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MEDICINAL PLANTS USED FOR THE MANAGEMENT OF HIGH BLOOD PRESSURE IN THE SOUTHERN PART OF CHAD: REVIEW AND PHYTOCHEMICAL SCREENING

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ABSTRACT: In Africa, hypertension has become a public health problem in recent years. While access to modern treatments remains limited for a large part of the population in several developing countries such as Chad. The present study aims to identify the plant species used by populations in the far south of Chad to treat this condition. To this end, an ethnobotanical survey was carried out among traditional practitioners who treat these illnesses. Phytochemical screening was carried out on the two most frequently cited plants and those less widely studied. The ethnobotanical inventory carried out in four (4) administrative regions among a sample of 46 traditional healers identified 57 plant species, including 31 recipes based on a single plant and 12 recipes composed of at least two plants. The plant organs most frequently used were leaves (31.6%), roots (24.5%) and bark (16.3%). Decoction (73.4%) is the most frequently cited mode of use. The phytotherapeutic citation index ranged from 1.0 to 6.1, and identified the twelve (12) most widely used plants. An inventory of chemical and pharmacological studies was carried out on these plants. Phytochemical screening of two plants least studied on hypertension (*Fadogia pobeguini* and *Siphonochilus aethiopicus*) revealed their richness in phenolic compounds, reducing compounds, mucilages, saponosides, triterpenoids and steroids. Further studies will be carried out on these plants with a view to their valorization.

INTRODUCTION: Hypertension, or high blood pressure, is a condition in which the pressure in the blood vessels is constantly high. It is a serious disease, and can increase the risk of heart, brain, kidney and other diseases. It is one of the world's leading causes of death.

Recent epidemiological data indicate that 1.4 billion adults aged 30 to 79 had high blood pressure. Two-thirds of them live in low- and middle-income countries.

While the African region has the highest prevalence which is projected to continue rising due in part to urbanization, unhealthy diets, sedentary lifestyles, and excessive alcohol and tobacco use Chad's prevalence stands at 34 percent, compared to the global average of 36 percent ¹. This wave of hypertension and non-transmissible

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diseases has taken African countries by surprise, as they are faced with other competing health priorities. An analysis of the costs of drug treatment for hypertension shows that African countries cannot afford the conventional treatments used in high-income countries². People are turning to traditional medicine, which in most cases harnesses the power of plants. In Chad, as in most low-income countries, botanical knowledge plays a key role in health. Otchom describes it as “an authentic mark of our civilization and an important element of our cultural identity”³. In these predominantly oral societies, phytotherapeutic knowledge is being eroded. A few prospective ethnobotanical studies have laid the foundations for the transcription of this ancestral knowledge. But in the context of cardiovascular disease, only a survey⁴ conducted in one administrative region noted the use of 17 plants in the treatment of hypertension and the major groups of compounds present in these plant parts used. Further ethnobotanical and pharmacochemical knowledge is required.

The aim of this article is, on the one hand, to transcribe the characteristics of traditional medicine in the deep south of Chad in the face of anti-hypertensive disease and, on the other hand, to research the main families of compounds in the fragments or organs of promising plants inventoried to plan suitable methods for their extraction with a view to their valorization.

MATERIAL AND METHODS:

Study Area: Chad is located in the heart of Africa, between the 7th and 24th parallels of latitude in the north and the 13th and 24th parallels in the East. One of the largest countries in Africa, it stretches 1,700 km from North to South and 1,000 km from East to West, covering an area of 1,284,000 km².

Its borders are with Libya to the North, Sudan to the East, the Central African Republic to the South and Cameroon, Nigeria and Niger to the West.

