Phytotherapy of High Blood Pressure in Three Phytogeographic Regions of Cameroon

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Abstract

Objective—High blood pressure is a public health challenge worldwide. According to World Health Organization, 30% of men and 50% of women 65 to 75 years old are suffering from high blood pressure. The number of hypertensive patients in the world will attain 1.56 billion of people, with 60% increase in prevalence. The incidence of high blood pressure increases with age, but nowadays, is being noticed an increasing incidence in young people. The socio-cultural medicine may provide new solutions in the management of this pathology. Therefore this study was carried out to record and document plants used against high blood pressure in socio-cultural medicine for future drugs discovery worldwide.

Methods—An ethno botanical survey was realized between 2002 and 2016 to identify manifold plants used to fight against high blood pressure. This survey was carried out in three phytogeographic regions of Cameroon. Amongst people living in those regions, 1131 randomly screened interviewees distributed in 58 socio-cultural groups were involved in this study.

Results—This survey reveals that about 70% of interviewees don't know high blood pressure which is a symptomless disease. A total of 28 species of plants were recorded. These plants belong to 25 genera and 24 families. They were used to prepare 28 herbal remedies for the treatment of high blood pressure. In the morphological point of view about 10/28 (36%) plants are herbs; 9/28 (32%) plants are trees and 9/28 (32%) plants are shrubs. Only 3/28 plants (11%) used including Allium sativum, Aloe barteri and Aloe buttneri) are cultivated. This means that the plants used in this study don't usually have some form of protection through cultivation which is encouraging in terms of their conservation.

Conclusion—The uncontrolled use of a hypotensive plants can provoke a fatal hypotension in hypertensive patients. Therefore the use of hypotensive plants needs to be controlled by physician
or by a patient verification using a blood pressure monitor. Recorded species which will slow the
high blood pressure will be used for the preparation of phytodrugs.

**Keywords**
Cameroon; Anti-hypertensive plants; Phytotheraphy; Phytogeographic areas

**Introduction**

High blood pressure is a multifactor disease, provoked by the association of the genetic
disposition and certain phenotypes like the sensitivity of the arterial blood pressure with
sodium concentration, hypocalcaemia and a strong influence of the environment, according
to the W.H.O. High blood pressure is manifested when the blood pressure values, measured
many times in the occasion of at least two different consultations in four months are superior
or equal to 140 mmHg for systolic and superior or equal to 90 mmHg for diastolic. These
parameters used to diagnose high blood pressure in occidental medicine are unknown in
socio-cultural medicine. Traditional healers, mostly from the hinterland will indirectly
control this disease by treating rather their observed and recognized symptoms and/or
complications including nose bleeding, filling of the flies before the eyes, dizziness,
insomnia, muscular and sexual weakness, edema, etc. The cost of the monthly treatment of
non-complicated high blood pressure is 92.24€ per patient. The diet increases the financial
charges of patients. Certain combinations of anti-hypertension's treatments, composed from
pharmaceutical products and their cost such as Hexen 50 (21.13€), Lodoz (15.88€) are rare
in rural zones or expensive for patients. Then the difficulties to get drugs can permit the
appearance of redoubtable complications including left ventricular hypertrophy, occlusion of
vessels in the heart (infarct) and in the brain (cerebral softness), strokes and kidney failure.

High blood pressure constitutes a public health problem in the World [1]. It is a chronic
disorder much frequent in Cameroon [2]. In fact the prevalence of high blood pressure
adjusted to the age is 16.6% and 12.6% in men and women respectively in urban population
[2]. The victims, with number always in increase constitute a charge for families in
Cameroon. They are condemned to dead, seeing their restriction of access to pharmaceutical
drugs. But the populations, mostly of hinterland, distant away of urban areas which are well
furnished in pharmaceutical products, have developed a wonderful experience on the uses of
medicinal and alimentary plants. Occidental medicine has developed hypertensive drugs, but
the progressive deterioration of the patients of blood pressure control by these drugs and the
poverty in the developing countries make the traditional medicine to be an alternative for the
treatment [3]. Therefore this study was carrying out to record and document plants used in
socio-cultural medicine for future drugs discovery worldwide.

