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Ethnopharmacological Survey on Antihemorrhagic Medicinal Plants in South of Benin

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Authors' contributions

This work was carried out in collaboration between all authors. Authors JRK and TVD designed the study, performed the statistical analysis, wrote the protocol and the first draft of the manuscript. They have also managed the analyses of the study and the literature searches. Authors AA and KK have identified plants species. Authors J-MA, FL, KD and MG have supervised the work. All authors read and approved the final manuscript.

Research Article

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ABSTRACT

Aims: Bleeding is the leading cause of early death and a post-traumatic major cause of maternal mortality worldwide. Although 80% of African people have used herbs to treat wounds, very little information is available about plants species with hemostatic properties. This study aims to contribute to a better knowledge of plants used for their hemostatic properties in southern Benin.
Study Design: Ethnobotanical and survey study.

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Place and Duration of Study: Southern Benin in West Africa between January and June 2011.
Methodology: Ethnopharmacological surveys were conducted from January to June 2011, with 66 traditional healers in Southern Benin using the method by Semi Structured Interview (SSI).
Results: We surveyed 55 species of medicinal plants belonging to 28 families. The most used species were: *Musa sapientum* L., *Jatropha multifida* L., *Rauvolfia vomitoria* Afzel., *Annona muricata* L., *Macrosphyra longistyla* DC. And *Newbouldia leavis* P. Beauv. The use of these plants is more common in postpartum hemorrhages (45.8%), scarification (22%), circumcision (13%) and snake bites (7%). Preparations administered orally (56.8%) or locally (43.2%) are most often in the form of various extraction products (latex sap or juice (31.9%), aqueous decoction (22.7%), aqueous maceration (17.6%) or powder (13.5%). The plant parts most frequently used are: leaves (38.2%), bark (23.6%), roots (12.7%) and latex (11.9%).
Conclusion: The extracts of these plants could therefore be an attractive option given the urgency posed by hemorrhages.

Keywords: Ethnopharmacological surveys; medicinal plants; bleeding; southern Benin.

1. INTRODUCTION

Hemorrhages are the leading cause of early posttraumatic death [1]. They are, at present, a major cause of maternal mortality worldwide [2,3]. They are unpredictable and can lead to sudden death in the absence of immediate and appropriate care [4]. Estimated that each year there are approximately 14 million cases of bleeding related to pregnancy and at least 128 000 deaths [5]. The use of hemostatic substances is often essential to stop bleeding [6]; [7]. Hemostatic products that currently exist are not always effective in treatment of bleeding [8]. Given this situation, the identification of more effective novel natural hemostatic agents could therefore improve the management of bleeding in all disciplines of clinical medicine. In this sense, the plants used in traditional medicine for their hemostatic properties may represent an alternative to conventional hemostatic. But there is very little work on ethnobotanical studies of these plants.

In Benin, no study has focused specifically on antihemorrhagic plant inventory. The few existing data were provided from ethnobotanical surveys that focused on medicinal plants as a whole [9,10,11]. This work therefore aims to provide a better knowledge of plants and remedies used in traditional medicine as antihemorrhagic plants Benin.

2. MATERIALS AND METHODS

2.1 Study Framework

Ethnopharmacological surveys were conducted in southern Benin, in Guinea-Congolian climate zone [12]. This area is characterized by an average rainfall of 1200 mm per year, an average daily temperature ranging from 25ºC to 29ºC and relative humidity ranging between 69% and 97%. There are several types of ecosystems including dense forests as flap [13].

Data were collected in the municipalities of Abomey-Calavi, Cotonou, Bonou, Adjohoun and Dangbo (Fig. 1). Populations were largely illiterate and 80% use traditional medicine to treat themselves [10].

