHO has therefore defined as a strategic priority the search for new drugs against schistosomiasis. Plants being one of the main sources of the production of biomolecules, present a therapeutic alternative to be explored. In addition, southern countries like Côte d'Ivoire constitute a pool of knowledge that feeds a traditional healthcare system based on a rich plant pharmacopoeia. Clearly, there is a wealth of traditional medical knowledge in the field of healthcare, embedded in traditional cultures. The treatment management of schistosomiasis by herbal recipes could therefore serve as a source of new molecules schistosomicidal. It is in this context that the present study was organized, the objective of which was to reveal the traditional knowledge in the treatment of schistosomiasis in order to eventually propose a therapeutic alternative.

Study materials and methods

Study zone

The region of Mé belongs to the sub-equatorial zone with a humid Attiean climate comprising four seasons, including two rainy seasons and two dry seasons. The temperature there is relatively constant, oscillating around 27.5°C. The annual rainfall is 1578 mm. The vegetation is dominated by the humid tropical forest made up of overexploited forest massifs (Kouakou, 2022). Primary forest is only found in the seven reserved forests, in particular Massa Mé, Mabi, Mé Mafo, Hein, Agbo, N'Toh and Besso. The selection criteria for the Health District were, among others, the high prevalence of schistosomiasis (MSHP, 2020), the humidity linked to the subequatorial climate, the hydrography, the hydro-agricultural facilities and the vegetation (Poda *et al.*, 2004 ; Yapi *et al.*, 2014) which would be favorable to the contraction and spread of this neglected tropical disease. Six localities which constitute Municipals were visited. They are the localities of Adzope, Abongoua, Yakasse-Attobrou, Assikoi, Bieby and Yakassé-mé (Figure 1).

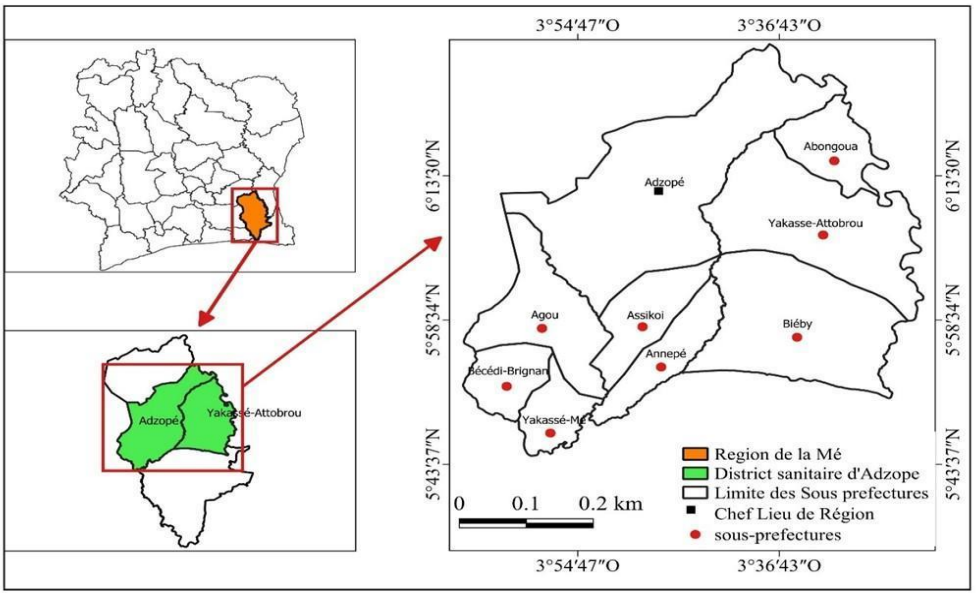

Figure 1. Location map of the study area (Adzope Health District)

The biological material consisted of all the plants identified in the Health District of Adzope. The technical field equipment for the ethnobotanical survey consisted of survey sheets, pruning shears and cutlasses, plastic bags, presses and newspapers for making the herbarium and a digital camera.

Ethnobotanical surveys

The ethnobotanical survey was conducted from February 15 to May 30, 2022. The semi-structured direct interview method was used, to which the "show-and-tell" technique was associated. It consisted of administering a questionnaire to traditional medicine practitioners in the Adzope Health District. These interviews focused on the socio-demographic characteristics (sex, age, profession, level of education and level of knowledge of schistosomiasis) of the traditional medicine practitioners (TMP), on the plants or plant organs used in the different recipes as well as their methods of preparation and administration for treating schistosomiasis and its symptoms. As for the so-called "show-and-tell" technique, it consisted of showing photographs of people with symptoms of schistosomiasis to the respondents. The questions were asked in the Attie language.