**Methodology**

In order to collect manifold plants that can treat high blood pressure, an ethnobotanical
survey was carried out in various socio-cultural groups [4] living in three big
phytogeographic regions including coastal rain forests; continental rain forests and Sudano-

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Zambezian Region and Guinian savannahs zones (4:5). The ethnobotanical survey was carried out in these units, with interviewees selected in different tribes.

A total of 58 socio-cultural groups (composed by 16 in coastal rain forests phytogeographic region, 14 in continental rain forests phytogeographic region and 23 in Guinian and Sudano-Zambezian savannahs region) were explored during the interview. The fieldwork was conducted using semi-structured questionnaire with different sections of plant species identification, ethnopharmacological detailed preparations, description of recipes, ethnomedical modes of administration, posology, duration of treatment, undesirable or secondary effects and toxic effects. The confirmation of the potential efficacy of some recorded antihypertensive plants was done using previous pharmacological studies. The plants and plant names (Scientific, English, and Vernacular), plant parts used, type of hypertension treated and photochemical principles of the plants \[5,6\] and frequency of plants were recorded. The identification of samples plant species has been confirmed in National Herbarium of Cameroon and samples plants recorded were conserved in the Institute of Medical Research and Studies of Medicinal Plants.

Results

- All the recipes recorded are described in detail at the end in Table 1. The statistical analysis realized from this table revealed the following results:
- A total of 28 species of plants were recorded. These plants belong to 25 genera and 24 families. They were used to prepare 28 herbal remedies for the treatment of high blood pressure.
- In the morphological point of view about 10/28 (36%) plants are herbs; 9/28 (32%) plants are trees and 9/28 plants are (32%). Only 3/28 plants (11%) used including Allium sativum, Aloe barteri and Aloe butneri) are cultivated. This means that the plants used in this study don’t have usually some form of protection through cultivation which is encouraging in terms of their conservation. Fifty-five percent (55%) of the herbal remedies are prepared with plants belonging to the families of Apocynaceae, Caesalpiniaceae, Liliaceae, Mimosaceae, Rubiaceae, Rutaceae and Fabaceae. The most frequent cited genera are Zanthoxylum, Musanga, Afzelia, Albizia, Voacanga and Hallea.
- For the parts of plants used the leaves 18/42 (43%) were the most important plant parts used in the preparation of the herbal remedies, following by the stem bark 14/42 (33%).
- It is important to note that harvesting of leaves for treatment of high blood pressure will be less detrimental to populations of plants compared to roots, stem materials and whole plants, especially in this case where there is no sustainable harvesting strategy. The leaves of the plants should be used as an alternative if their chemical composition is not very different from that of the roots, stem materials or the whole plant.
• The most used plants are *Moringa oleifera* (280 repetitions), following by *Aloe buettneri* and *Aloe barteri* (208 repetitions each).

• Most of the herbal remedies were prepared by boiling in water or decoction 19/28 (68%), following by infusion 5/28 (18%), maceration 3/28 (11%) and consumption 1/28 (3%). This situation is not different from what has been reported in the treatment of malaria in Ghana [7-8] and in Budiope County of Uganda [9] and Msambweni District of Kenya [10]. Boiling of plant materials was also the main method of ethnopharmacological preparation of herbal remedies for the treatment of high blood pressure such as in Yaounde and its surroundings areas in the case of diabetes treatment [11].

• All the herbal remedies used in this study were administered orally. Dosage prescriptions were adapted approximately to a glassful (equivalent to 250 mL) or half a glassful three times per day was respectively prescribed for adults and children. Treatment was supposed to be continued until recovery. The problems associated with dosage prescription in the use of herbal remedies for the treatment of malaria has been highlighted by a number of authors [7,9]. In this study we have try to resolve the problem by quantifying the amount of plants material used and the dosage.