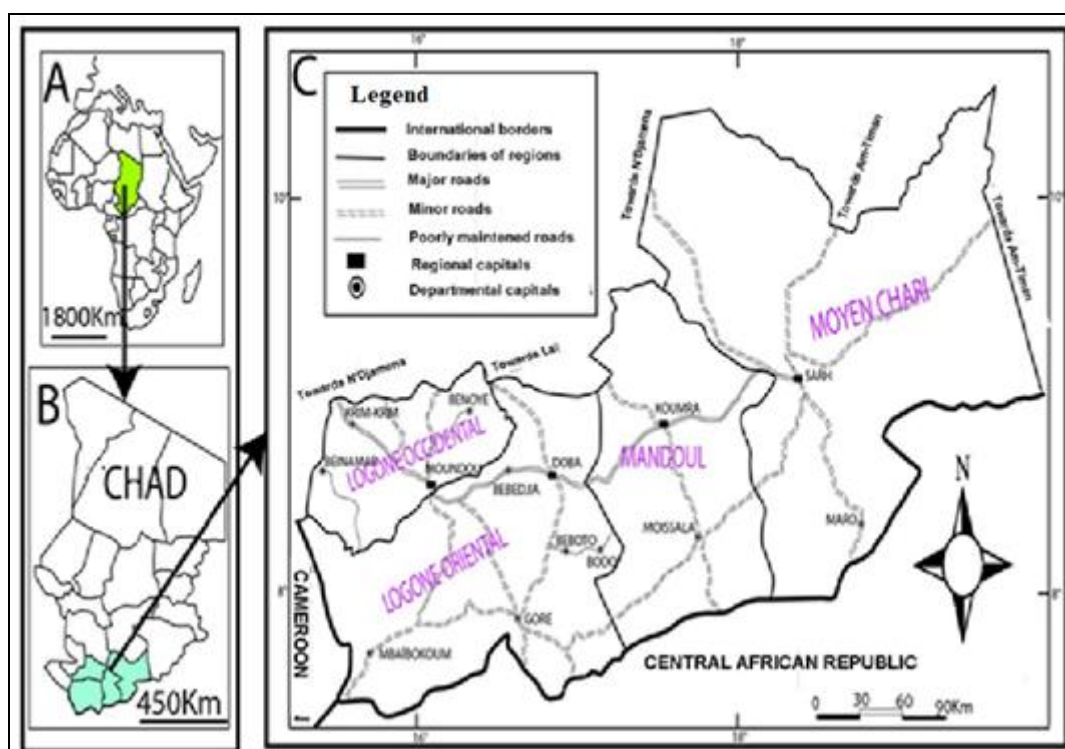


FIG. 1: GEOGRAPHICAL LOCATION OF THE STUDY AREA

Three major phytogeographical or bioclimatic zones cover the country. From North to South, we find successively the Saharan zone, the Sahelian zone and the Sudanian zone. The Sudanian zone comprises sub-equatorial regions with isohyets of between 800 and 2,000 millimetres per year. Thus

defined, the Sudanian zone of Chad lies between the 7th and 11th degrees north latitude⁵. Our study area falls within this zone. The study area comprises four (04) administrative provinces: Logone Occidental, Logone Oriental, Mandoul and Moyen-Chari. This subset occupies 1/14th of the

national territory and accounts for about ¼ of the population ⁶. Figure 1 shows the study area. According to Dumont, the Sara people, who make up 33.9% of the country's population, mainly occupy these areas. This area includes vast, highly fertile areas for both cash and food crops (rice, pearl millet, groundnuts, sorghum) and other food crops including oilseeds and tubers ⁷.

Data Collection: The inventory of presumed antihypertensive plants was carried out from January 2022 to July 2022 in two departments of each of the four (04) provinces. A pre-designed questionnaire, usually used by our research team, was used as a guide for an interview with each person interviewed ⁸. The interviewees were traditional healers selected on the basis of their reputation in their community and their willingness to cooperate with us. A total of 46 people agreed to participate in the study. The questionnaire includes, among other things, the profile of the healers (age, sex, etc.), an exhaustive list of the remedies prescribed, the ingredients of these remedies and their preparation and administration methods.

Plant Identification: The plants, referred to by their local names, were collected and taken to the Biology Laboratory of the University of Sarh, where they were identified by Dr. Saradoum GOY. For the complete identification of the plants, the online taxonomic key databases of PROTA, Plant resources of Tropical Africa (www.prota.org) and IPNI, International Plant Names Index were used.

Data Treatment: Microsoft Excel 2013 spreadsheet software from Office 365 was used to calculate the phytotherapeutic citation index of each plant species using formula 1 ⁹. Plots were generated using Sigma-Plot 12.5 software (Systat Software Inc., San Jose, USA).

$$\text{Formula 1: CIs} = 100 \times N_q / N_t$$

N_q is the number of questionnaires in which the given species was cited, N_t the total number of citations of all plants used in the treatment of arterial hypertension.