Collection and identification of listed plants

Each interview with traditional medicine practitioners was followed by field trips to collect samples of the species mentioned on the basis of the

vernacular names of these plants. One specimen of each species was packaged in the form of herbariums and identified at the Swiss Center for Scientific Research in Côte d'Ivoire (CSRS). The nomenclature used is that of Lebrun & Stork (1991, 1992 and 1995). The botanical families have been updated with the APG IV (2016) classification system.

Determination of ethnobotanical parameters

Species Citation Frequency (CF)

The citation frequency (%) reflects the distribution of a species within the regularity in the community of traditional healers. It is expressed by the percentage of mention of a species compared to the total number of people surveyed. The importance of the parts of plants used and their uses are determined from the number of spontaneous citations based on the principle that the species whose organs are mentioned the most by several respondents obtain a high rank (Cotton, 1996).

The frequency of citation of each of the taxa listed is calculated by the formula used by Gbekley *et al.* (2015).

$$CF = \frac{n}{N} \times 100$$

With: n: number of people who mentioned the species

N: total number of respondents

Contribution of each species in recipes (CPr)

The CPr (%) makes it possible to assess the frequency of involvement of a plant in the recipes. It was determined for each species by the formula (Adomou *et al.*, 2012):

$$Cpr = \frac{Nr}{Nt} \times 100$$

With Nr: recipe number

Nt: total number of recipes

Results

Sociodemographic profile of respondents

The socio-demographic characteristics of the people surveyed are recorded in Table I. The surveys were conducted among 40 traditional medicine practitioners (PMT). These PMTs interviewed are made up of 45% men and 55% women. The most represented age group is [35-60 years old) with a proportion of 42.5% of respondents. With regard to the level of education, 40% of the people surveyed are illiterate, 25% have secondary school education level and 35% have primary education level.

Table I. Sociodemographic characteristics of people surveyed in the Adzope Health District

Sociodemographic characteristics	Parameters	People surveyed	
		Number	Proportions (%)
Gender	Male	18	45
	Female	22	55
Age group (yrs)	[18-35[	7	17,5
	[35-60[	17	42,5
	[60-70[	16	40
	≥ 70	0	0
Education level	illiterate	16	40
	Primary	14	35
	Secondary	10	25

Specific richness of the plants listed

This study made it possible to list 33 species of plants which are divided into 31 genus and 21 botanical families. The plants identified, the organs used, the methods of preparation and mode of administration are recorded in Table II. The most represented families are the Annonaceae, Asteraceae, Euphorbiaceae and Fabaceae, each with three species, i.e. 14.28%.

Ethnobotanical parameters

Figure 2 shows the frequency of citation of the species identified by the respondents. The species most cited by the TMPs for the treatment of schistosomiasis are in ascending order and according to the frequency of citation: *Combretum paniculatum* (CF = 14.79%), *Mareya micrantha* (CF = 10.56%), *Newbouldia laevis* (CF=7.04%), *Desplatsia chrysochlamys* 6.34%, *Albizia zygia* (CF=4.33%).