• Traditional healers reported that their herbal remedies had no side effects. This is not verified because traditional healers do not follow up for the side effects of their remedies. Similar observations have been made in Ghana [8].

• There is no significant difference between trees, herbs and shrubs recorded.

### Discussion

#### Knowledge about high blood pressure and treatment practices

Traditional healers interviewed, seemed to know high blood pressure through observation of some signs, symptoms and complications. Those included feeling of the flies before eyes (90%), sexual weakness (70%), muscular weakness (90%), insomnia (95%), dizziness (90%), edema (64%), hemiplegic paralysis (12%), angina (10%), nosebleeds or nose hemorrhage (21%), severe headaches (45%), severe anxiety (30%) and shortness of breath (8%). The percentage number of interviewees is indicated in brackets. The mode of transmission of the disease wasn’t well known. Some interviewees know that high blood pressure is family disease. All the traditional healers interviewed used herbal remedies for the treatment of high blood pressure. The reasons for using herbal remedies were their availability and their cost-effective. It is important to note that herbal remedies were used for only curative purposes. So in the management of high blood pressure herbal remedies were not used for prevention in tribes visited.

#### Comparison of ethnopharmacological uses with previous pharmacological studies

*antihypertensive plant extracts and physiochemical constituent’s activities*

The literature search showed that many antihypertensive plants were used to treat malaria in other parts of Africa. However, 12% of plants are documented for the treatment of high
blood pressure in the literature search viewed [12-28]. The more important of these plants are *Allium sativum*, *Hallea inermis* and *Hallea stipulosa*. The phytochemical constituents of these plants have also been isolated. The phytochemical composition of medicinal plants is rarely constant, which may be an advantage over chemically homogeneous drugs controlling chronic disease such as high blood pressure. Nevertheless, knowledge of the pharmacological, phytochemical and toxicological properties of the herbal remedies used needs to be investigated in order to ensure the effective treatment for high blood pressure as well as its safety for people and the need to presents the active compounds in those plants as well as their antihypertensive activities (Table 1).

**Secondary high blood pressure**

The presences of one or several antihypertensive substances in plants of Table 1 which can treat the secondary high blood pressure (Table 1) confirm the use of these plants in socio-cultural medicine against high blood pressure.

**Essential high pressure**

*Phyllanthus niruri* is the only plant which can treat the essential high blood pressure (Table 1).

**Distribution of usual antihypertensive plants**

Usual antihypertensive plants were recorded with the aid from 30% traditional healers and other informants who know high blood pressure. Table 2 presents their distribution.

**Conclusion**

At the end of this study we realize that plants which can play an important role in the treatment of high blood pressure are effectively different between the three phytogeographic regions. According to this reason manifold plants and recipes were identified. The determination of the type of high blood pressure treated was necessary to optimize the effectiveness of plants used. The development of complications and the no mastering of the multiple causes of this affection make more difficult the action of herbal remedies. The traditional healers should imperatively oblige patients to confirm their high blood pressure state by taking at least two times their blood pressure in two different consultations in four weeks. This practice can help for an earlier diagnostic of patients. The knowledge of bioactive plants can favor a better management of patients and the improvement of the quality of socio-sanitary cares administered to patients. Amongst antihypertensive plants recorded *Allium sativum* (garlic) is able to reduce significantly the rate of cholesterol in the blood. This species is an important antihypertensive plant due to its hypotensive actions, thus can be strongly recommended to traditional healers. The uncontrolled use of a hypotensive plant can provoke a fatal low blood pressure in hypertensive patients. Therefore the use of hypotensive plants needs to be controlled by physician or by a personal verification using a blood pressure monitor.
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Table 1

Ethnopharmacological description of all herbal remedies according to phytogeographic regions. The Table 1 presents the distribution of herbal remedies with precision on the morphology of the plants used, parts used, ethnopharmacological methods of preparation, administration route, dosages, frequencies of use, different types of herbal remedies recorded and duration of treatments. R1: Coastal rain forests region; R2: Continental rain forests region; R3: Guinean and Sudano-Zambezian Region and savannas region.