Pharmacological Activity Points and Isolated Compounds of Frequently Used Plants: Data on the isolated compounds and pharmacological activities of plants commonly used in the extreme

south of Chad were collected from bibliographic databases and search engines such as ScienceDirect, PubMed, ResearchGate and Google Scholar. The search was based on scientific articles, memoirs and theses. A selection of keywords was adapted to each plant studied, in order to optimize the collection of information. In addition, general terms were used, such as "isolated compounds of plant, phytochemistry of plant, chemical study of plant, biological activity of plant, and pharmacological activity of plant ...", to ensure a more exhaustive search.

Collection of Plant Material for the Analysis of Phytochemicals: The roots of *Fadogia pobeguini* were collected in November, 1st 2022 on the banks of the Chari River, at Sarh. The rhizomes of *Siphonochilus aethiopicus* were harvested in November, 10th 2022 at Mbalkabra, about 30 km north of Moundou. Each batch was sorted, cleaned and dried at 25°C in the Chemistry Laboratory of the University of Sarh before being ground and sieved to obtain a fine powder ready to analyse.

Phytochemical Screening: It is performed using test tube reactions. The operating protocol described by ¹⁰ was used for the characterisation of alkaloids, anthocyanins and leucoanthocyanins, anthracene derivatives, catechin and gallic tannins, coumarins, cyanogenic derivatives, flavonoids, mucilages, quinones and their derivatives, saponosides, triterpenoids and steroids.

RESULTS AND DISCUSSION:

Overview of the Traditional Health Practitioners: In this part of the country, there are a large number of traditional healers with recipes for the treatment of high blood pressure. They were men and women, aged at least 35, with at least ten years' experience in traditional medicine. Of these, 86.96% were male. The predominance of men as healers is a feature observed elsewhere in the central region of Togo and in the Mbour region of Senegal, where the proportion of men was 85.71% and 100% respectively ^{11, 12}. It is justified by the primacy given to men (boys) in our societies in terms of inheritance, property rights and succession within the patrilineal lineage system in force in the study area ¹³. In addition to being traditional healers, the men were farmers, teachers, soldiers,

religious leaders, village heads, hunters, etc., while the women were housewives.

Plant Diversity in the Treatment of High Blood Pressure: This research has led to an inventory of 64 recipes involving 57 plant species belonging to 54 genera and 27 botanical families. The Fabaceae family was the most frequently cited (21.88%) and the most represented (13 species).

This was followed by Anacardiaceae (7.29%, 2 species), Combretaceae (7.29%, 5 species) and Rubiaceae (7.29%, 3 species), then Apocynaceae (6.25%, 4 species), Arecaceae (6.25%, 2 species), Moringaceae (6.25%, 1 specie) and Zingiberaceae (4.17%, 1 specie). 11 other families were mentioned only once (1.04%). The recorded recipes are divided into two categories. The first,

representing 81.25% of the recipes, includes those in which only one plant specie is used in the preparation **Table 1**. The second category (18.75%) is made up of recipes in which 2, 4, 5 or even 8 species are used in their preparation **Table 2**. The citation indices for herbal medicines are not very high due to the low number of plant citations. This shows that traditional healers offer a wide variety of medicines. Cross-checking of the information collected allowed us to retain twelve (12) plant species that were cited more than once (CI >1.04) and by different traditional healers. **Table 3** lists these species and, for each, the molecules isolated and the biological properties already studied. As far as we know, *Fadogia pobeguini* and *Siphonochilus aethiopicus* have not been investigated for treating hypertension.