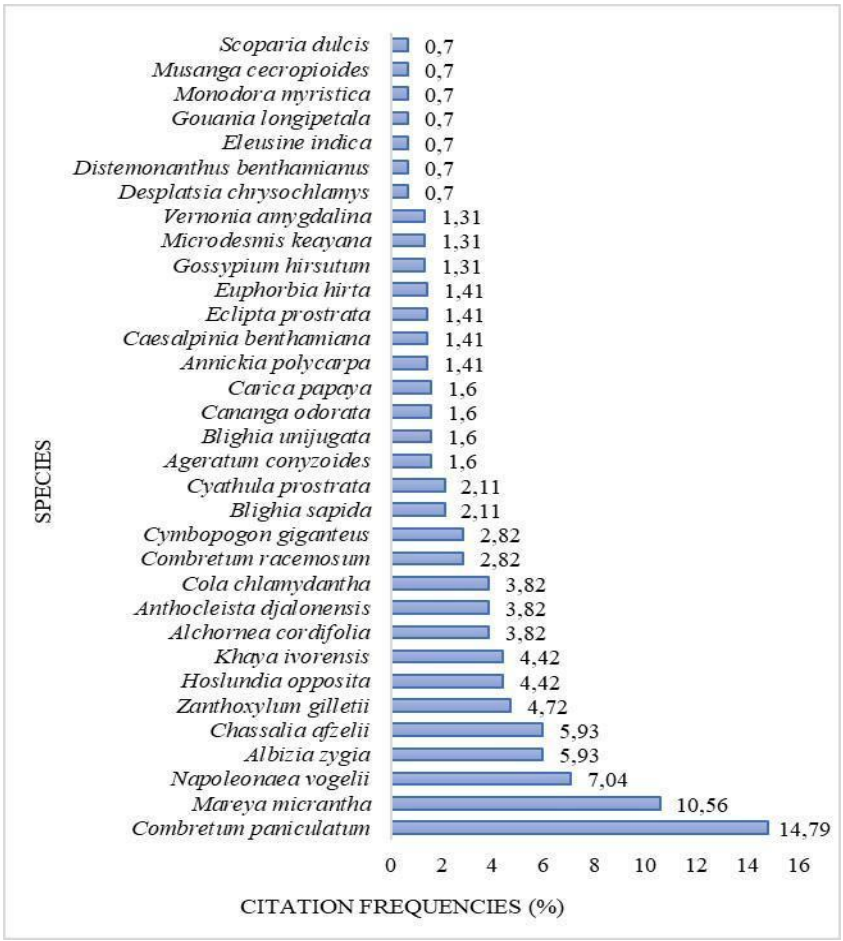

Figure 2. Citation frequencies of listed species used for the treatment of schistosomiasis

Contribution of species to the recipes

The plants identified are involved in 61 medicinal recipes, both mono-specific and multi-specific with greater use for mono-specifics. The species mostly used in recipes by TMPs to treat schistosomiasis are *Caesalpinia benthamiana, Cymbopogon giganteus, Gossypium hirsutum, Microdesmis keayana, Vernonia amygdalina, Zanthoxylum gilletii* (CPr = 4.92%), (Table II).

The plant organs most used by TMP are the leaves (52%) followed by stem bark (24%) and whole plant (12%). The whole plant (9%) and roots (3%) are also used in recipes (Figure 3).

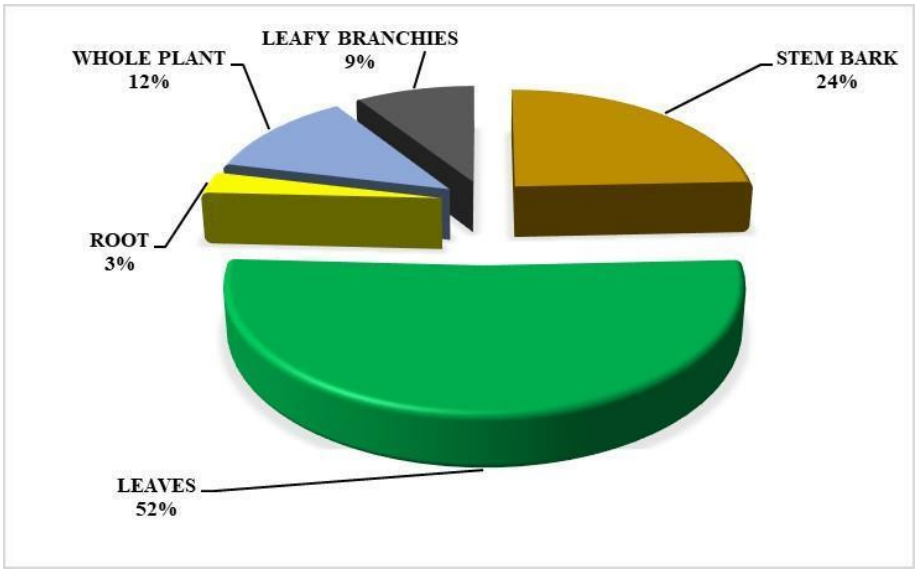

Figure 3. Plant organs used in recipes

Figure 4 shows the four preparation methods for traditional recipes. The most cited by the TMPs of Adzope are decoction (72.7%) and maceration (18.2%).