| Number | Usual antihypertensive plants | Plants with previous hypotensive effect |
|--------|-------------------------------|----------------------------------------|
| R1     | 8                             | 8                                      |
| R2     | 7                             | 6                                      |
| R3     | 13                            | 28                                     |
| Total  | 28                            | 38                                     |
| % of usual antihypertensive plants with established hypotensive effects: 64% |

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| S/N | Family, scientific and English names | Vernacular names | Plant part(s) used | Medicinal Plants | Principles and activities | Methods of preparation | Route of administration | Posology, duration of treatment and secondary effects | FR |
|-----|------------------------------------|-----------------|-------------------|-----------------|--------------------------|------------------------|-----------------------|-----------------------------------------------|----|
| 1   | Menispermaceae Jateorhiza macrantha Herb | Mbi (Bakola), Keliuso (Bakoum), Young leaves | Secondary high blood pressure | Columbarine/hypotensive [14] | Decoction of 100 g of young leaves in 3 L of water, for 25 min. | Oral | Take 250 mL of decoction three times a day, for a week. | 5 |
| 2   | Calophyllaceae Afzelia bipindensis English: Doussie Doussie Rouge Tree | Common name Apa Mbanga (Douala), Ndemba (Basau), Timi (Baka), Nyoe (Ewondo). | Fresh leaves |  | Decoction of 200 g of fresh leaves in 3 L of water for 15 min. | Oral | Take 250 mL of decoction 3 times daily, for a week. | 6 |
| 3   | Apocynaceae Voacanga thomasi English name: Wild frangipani Small tree | Eyolla njongi (Douala) | Fresh bark |  | Decoction of 100 g of fresh bark, in 3 L of water, for 30 min. | Oral | Drink 250 mL of decoction, 3 times a day, for 5 days. | 18 |
| 4   | Urticaceae Laportea ovalifolia English name: Fowl nettle Hawai'i woody nettle Herb | Tololi, Inol (Oroko), Sasa kola (Basau), Sasangba (Pygmies), Kinshei (Widekam), Kinshei (Banso), Sisie (Bamilé), Dandy (Bagweri) | Aerial parts | saponins, tannins, and phenolic compounds for aqueous extract and sugars, saponins, phenolic compounds, Sterol, triterpens lipids, alkaloids, and Glycosides for methanol/methylene chloride extract [15]. | Maceration of 100 g of aerial parts in 2 L of water. | Oral | Drink 250 mL of macerate 2 times a day, for a week. | 21 |
| 5   | Amperidaceae Gossia quadangularis English names: asthisamharaka; Asthisamharaka, Chadthuap, Chadthuap Herb | Epripri (Wum), Njol (Bassa) Ndieh gap (Bamoun), Ntang-dikun (kom), Ndig (Kaka); alvarahala, Gadal, Chimbaral (Fufuldé) | Leafy stem | Secondary high blood pressure Vitamin C/Antioxidant [14,19] | Maceration of 200 g of leafy stems lightly cut, in 2 L of water. | Oral | Drink 250 mL, 3 times a day, for 3 days. | 7 |
| 6   | Rutaceae Zanthoxylum heitzii English names: African satinwood, African stainwood, white African mahogany Tree | Bolonais (Baka), Bongo (Ewondo), Oblong (Fang), Djouba (Bakweri) | Stalk bark |  | Decoction of 200 g of stem bark, for 15 min, in 2 L of water. | Oral | Drink 250 mL of decoction, 2 times daily, for 5 days. | 3 |
| 7   | Calophyllaceae Afzelia pachyloba English names: African oak; African mahogany Tree | common names "pod mahogany Edison fun (Boulo), Njé-bondondé (Baka) | Bark |  | Decoction of 200 g of bark in 3 L of water, for 15 min. | Oral | Drink 200 mL of decoction times daily, for a week. | 6 |
| 8   | Asteraeae Bidens pilosa English names: beaver tick; bar man gold; cabbler's pegs; dusty needles; farmer's friend; needle grass Herb | Teesneek, Malele, Yimba Menoua, Fonta (Lamsi), yéó, Teesneek (Bamoun), Enjouh misi (Kaka), Pottar (Nse), Fonta (Bassu), Pichawua (Batu Haati-Nkam), Fasamento-Combou (Bakossi), Njennamjum (Basso), Annur (Butolo), Biakona (Péé-Hant-Nkam), Nañthate (Fedade), Kegs (Oko), Fosserai (Ncoo), Ndauegfe (Medimba-Ndè), Mlaona, Avé-Bikan (Ewondo), Lilua (Bakoum) | Fresh leaves | Secondary high blood pressure Phystostigm-β Hypotensive [16,23] | Decoction of 200 g of fresh leaves or 80 g of dry leaves in 4 L of water, for 20 min. | Oral | Drink 250 mL of decoction, 4 times a day, for a week-days | 8 |