TABLE 1: UNIQUE PLANT RECIPES FOR THE MANAGEMENT OF HYPERTENSION

S. no.	Scientific name	Family	Local Name	Plant part	Method of preparation	Route of administration	CI
1	<i>Anacardium occidentale</i>	Anacardiaceae	ND	Leaves Bark	Decoction Infusion/ Decoction	Oral Oral	4.1
2	<i>Sclerocarya birrea</i>	Anacardiaceae	Lobè-lobè	Bark	Infusion	Oral	3.1
3	<i>Chrysanthemum americanum</i>	Asteraceae	Djeurmadjein	Whole plant	Decoction	Oral	1.0
4	<i>Catharantus roseus</i>	Apocynaceae	ND	Flowers	Decoction	Oral	1.0
5	<i>Calotropis procera</i>	Apocynaceae	Kamndabinan	Leaves/Root Root	Decoction Powder	Oral Nasal	3.1
6	<i>Hyphaene thebaica</i>	Arecaceae	Gaï	Fruits	Chewing	Oral	3.1
7	<i>Borassus aethiopicum</i>	Arecaceae	Mar	Bark	Calcination	Oral	3.1
8	<i>Heliotropium indicum</i>	Boraginaceae	Korba	Aerial part	Decoction	Oral	1.0
9	<i>Crateva adansonii</i>	Carparidaceae	Bôò	Leaves	Decoction	Oral	1.0
10	<i>Ipomoea batatas</i>	Convolvulaceae	Bangaou	Leaves	Decoction	Oral	1.0
11	<i>Combretum collinum</i>	Combretaceae	Rəmbe	Bark	Decoction	Oral	1.0
12	<i>Combretum nigricans</i>	Combretaceae	Ndeybina	Fruits	Powder	Oral	1.0
13	<i>Guiera senegalensis</i>	Combretaceae	Kamnda	Root	Powder	Oral	2.0
14	<i>Tetracera masuiana</i>	Dilenaceae	Mba-gon-nasə	Root	Decoction	Oral	1.0
15	<i>Entada africana</i>	Fabaceae	Ndangkeur	Bark	Decoction	Cutaneous	2.0
16	<i>Amblygonocarpus andongensis</i>	Fabaceae	Məro	Seeds Leaves	Powder Decoction	Oral Oral	3.1
17	<i>Isoblerlinia doka</i>	Fabaceae	Kabə	Seeds	Sauce	Oral	2.0
18	<i>Parkia biglobosa</i>	Fabaceae	Matə	Bark	Decoction	Oral	2.0
19	<i>Senna nigricans</i>	Fabaceae	Kad-kolé	Leaves	Decoction	Oral	1.0
20	<i>Allium sativum</i>	Liliaceae	Toum	Cloves	Chewing/ Infusion	Oral	3.1
21	<i>Azadirachta indica</i>	Meliaceae	ND	Leaves	Maceration	Oral	1.0
22	<i>Moringa oleifera</i>	Moringaceae	Kagə-ndogə	Seeds Flower/Leaves Bark/Root	Chewing Decoction Decoction	Oral Oral Oral	6.1
23	<i>Boerhavia diffusa</i>	Nyctagynaceae	Dəlem	Whole plant	Decoction	Oral	1.0
24	<i>Phyllanthus amarus</i>	Phyllanthaceae	Kum-nang	Aerial part	Decoction	Oral	1.0
25	<i>Oxytenanthera abyssinica</i>	Poaceae	Nal	Leaves	Decoction	Oral	1.0

26	<i>Zea mays</i>	Poaceae	Massar	Corn	Decoction	Oral	1.0
27	<i>Fadogia pobeguini</i>	Rubiaceae	Kənga-məra	Root	Decoction	Oral	4.1
28	<i>Crossopterix febrifuga</i>	Rubiaceae	Ndəbə	Bark	Decoction	Oral	2.0
29	<i>Zanthoxylum zanthoxyloides</i>	Rutaceae	Ogbedelokal	Bark	Decoction	Oral	2.0
30	<i>Sterculia setigera</i>	Sterculiaceae	Da-kula	Bark	Decoction	Oral	1.0
31	<i>Siphonochilus aethiopicus</i>	Zingiberaceae	Mbəue	Rhizome	Decoction/ Powder	Oral/Cutaneous	4.1