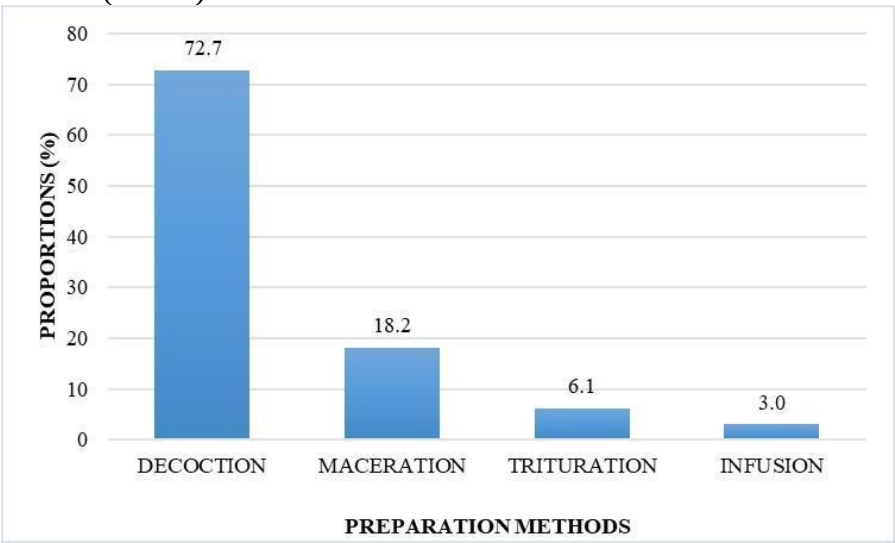

Figure 4. Proportions preparation methods

The mode of administration most cited by the TMPs for the treatment of schistosomiasis are presented in figure 5. They are: the oral route (55%), the ocular route (18%), the anal route (15%) and the cutaneous route (12%).

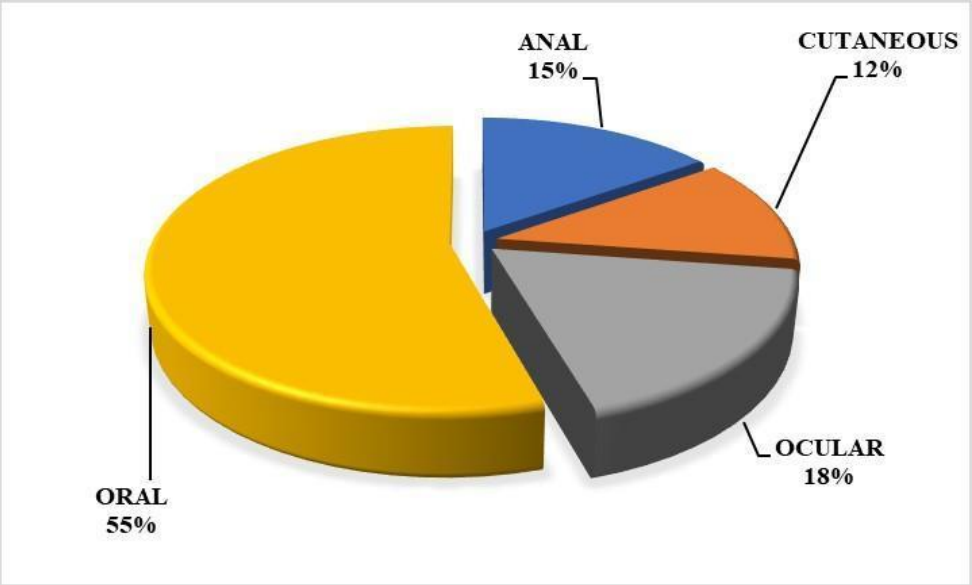

Figure 5. Proportions of administration mode

Table II. List of identified plants and organ used against schistosomiasis in the Health District of Adzope

N°	*Scientific names*	Botanical families	Vernacular names (Attie)	Organ Used	Preparation Methods	Administration routes	Dosage	CF (%)	CPr (%)
1	*Ageratum conyzoides*	Asteraceae	Metêveuhdoum	LB	Trituration	Ocular	3 VT	1,6	3,28
2	*Albizia zygia*	Fabaceae	Koê	SB	Maceration	Anal	2 VT	5,93	3,28
3	*Alchornea cordifolia*	Euphorbiaceae	N'dzin	L	Decoction	Oral	2 VT	3,82	1,64
4	*Annickia polycarpa*	Annonaceae	Bêdou	SB	Decoction	Oral	1 VT	1,41	3,28
5	*Anthocleista djalonensis*	Gentianaceae	Agnime	SB	Decoction	Anal	1 VT	3,82	1,64
6	*Blighia sapida*	Sapindaceae	Beuhfi	L	Decoction	Oral	2 VT	2,11	1,64
7	*Blighia unijugata*	Sapindaceae	Beuhbi	L	Decoction	Oral	3 VT	1,6	3,28
8	*Caesalpinia benthamiana*	Fabaceae	Apkabagnon	L	Maceration	Oral	1 VT	1,41	4,92
9	*Cananga odorata*	Annonaceae	Pôtôpoin	SB	Decoction	Cutaneous	2 VT	1,6	1,64
10	*Carica papaya*	Caricaceae	Bane/ Mon m'poussin/ Monmouh	R	Decoction	Cutaneous	2 VT	1,6	3,28
11	*Chassalia afzelii*	Rubiaceae	Chibibaté	L	Decoction	Anal	2 VT	5,93	1,64
12	*Cola chlamydantha*	Malvaceae	Lobeu	L	Decoction	Oral	3 VT	3,82	3,28
13	*Combretum paniculatum*	Combretaceae	Atcholô / Betsôssôh/ Yatanbaté	L	Infusion	Ocular	1 VT	14,79	3,28
14	*Combretum racemosum*	Combretaceae	Betchô	L	Decoction	Oral	3 VT	2,82	3,28
15	*Cyathula prostrata*	Amaranthaceae	N'kpe	LB	Maceration	Oral	2VT	2,11	3,28
16	*Cymbopogon giganteus*	Poaceae	Baté-bêchou	WP	Decoction	Anal	3 VT	2,82	4,92
17	*Desplatsia chrysochlamys*	Tiliaceae	Guilo	SB	Decoction	Oral	2 VT	0,7	1,64
18	*Distemonanthus benthamianus*	Fabaceae	Adouanga	SB	Decoction	Oral	2 VT	0,7	3,28
19	*Eclipta prostrata*	Asteraceae	Gnikiê	WP	Decoction	Ocular	1 VT	1,41	3,28
20	*Eleusine indica*	Poaceae	Ihinkpi	WP	Decoction	Ocular	2 VT	0,7	1,64
21	*Euphorbia hirta*	Euphorbiaceae	Atordou	L	Maceration	Oral	2 VT	1,41	1,64
22	*Gossypium hirsutum*	Malvaceae	Ihêssêtê	L	Decoction	Oral	1 VT	1,31	4,92
23	*Gouania longipetala*	Rhamnaceae	Kezôr	WP	Decoction	Ocular	3 VT	0,7	3,28