| Sr. No | Family | Vernacular names | Plant part (s) used | Medicinal Plants | Principles and activities | Methods of preparation | Route of administration | Posology, duration of treatment and secondary effects | FR |
|--------|--------|------------------|--------------------|------------------|--------------------------|------------------------|------------------------|-----------------------------------------------|----|
| 1      | Phyllanthaceae Phyllanthus niruri | English names: Tonebreaker, Seed-Under-Leaf Herb | Aerial part | Essential high blood pressure | Inhibitor of conversion enzyme (ICE) functioning with three substances: ellargic acid, gallic acid and geraniin. | Decoction of 100 g of aerial part in 2 L of water, for 15 min | Oral | Drink 250 ml of decoction, 2 times daily, for a week | 10 |
| 2      | Liliaceae Aloe buttneri | Herb | Bulb | | | Infuse 200 g of bulb of onion, cut into small pieces, in 2 L of water, for 24 h. | Oral | Drink 250 ml of infusion, 4 times a day, for a week | 208 |
| 3      | Liliaceae Aloe barteri | Herb | Leaves | Secondary high blood pressure | | Decoction of 100 g of young leafy stems, in 2 L of water, for 15 min. | Oral | Drink 250 ml of decoction, 3 times daily, for 7 days | 4 |
| 4      | Fabaceae Mucuna pruriens | English common name: Cowhage | Leaves | Secondary high blood pressure | | Decoction of 100 g of young leafy stems, in 2 L of water, for 15 min | Oral | Drink 250 ml of decoction, 3 times daily, for 7 days | 4 |
| 5      | Apocynaceae Voacanga thouarsii | English name: Wild Frangipani | Bark | Secondary high blood pressure | Voacamine, Vibesactine, Veucafrine, Vouacamine, Vouacamine [12,13,21,24] | Boil 200 g of bark in 4 L of water, for 20 min. | Oral | Drink 250 ml of decoction, 3 times a day, for a week | 8 |
| 6      | Rutaceae Zanthoxylum macrophylla | English African satinwood Tree | Fresh Leaves | | | Infusion of 50 g of fresh leaves in 1 L of water, for 30 min. | Oral | Drink 250 ml of infusion 4 times a day, for a week. | 8 |
| 7      | Rutaceae Vepris lousii | Tanda (Baka) | Bark | | | Decoction of 250 g of root bark, in 6 L of water, for 25 min. | Oral | Drink 250 ml of decoction, 3 times daily, for 5 days. | 8 |
| 8      | Rubiaceae Hallea inermis | English name: false abura Tree | Bark | | Rotundifoline, rhynchophylline/ Hypotensive | Decoction of 200 g of stem bark in 3 L of water, for 20 min. | Oral | Drink 250 ml of decoction, 3 times a day. | 3 |
| 9      | Rubiaceae Hallea stipulosa | English names: poplar, Trade abura; bahia Tree | Stem bark | Secondary high blood pressure | | Decoction of 200 g of stem bark in 4 L of water, for 30 min. | Oral | Drink 250 ml of decoction, 3 times daily, for 7 days | 7 |
| 10     | Liliaceae Allium sativum | English name: Garlic Herb | Stem Bulb | Secondary high blood pressure | Organic sulfuric/ Peripheral vasodilatation [14] Calcium channel inhibitor | Boil 100 g of fresh leaves in 3 L of water, in 30 mn. | Oral | Drink 250 ml of decoction, 3 times a day. | 8 |
| 11     | Rubiaceae Vepris heterophylla | English name: Candlewood | Fresh leaves | | | Boil 100 g of fresh leaves in 3 L of water, for 30 min. | Oral | Drink 250 ml of decoction, 3 times a day. | 2 |
| 12     | Mimosaceae Albizia coriaria | English names: worm-bark false-thorn, worm-cure albizia, cherry-blossom Tree | Stem bark | | | Maintain in ebullition 100 g of stem bark in 2 L of water, for 25 mn. | Oral | Drink 250 ml of decoction, 4 times a day. | 6 |
| S/N | Family, scientific and English names | Vernacular names | Plant part(s) used | Medicinal Plants | Principles and activities | Methods of preparation | Route of administration | Posology, duration of treatment and secondary effects | FR |
|-----|------------------------------------|-----------------|------------------|-----------------|-------------------------|-----------------------|------------------------|-----------------------------------------------|----|