TABLE 2: RECIPES MADE OF AT LEAST TWO PLANTS FOR THE MANAGEMENT OF HYPERTENSION

S. no.	Scientific name	Family	Local name	CI	Plant part	Mode of preparation	Route of administration
1	<i>Afzelia africana</i>	Fabaceae	Tagla	1.0	Bark	Decoction	Oral
	<i>Annona senegalensis</i>	Annonaceae	Mboro	1.0	Root		
2	<i>Allium sativum</i>	Liliaceae	Toum	3.1	Cloves	Maceration	Oral
	<i>Citrus aurantifolia</i>	Rutaceae	ND	2.0	Fruits		
3	<i>Burkea africana</i>	Fabaceae	Waroun	1.0	Bark	Decoction	Oral/Cutaneous
	<i>Crossopterix febrifuga</i>	Rubiaceae	Ndəbə	2.0	Bark		
4	<i>Entada africana</i>	Fabaceae	Mbimbii	2.0	Bark	Decoction	Oral
	<i>Hyphaene thebaica</i>	Arecaceae	Gäi	3.1	Fruits		
5	<i>Ficus polita</i>	Moraceae	ND	1.0	Leaves/ bark	Decoction	Oral
	<i>Tamarindus indica</i>	Fabaceae	Masse	1.0	Fruits		
6	<i>Hyphaene thebaica</i>	Arecaceae	Gäi	3.1	Root	Decoction	Oral
	<i>Parkia biglobosa</i>	Fabaceae	Matə	2.0	Bark		
7	<i>Citrus aurantifolia</i>	Rutaceae	ND	2.0	Fruits		
	<i>Kigelia africana</i>	Bignoniaceae	Kə-mbaa-bo	1.0	Root	Maceration	Oral
	<i>Moringa oleifera</i>	Moringaceae	Kagə-ndogə	6.0	Root		
	<i>Securidaca longipedunculata</i>	Polygalaceae	Kəlar	1.0	Root		
8	<i>Acacia nilotica</i>	Fabaceae	Garatte	1.0	Fruits		
	<i>Leptadenia hastata</i>	Apocynaceae	Dəsa	1.0	Root	Decoction	Oral
	<i>Sarcocephallus latifolius</i>	Rubiaceae	Gan-ké	1.0	Root		
	<i>Senna sieberiana</i>	Fabaceae	Kə-leng-leng	1.0	Root		
9	<i>Anogeissus leiocarpa</i>	Combretaceae	Yida	3.1	Root		
	<i>Detarium microcarpum</i>	Fabaceae	Mourkoutou	2.1	Root		
	<i>Isoblerlinia doka</i>	Fabaceae	Kabə	1.0	Root	Decoction	Oral
	<i>Lonchocarpus laxiflorus</i>	Papilionoideae	Do-mbala	1.0	Root		
	<i>Stereospermum kunthianiron</i>	Bignoniaceae	Nd	1.0	Root		
10	<i>Hyphaene thebaica</i>	Arecaceae	Gäi	3.1	Fruits	Decoction	Oral
	<i>Ximenia americana</i>	Ximeniaceae	Titə	2.0	Leaves		
	<i>Hexalobus monopetalus</i>	Annonaceae	Nam	2.0	Leaves		
	<i>Senna obtusifolia</i>	Fabaceae	Jenga-suu	2.0	Leaves		
	<i>Prosopis africana</i>	Fabaceae	Der	1.0	Leaves		
11	<i>Fadogia pobeguini</i>	Rubiaceae	Kənga-məra	4.1	Whole plant	Decoction	Oral
	<i>Ximenia americana</i>	Ximeniaceae	Titə	2.0	Leaves		
	<i>Parkia biglobosa</i>	Fabaceae	Matə	2.0	Leaves		
	<i>Anogeissus leiocarpa</i>	Combretaceae	Yida	3.1	Leaves		
	<i>Hexalobus monopetalus</i>	Annonaceae	Nam	2.0	Leaves		
	<i>Senna obtusifolia</i>	Fabaceae	Jenga-suu	2.0	Leaves		
	<i>Diospyros mespiliformis</i>	Ebenaceae	kəm	1.0	Leaves		
12	<i>Anogeissus leiocarpa</i>	Combretaceae	Yida	3.1	Leaves	Decoction	Oral
	<i>Cymbopogon giganteus</i>	Poaceae	Karwey	1.0	Leaves		
	<i>Guiera senegalensis</i>	Combretaceae	Kamnda	2.0	Leaves		
	<i>Detarium microcarpum</i>	Fabaceae	Mourkoutou	2.0	Leaves		
	<i>Ectadiopsis oblengiflora</i>	Apocynaceae	Sigam-dül	1.0	Leaves		
	<i>Flueggea virosa</i>	Phyllanthaceae	Kesəbyan	1.0	Leaves		