N°	*Scientific names*	Botanical families	Vernacular names (Attie)	Organ Used	Preparation Methods	Administration routes	Dosage	CF (%)	CPr (%)
24	*Hoslundia opposita*	Lamiaceae	Feuhfi	L	Trituration	Ocular	1 VT	4,42	1,64
25	*Khaya ivorensis*	Meliaceae	Zapinchi	SB	Decoction	Oral	2 VT	4,42	3,28
26	*Mareya micrantha*	Euphorbiaceae	Wiya	L	Decoction	Anal	1 VT	10,56	3,28
27	*Microdesmis keayana*	Pandaceae	Kpezun	L	Decoction	Oral	2 VT	1,31	4,92
28	*Monodora myristica*	Annonaceae	Ikpor	L	Decoction	Oral	2 VT	0,7	3,28
29	*Musanga cecropioides*	Urticaceae	Moin-nin	L	Decoction	Oral	1 VT	0,7	1,64
30	*Napoleonaea vogelii*	Lecythidaceae	Têkpi	L	Decoction	Oral	3 VT	7,04	3,28
31	*Scoparia dulcis*	Plantaginaceae	Ahin gbazor	LB	Maceration	Cutaneous	2 VT	0,7	1,64
32	*Vernonia amygdalina*	Asteraceae	Torzor	L	Maceration	Oral	1 VT	1,31	4,92
33	*Zanthoxylum gilletii*	Rutaceae	Kponh	SB	Decoction	Cutaneous	2 VT	4,72	4,92

L: Leaves, LB: Leafy branches, SB: Stem bark, R: Roots, WP: Whole plant, VT: Tea glass, CPr: Contribution of plants to the recipe, CF: citation Frequency

Discussion

The data presented at the end of this study focused on the sociodemographic characteristics of the participants as well as the ethnobotanical parameters. With regard to socio-demographic parameters, the traditional medicine practitioners surveyed are mostly women with a proportion of 55%. Their predominance in the practice of this occupation could be explained by the fact that they hold more endogenous knowledge of medicinal plants and as wives and mothers, the responsibility falls on them first and foremost to provide first aid to the patients. This profile is observed in numerous studies such as those of Fah *et al.* (2013), Bene *et al.*, (2016), Asseh *et al.* (2019) confirming the appropriation of different TMP in Côte d'Ivoire by the female gender. In this study, only the Attie people are represented. These results are understandable given that the study area is mainly populated by Attie natives. In addition, the Akan ethnocultural group is known for its great knowledge of plants and their uses in the pharmacopoeia (Manouan *et al.*, 2010). On the other hand, the knowledge of plants is widespread in the age group going from 35 to 70 with a dominance of the age group from 35 to 60 years (42.5%), the respondents mainly belong to the adults age group. This percentage would be justified by the knowledge of the properties and uses of plants which is generally acquired following a long period of experience accumulated and transmitted from one generation to another (Anyinam, 1995). People of this age group are those who have the most experience in traditional medicine and hold a good part of the ancestral knowledge which is done by oral transmission (Lakouéténé *et al.*, 2009). The TMPs are distributed over all three levels of education. However, those with no educational level stand out (40%).