| 6   | Caesalpiniaceae Senna occidentalis Engl. name: Mamutasha herb | (Fufuldé), Sangatsasha (Eton), Sanga (Iwondo), Ngasila (Bayá) common name: Coffee weed | leaves | Secondary high blood pressure | Leaf extract/ Reducing blood pressure by inhibiting Ca^{2+} influx through receptor-operated channel and voltage-sensitive channel [20], relaxant effect on the aortic rings [20] | 1-Decoction of a teaspoon of powder of leaves, in 200 mL of water, for 10 min. 2-consumption of young | Oral | Take a teaspoon in the morning, mid-day and evening, for 7 days. 2-Eat the young leaves like vegetable. | 7 |
| 7   | Caesalpiniaceae Afzelia africana English names: African oak; African mahogany Tree | Gbilla (Bayá), Ekam (Eton), Bakong (Douala) | Bark | | | Maceration of 100 g of bark in 6 L. | Oral | Drink 250 mL of macerate, 4 times a day, for 7 days. | 4 |
| 8   | Ulmaceae Celtis senegalensis English names: nettle tree, African nettle tree: African false elm, hackberry Tree | Ganki, Jikengeni (Fufuldé) | Bark | | | Decoction in 4 L. of water, 230 g of root bark, in 30 min. | Oral | Drink 250 mL of decoction, 4 times daily, for a week. | 4 |
| 9   | Rhamnaceae Ziziphus mauritiana English Names: Indian Jujube, ber, Chinee apple, jujube, Indian plum, Karasina Shurb | Fr (Tolokol), Magaria, Mgarar, Kousa (Haoussa), Déré (Topourn), Bembé (Moundang), Verkaal (Musalo), Dousami (Kapsiki), Galamatsi (Fufuldé) | Fruit | Secondary high blood pressure | Vitamin c/ Antioxidant [17,19,24] | Eating of fruits | Oral | Eat 3 fruits per day, for a week. Root is toxic in strong dosage | 6 |
| 10  | Rutaceae Zanthoxylum zanthoxyloides, English names: prickly shrub or low-branching shrubby Tree | Gah-tchou (Bamiléké) | Stem bark | | Decoction of 300 g of stem bark, in 2 L of water, for 20 min. | Oral | Drink 250 mL of decoction, 3 times a day, a week. | 6 |
| 11  | Combretaceae Gaertn. senegalensis English name: sabara Shurb | Gekki, Gëbelë (Fufuldé), Sabara, Schubala (Haoussa), Abo, Rlhebes, Rubes (Arabes-Choa), Kose (Kotonko), Walsenbtro (Fall), Fulfrall (Massa), Hëfay (Moundang), Fë, fëri (Tapount) | Leaves | | | Infusion of 100 g of leaves in 3 L of water, for at least 2h. | Oral | Drink 250 mL of infusion, 3 times a day, for 5 days. | 6 |
| 12  | Fabaceae Pterocarpus santalinus English names: prickly custard apple, soursop Shurb | Bolota (Bayá), Mâdobihia (Haoussa) | Stem bark | bioactive substances (flavonoids, tannins, saponins, phenols Polyphenol) [28] | Deoction of 250 g of stem bark, in 5 L of water, for 40 min. | Oral | Drink 250 mL of decoction, 3 times a day, for 5 days. | 4 |
| 13  | Balanitaceae Balanites aegyptiaca Common. English names: soapberry tree; thorn tree; desert date Shurb | Adosa (Fulbés) | Fruits | Secondary high blood pressure | Fruits/ Hypocholesterolemic Vasodilatator [17] | Eating | Oral | Eat three fruits a day, for two weeks | 10 |
|     | Common in the three phytogeographic regions | | | | | | | | | |
| S/No | Family, scientific and English names | Vernacular names | Plant part(s) used | Medicinal Plants | Principles and activities | Methods of preparation | Route of administration | Posology, duration of treatment and secondary effects | FR |
|------|--------------------------------------|-----------------|-------------------|-----------------|--------------------------|------------------------|------------------------|-----------------------------------------------|-----|
| 3    | Cecropiaceae Musanga ceropoides English names: African corkwood tree or umbrella tree Tree | Common name: Umbrella tree, Cork Wood | Stem bark | Secondary high blood pressure | The latex and the leaves aqueous extract Vasorelaxant agent. The water extract of the stem bark reduction in mean arterial blood pressure, which fell by 4.51 ± 0.5 mmHg at the dose of 30 mg/kg and 65.23 ± 6.28 mmHg at 40 mg/kg dose [26,27]. | Decoction of 15 g of stem bark per kg of body weight in 3 L of water for 15 min. | Oral | Take 250 mL of decoction, 2 times a day, for 5 days. The long time use and the strong doses can provoke gastric ulcers (12). | 18  |