<i>Terminalia laxiflora</i>	Combretaceae	Rondul	1.0	Leaves
<i>Trichilia emetica</i>	Meliaceae	Kouma dée	1.0	Leaves

TABLE 3: PLANTS FREQUENTLY USED IN THE EXTREME SOUTHERN REGIONS OF CHAD

N°	Plant	Isolated compounds	Biological properties investigated
1	<i>Amblygonocrapus andongensis</i>	Butein, isoliquiritignin naringenin, aesculetin, aridanin, L- γ -methyleneglutamic acid, L- γ -ethylideneglutamic acid, scopoletin, umbelliferone, ferulic acid ¹⁴	Antibacterial, molluscidal, antipsychotic, antioxidant, antidiarrhoeal, hepatoprotective hypotensive, anti-inflammatory ^{15,16}
2	<i>Anacardium occidentale</i>	Gallic acid and its glucosides, agathisflavone, luteolin, quercetin galloyl- O- eoxyhexoside, epicatechin gallate, quercetin O-hexoside, B-type rocyanidin dimer ¹⁸	Antibacterial, antidiarrhoeal, antioxidant hypotensive, vascular relaxant ^{19,20}
3	<i>Allium sativum</i>	Ajoen, alliin, allicin, diallyldisulfide, diallyltrisulfide, 3-vinyl-1,2-dithiin, apigenin, rutin, diallylsulfide, apigenin, bergamottinenobiletin, sativoside B1-5 ²¹	Antifungal, antimicrobial, antiscavenging, antioxidant, fumigant effect, antihypertensive, insecticidal ^{22,23,24}
4	<i>Crossopterix febrifuga</i>	Crosssoptine A-B, vitexin, isovitexin, orientin, myricetin 3-galactoside, quercetin 3-rutinoside, quercetin-3-arabinoside, severalsterols, triterpenoids and iridoids ^{25,26,27}	Analgesic, antipyretic, antiinflammatory, antimalarialantimicrobial, antihypertensive ^{28,29,30}
5	<i>Calotropis procera</i>	Phytyl iso-octylether, procerasesterterpenoyl triglucoside, calotropin, calotoxin, uscharidin, akundarol, uscharidin, calotropin, frugoside, calotroposides A- G ^{31,32}	Anti-inflammatory, antioxidant, antidiabetic, analgesic activity, anticancer, hypotensive ^{32,33}
6	<i>Guiera senegalensis</i>	Harman, tetrahydroharman, guieranone A, epicatchin, rutin, catechin, catechin3-O-gallate, 5-méthylflavasperone, myricitrin, hyoscyaminevitexin, rhamnetin, solanine ^{34,35}	Antiplasmodial, antimicrobial, antidiabetic, anti- diarrhoeal, antioxidant, anti-hypertensive ^{35,36,37}
7	<i>Fadogia pobequinii</i>	No compound known	Stimulation of the intramural nerves of the vas deferens via postsynap α 1- adrenergicreceptors ³⁸
8	<i>Hyphaene thebaica</i>	luteoline-O-rutinoside, chrysoeriol-O-rutinoside, chrysoeriol, luteolin, tricrin, ferulic acid, vanillic acid, malic acid, citric acid, chlorogenic acid, O-caféylshikimicacid ^{39,40}	Antidiabetic, anti- and hypotensive, hypolipidemic, antioxidant, antimicrobial, inhibition effect of renin and angiotension conversion enzyme ^{41,42}
9	<i>Moringa oleifera</i>	Moringine, moringinine, 4-hydroxymelline, niaziminine, niazininane, niazimicine acetate aurantiamide, isoquercitrinquercetin, kaempferat, rhamnetin, kaempferitrin ^{43,44}	Antibacterial, antioxidant, anti-inflammatory, anti-hyperglycemic, anti-dislipidemic, hypotensive properties ^{44,45}
10	<i>Sclerocarya birrea</i>	Flavanone, myricetin glucoside, homaloside D, (epi)catechin gallate and isomers, caryophyllene, α -humulene, copaene and stearic, palmitic arachidonic, azelaic, ellagicacids ^{46,47}	Antimicrobial, antioxidant, antidiabetic, anti-inflammatory, analgesic, anti-hypertensive ^{48,49}
11	<i>Siphonochilus aethiopicus</i>	Curzerenone, epi-curzerenone, furanodiene, furanodienone, 1,8-cineoleisofuranodiene, zerumin A, cis-alloocimene, siphonochilone ^{50,51}	Anti-asthmatic, antimicrobial, antioxidant, antiplasmodial, anti-inflammatory ^{50,52}
12	<i>Zanthoxylum zanthoxyloides</i>	Acridone alkaloids, burkinabines A-C, zanthoamides G-I, α -pinene, trans- β -ocimene, citronellol, α -terpinolene, the α -phellandrene, geraniol, limonene, β -myrcene ^{53,54}	Antimicrobial, antioxidant, antiparasitic, antitumoral insecticidal, antidiabetic, activity, hypotensive ^{53,55}