At the ethnobotanical level, the interview with the Practitioners of Traditional Medicine made it possible to list 33 species of plants which are divided into 31 genus and 21 botanical families. Annonaceae, Asteraceae, Euphorbiaceae and Fabaceae are the most represented families at 14.28%. This predominance could be explained by the fact that these family are one of those that contain many species exploited for their medicinal property. These results agree with those of Muya *et al.* (2014) who made an "Ethnobotanical overview of some plants used against urogenital schistosomiasis in Lubumbashi and surroundings". These authors revealed a strong representativeness of Fabaceae. In Côte d'Ivoire, these different plants identified are revealed for the first time in the treatment of schistosomiasis through this study. A phytochemical study would justify the anti-schistosomiasis activity of these medicinal species.

Among the medicinal species indicated in the treatment of schistosomiasis, *Combretum paniculatum* Vent. (Combretaceae), is the most cited species. It is a vining shrub or stout liana up to 15 m long, with bright

scarlet flowers. It is widely distributed in tropical Africa. Traditionally this taxon is used in the treatment of several pathologies. The leaf sap is used externally against gonorrhea in Tanganyika, while the galled leaves are crushed with salt and the paste applied to the tongue and inside the mouth of babies with stomatitis in Côte d'Ivoire (Sowemimo *et al.*, 2012). Indeed, various studies conducted on the biological and phytochemical activities of *Combretaceae* have shown very good results (Soumahoro *et al.*, 2016, Haïdara *et al.*, 2022). Studies by Haïdara *et al.* (2022) relating to the identification of chemical constituents and their antiradical activities of three *Combretaceae* revealed the richness of this botanical family in phytocompounds such as polyphenols, flavonoids, tannins and compounds with triterpene genins such as saponosides which can justify biological activities. This taxon, although revealed for the first time in the treatment of schistosomiasis, has nevertheless been the subject of several studies in phytochemistry and pharmacology. The aqueous extracts of the leaves and the inflorescence are said to have an action against cancerous tumors (Burkill, 1985). The plant's anti-HIV activity has also been reported (Asres *et al.*, 2001). Antimicrobial compounds such as cholest-5-en-3-ol, 2-phyten-1-ol, gallocatechin and apigenin have been reported in the plant (Samdumu, 2007).

The majority use of leaves in the preparation of medicinal recipes is explained not only by the ease and speed of harvesting this organ but also by the fact that the leaves are the site of photosynthesis and the place of storage of secondary metabolites, which would be at the origin of the pharmacological properties of plants (Mangambu *et al.*, 2014). This observed leaf dominance has been obtained in other studies carried out on plants in the treatment of other diseases by certain authors including Kipré *et al.* (2017) and Sulla *et al.* (2018). For the preparation of medicinal recipes, decoction is the most common mode of preparation (72.7%). The local population believes in the method of decoction and finds it adequate to warm the body and disinfect the plant (Bwassiwe *et al.*, 2014). In addition, the decoction makes it possible to collect the most active ingredients and attenuates or cancels the toxic effect of certain recipes. This result is consistent with those of Muya *et al.* (2014). Monospecific recipes predominate, which is to the advantage of patients. Indeed, associations of plants, poorly matched, are sometimes dangerous. In Africa, about 30% of fatal accidents are due to the use of mixtures (El-Said *et al.*, 1969). Very often, practitioners add other plants (multi-specific recipes), ingredients or adjuvants to make the recipe more effective and excipients to facilitate the shaping of the traditional medicine. All these preparations are almost all administered orally. Oral prescription could be explained by the fact that the disease is linked to parasitic infections localized in deep organs. To reach them, the compound

must pass through the digestive tract to facilitate assimilation and action. The absorption of metabolites takes place in the small intestine, the liver intervenes for a detoxification of toxic substances.

Conclusion

This work consisted of researching plants capable of treating schistosomiasis based on the knowledge of TMPs in the Health District of Adzope. The ethnobotanical survey conducted among this target population revealed a diversity of 33 species of plants divided into 21 families with a dominance of a few families, namely Annonaceae, Asteraceae, Euphorbiaceae and Fabaceae, each with three species. The different recipes show a predominance of leaves and bark as the most used plant organs. Decoction is the main mode of preparation which is usually administered orally. These results obtained constitute a valuable database for pharmacological and phytochemical studies with a view to developing a phytomedicine to relieve populations exposed to this neglected tropical disease.

Acknowledgement

Our thanks and profound appreciation go to the Science, Technology and Innovation Fund (FONSTI), the International Development Research Center of Canada (IDRC) through the Science Granting Council Initiative (SGCI). These institutions fully funded this study. who fully funded the study. We also thank the Traditional Medicine Practitioners (TMPs) of the Adzope Health District who agreed to reveal their endogenous knowledge.