Number of species by morphology: Total: 28 (100%)
- Trees: 9 (32%)
- Herb: 10 (36%)
- Shrub: 9 (32%)

Parts of the plants used:
- Total: 42 (100%)
  - Leaves: 18 (43%)
  - Bark: 14 (33%)
  - Aerial part: 4 (12%)
  - Fruit: 2 (5%)
  - Bud: 2 (5%)
  - Stem: 1 (2%)

Number of times that each mode of preparation appeared:
- Total: 28 (100%)
  - Decoction: 19 (68%)
  - Maceration: 3 (11%)
  - Infusion: 5 (18%)
  - Consumption: 1 (3%)

Route of administration:
- Oral: 28 (100%) Number of times that an ethno pharmacological preparation time appeared:
- Total: 19
  - 15 mn: 8 (42%)
  - 20 mn: 4 (21%)
  - 21 mn: 2 (11%)
  - 30 mn: 4 (21%)
  - 2 h: 1 (5%) Number of times that a duration of treatment appeared:
- Total: 29
  - 1 day: 1 (3%)
  - 3 days: 2 (7%)
  - 5 days: 7 (24%)
  - 280: 1 (4%)
  - 208: 1 (4%)
  - 206: 1 (4%)
  - 208: 1 (4%)
  - 4.5: 1 (4%)
  - 8.2: 1 (4%)
  - 7.3: 1 (4%)
  - 8.2: 1 (4%)
  - 10.2: 1 (4%)
  - 3.2: 1 (4%)
  - 11: 1 (4%)
  - 5.1: 1 (4%)
  - 21: 1 (4%)

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