Traditional healers often use fragments or specific organs of plants. 11 plant parts were identified, with the leaf being the most commonly used (31.63%), followed by the root (24.49%) and then the bark of the trunk (16.33%); the beard is the least commonly used (1.02%), as shown in **Fig. 2**.

This finding on the use of plant parts is supported by some research conducted in the country^{4, 56}. The use of leaves in traditherapy would not threaten the plant resources exploited, but the use of roots would expose the life of these plants and lead to their extinction.

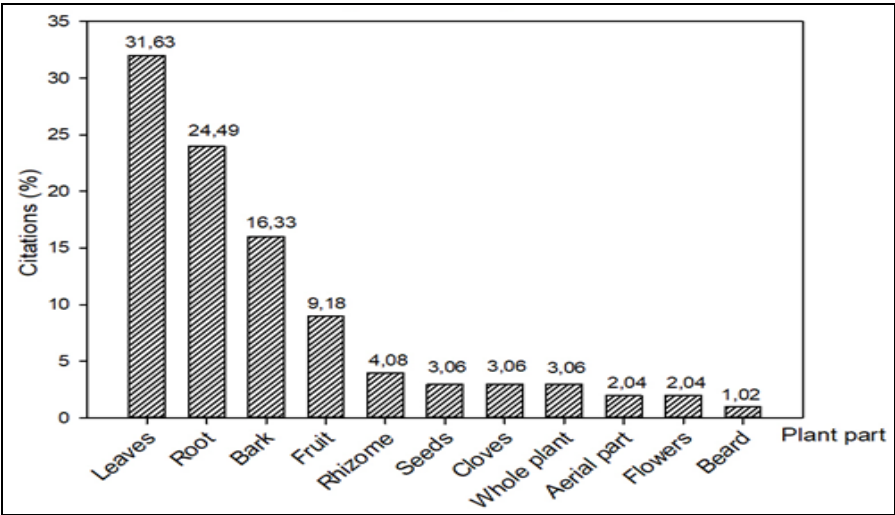


FIG. 2: MEDICINAL PLANT PARTS USED BY TRADITIONAL HEALERS FOR THE MANAGEMENT OF HYPERTENSION

Modes of Preparation and Administration of Medicinal Plants: Phytomedicines are mainly prepared by decoction (73.44%), powder (7.81%) or maceration (6.25%). Calcination or cooking of plant parts is rare (1.06%). **Fig. 3** illustrates these preparation methods with the frequency with which they were used. Three routes of administration of phytomedicines were recorded: oral (96.75%),

dermal (3.10%) and nasal (3.10%). It is likely that decoction is the preferred route of treatment for arterial hypertension in sub-Saharan Africa^{57, 58}. Although decoction allows maximum extraction of the active compounds from the plant organs, it has been suggested that it destroys thermodegradable molecules. According to⁹, this method of preparation dilutes the toxic effects of extracts.