References:

1. Adomou AC, Yedomonhan H, Djossa B, Legba SI, Oumorou M & Akoegninou A (2012) Etude ethnobotanique des plantes médicinales vendues sur le marché Abomey-Calavi au Bénin. International Journal of Biological and Chemical Sciences, 6(2): 745-772.
2. Anyinam C (1995) Ecology and ethnomedicine: exploring links between current environmental crisis and indigenous medical practices. Social Science & Medicine, 40(3): 321-329.
3. APG IV (2016) An update of the Angiosperm Phylogeny Group classification for the orders and families of flowering plants: APG IV. Botanical Journal of the Linnean Society, 181: 1–20.
4. Asres K, Bucar F, Kartnig T, Witvrouw M, Pannecoupe C & De Clercq E (2001). Antiviral activity against human immunodeficiency virus type 1 (HIV-1) and type 2 (HIV-2) of ethnobotanically selected Ethiopian medicinal plants. Phytotherapy Research, 15: 62-69.

5. Assare RK, Knopp S, N'guessan NA, Yapi A, Tian-Bi Y-NT, Yao PK, Coulibaly JT, Ouattara M, Meïté A, Fenwick A, N'Goran EK & Utzinger J (2014) Sustaining control of schistosomiasis mansoni in moderate endemicity areas in western Côte d'Ivoire: a SCORE study protocol. BMC Public Health, 14: 1290-1301.
6. Asseh EE, Ake-Assi E & Koffi KJ (2019) Diversité biologique et influence des changements climatiques sur la distribution géographique de quelques espèces d'Acanthaceae en Côte d'Ivoire. International Journal of Biological and Chemical Sciences, 13(2): 676-692.
7. Aubry P & Gaüzère BA. Maladies tropicales négligées – Actualités 2020. Médecine tropicale, Centre René Labusquière, Institut de Médecine Tropicale, Université de Bordeaux, 33076 Bordeaux, France, 2020, 7p.
8. Béné K., Camara D., Fofie N'G.B.Y., Kanga Y, Yapi A.B., Yapo Y.C., Ambe S.A. & Zirihi G.N. (2016). Étude ethnobotanique des plantes médicinales utilisées dans le Département de Transua, District du Zanzan (Côte d'Ivoire). Journal of Animal & Plant Sciences, 27(2): 4230-4250.
9. Burkill HM (1985). The useful plants of West Tropical Africa. 2nd Edn. Richmond, UK, Kew Royal Botanical Garden, London, 404p.
10. Bwassiwe H, Metowogo K, Aklesso P, Mouzou R, Tossou R, Ahounou J, Eklu-Gadegbekou K, Dansou P & Aklikokou K (2014) Enquête ethnobotanique sur les plantes utilisées dans le traitement traditionnel des contusions musculaires au Togo. Revue Ivoirienne des Sciences et Technologie, 24: 112-130.
11. Cioli D, Valle C, Angelucci F & Miele AE. (2008) Will new antischistosomal drugs finally emerge? Trends in Parasitology, 24: 379-382.
12. Cotton CM (1996). Ethnobotany: Principles and Applications. Chichester, UK: Wiley. NP. Journal of Medicinal Chemistry, 40(13): 2108-2118.
13. Dissous C, Ahier A & Long T (2009) Un nouvel espoir dans le traitement de la schistosomiase. Médecine/sciences (Paris), 25: 24-26.
14. El-Said F, Sofowora EA, Malcolm SA & Hofer A (1969) An investigation into the efficacy of Ocimum gratissimum as used in Nigeria native medicine. Planta Medica. 17: 194–200.
15. Fah L, Klotoé JR, Dougnon V, Koudokpon H, Fanou VBA, Dandjesso, Loko F (2013) Étude ethnobotanique des plantes utilisées dans le traitement du diabète chez les femmes enceintes à Cotonou et

Abomey-Calavi (Bénin). Journal of Animal & Plant Sciences, 18(1) : 2647-2658.
16. Gbekley EH, Karou DS, Gnoula C, Agbodeka K, Anani K, Tchacondo T, Agbonon A, Batawila K & Simpore J (2015) Étude ethnobotanique des plantes utilisées dans le traitement du diabète dans la médecine traditionnelle de la région Maritime du Togo. PanAfrican Medicla Journal. 20 : 437-452.
17. Haïdara M, Dénou A, Tienou MH, Ly M, Kamaté B, Djimdé A & Sanogo R (2022) Etude pharmacognosique de trois Combretaceae, utilisées en médecine traditionnelle dans la prise en charge de cancers au Mali. Journal de la Société Ouest-Africaine de Chimie, 51 : 31 – 37
18. Kipré GR, Offoumou M'BR, Silue K, Bouabre GM, Zirihi GN Djaman AJ (2017) Enquête ethnopharmacologique des plantes antipaludiques dans le département d'Agboville, sud-est de la Cote d'Ivoire. Journal of Applied Biosciences, 109 : 10618-10629.
19. Kouakou L (2002) Situation des schistosomoses en Côte d'Ivoire. La lutte contre les schistosomoses en Afrique de l'Ouest. 8p.
20. Lakouéténé DPB, Ndolngar G, Berké B, Moyen J-M, Kosh Komba É, Zinga I, Silla S, Millogo-Rasolodimby J, Vincendeau P, Syssa-Magalé J-L, Nacoulma-Ouedraogo OG, Laganier R, Badoc A & Chèze C (2009) Enquête ethnobotanique des plantes utilisées dans le traitement du paludisme à Bangui. Bulletin de la Société de pharmacie de Bordeaux, 148 : 123-138.
21. Lebrun JP & Stock AL (1991) Enumération des plantes à fleur d'Afrique tropicale : 1 généralité et Annonaceae à Pandaceae, conservatoire et jardin botanique de Genève, 249p
22. Lebrun J.P. & Stock A.L. (1992) Enumération des plantes à fleur d'Afrique tropicale : 2 Chrysobalanaceae à Apiaceae, conservatoire et jardin botanique de Genève, 257p.
23. Lebrun J.P. & Stock A.L. (1995). Enumération des plantes à fleur d'Afrique tropicale : 3 monocotyledone Limnocharitaceae à Poaceae., conservatoire et jardin botanique de Genève, 341p.
24. Mangambu MJdD, Mushagalusa KF & Kadima NJ (2014) Contribution à l'étude phytochimique de quelques plantes médicinales antidiabétiques de la ville de Bukavu et ses environs (Sud-Kivu, R.D.Congo). Journal of Applied Biosciences, 75 : 6211–6220.
25. Manouan NJ-M, N'Guessan BB, Kroa E, Tiembré I (2010) Identification des acteurs de la médecine traditionnelle en Côte d'Ivoire : Cas du District Autonome d'Abidjan. Ethnopharmacologia, 46 : 75-80.

26. MSHP (2020) Plan directeur national de lutte contre les maladies tropicales négligées, 141P.
27. Muya K, Tshoto K, Cioci CC, Aseho MM, Kalonji M, Byanga K, Kalonda E, & Simbi L (2014) Survol ethnobotanique de quelques plantes utilisées contre la schistosomiase urogénitale à Lubumbashi et environs ». Phytothérapie 12 (4): 213-28.
28. OMS (2021) Weekly Epidemiological Record, 2021, [full issue] 29(96): 321-328.
29. Poda JN, Traore A & Sondo BK (2004). L'endémie bilharzienne au Burkina Faso. Bulletin de la Société de Pathologie Exotique, 2004, 97(1) : 47-52.
30. Samdumu FB (2007). Characterization of antimicrobial compounds from Combretum paniculatum, a plant with proven anti-HIV replication activity. Doctoral thesis, University of Pretoria, South Africa. 119p.
31. Soumahoro IA, d'Almeida KM-A, Gnahoue G, Kra AKM & Djaman AJ (2016) Evaluation of ointment activity based on Terminalia mantaly extract. Journal of Drug Delivery & Therapeutics. 6(5): 41-45.
32. Sowemimo A, Venter Mvd, Baatjies L, Koekemoer T, Adesanya S & Lin W (2012). Cytotoxic compounds from the leaves of Combretum paniculatum Vent. African Journal of Biotechnology. 11(20) : 4631-4635.
33. Sylla Y., Silué D.K., Ouattara K. & Kone M.W. (2018) Etude ethnobotanique des plantes utilisées contre le paludisme par les tradithérapeutes et herboristes du District sanitaire d'Abidjan. International Journal of Biological and Chemical Sciences 12(3) : 1380-1400.
34. Tchuenté TLA, Noumedem CD, Ngassam P, Kenfack CM, Gipwe NF, Dankoni E, Tarini A & Zhang Y (2013) Mapping of schistosomiasis and soil-transmitted helminthiasis in the regions of Littoral, North-West, South and South-West Cameroon and recommendations for treatment. BMC Infectious Diseases, 13 : 602-614.
35. Yapi G, Traore FD, Coulibaly D & Tia E. (2014) Etude contributive à la connaissance des populations de simulies dans la commune de Bouaflé, Centre-Ouest de la Côte d'Ivoire. International Journal of Biological and Chemical Sciences, 8(6) : 2540-2551.
36. Zoni AC, Catala L & Ault SK (2016) Schistosomiasis Prevalence and Intensity of Infection in Latin America and the Caribbean Countries, 1942-2014: A Systematic Review in the Context of a Regional Elimination Goal. PLOS Neglected Tropical Diseases, 10(3) : 1-22