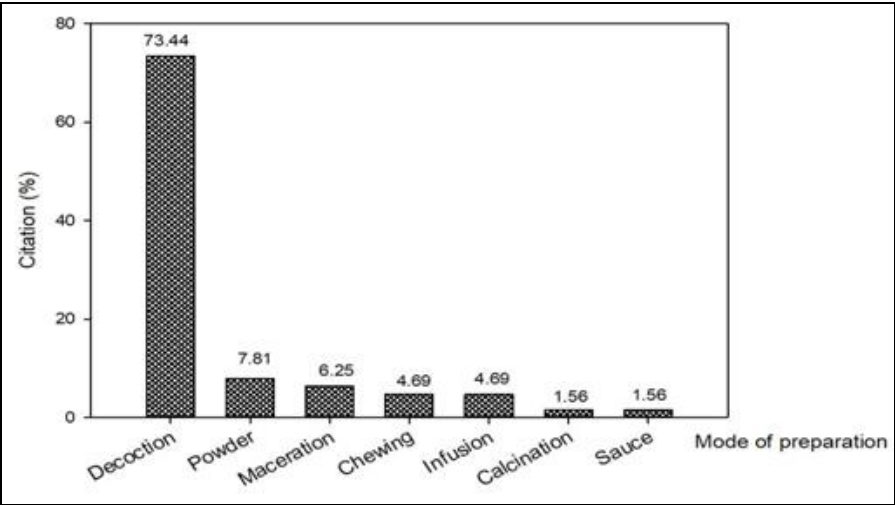


FIG. 3: MODES OF PREPARATION OF MEDICINAL PLANTS BY TRADITIONAL HEALERS FOR HYPERTENSION

Main Chemical Groups Present in *F. pobeguinii* and *S. aethiopicus*: Phytochemical investigations showed the richness of *F. pobeguinii* root and *S. aethiopicus* rhizome in phenolic compounds, notably flavonoids and tannins, reducing

compounds, mucilages, saponosides, triterpenoids and steroids **Table 4**. In addition to these groups of compounds, there are coumarins and anthracene derivatives in *F. pobeguinii*; essential oil is found in the rhizome of *S. aethiopicus* **Table 4**.

TABLE 4: CHEMICAL GROUPS PRESENT IN *F. POBEGUINII* ROOTS AND *S. AETHIOPICUS* RHIZOMES

Specific metabolites	Results	
	<i>F. pobeguinii</i> roots	<i>S. aethiopicus</i> rhizomes
Alkaloids	-	-

Anthocyanes	-	-
Leucoanthocyanes	-	-
Anthracenederivatives	+	-
Cardenolides	-	-
Coumarins	+	-
Cyanogenicderivatives	-	-
Essential oil	-	+
Flavonoids	+	+
Quinone derivatives	-	-
Mucilages	+	+
Reducing compounds	+	+
Saponins	+	+
Sterols	+	+
Triterpenes	+	+
Catechic tannins	+	+
Gallic tannins	+	+
Legend :+ : present - : absent		

Flavonoids and tannins present in 2 plants are groups of compounds with a reputation for anti-hypertensive activity. Flavonoids act by 3 mechanisms: (i) increasing the bioavailability of nitric oxide (ii) reducing oxidative stress in endothelial cells (iii) modulating vascular ion channels^{59, 60, 61, 62}.

The hypotensive effects of tannins are mediated by inhibition of the converting enzyme^{63, 64}. Saponins have a diuretic effect and may lower blood pressure⁶⁵ By excreting water and the electrolyte Na⁺, they reduce blood volume and thereby blood pressure. In addition, triterpenoids present may be linked to hypotensive effects, as the essential oils of many Zingiberaceae, rich in monoterpenes and sesquiterpenes, have been shown to have hypotensive effects *via* different mechanisms⁶⁶.

The presence of all these groups of compounds in these plant organs would explain their folkloric use in the treatment of arterial hypertension.

CONCLUSION: The present study involved an ethnobotanical inventory of plants and remedies used in the treatment of arterial hypertension in southern Chad. Compilation and analysis of the data collected enabled us to draw up a list of twelve plant species commonly used to treat this condition. A bibliographical review of these plants identified two (*Fadogia pobeguinii* and *Siphonochilus aethiopicus*) that had not been previously studied in relation to arterial hypertension. Phytochemical screening of these plants revealed, among other things, their richness in flavonoids, tannins, saponins, triterpenoids and steroids, which could

justify their use in the treatment of hypertension. Extracting these families of compounds and testing them on experimental models of hypertension will enable us to better understand the use of these plants.

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