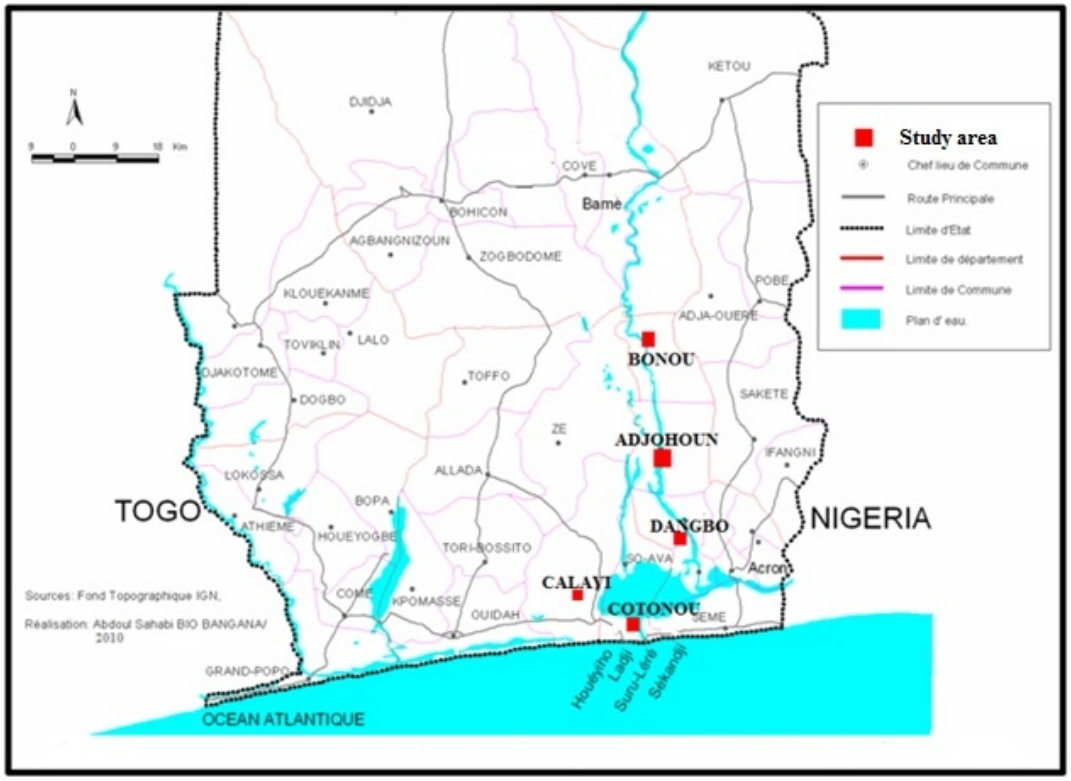

Fig. 1. Localisation of survey sites

2.2 Study Method

2.2.1 Data collection

Ethnopharmacological investigation was conducted by questioning each individual traditional healer using the method of semi-structured interview [14,15]. A survey form was designed with issues about botanical and ethnopharmacological information. The gathered information was about the profile of the respondent (age, sex, education level, monthly income) and the plants used to treat bleeding (external, digestive and obstetrical). We were interested in the local name and part of the plant used therapeutic indications, the crop conditions, revenues, modes of administration and side effects.

2.2.2 Identification of plant species

Plants collected in the field were identified and authenticated at the National Herbarium of the University of Abomey-Calavi. The following characteristics were sought: family name, Latin name, French name and common name. The Analytical flora of Benin [11] was used for the botanical identification of plant species.

The identification of ethnobotanical species, begun in the field, has been deepened by using appropriate books [9,10].

2.2.3 Statistical analysis

The data recorded on the survey forms are then entered and analyzed by SPSS 17.0. The frequency (F) of each used plant species was determined by the formula:

$$F = \frac{Number\ of\ citations\ of\ the\ concerned\ plant}{Total\ recipes}$$

3. RESULTS AND DISCUSSION

In total, 66 traditional healers have participated in the survey: 33.3% female and 66.7% male. With 55 years on average (between 18 and 80 years) (Fig. 2), they are illiterate for 73,0% (Fig. 3) and 79.4% had a monthly income less than the minimum wage (SMIC) (Fig. 4).

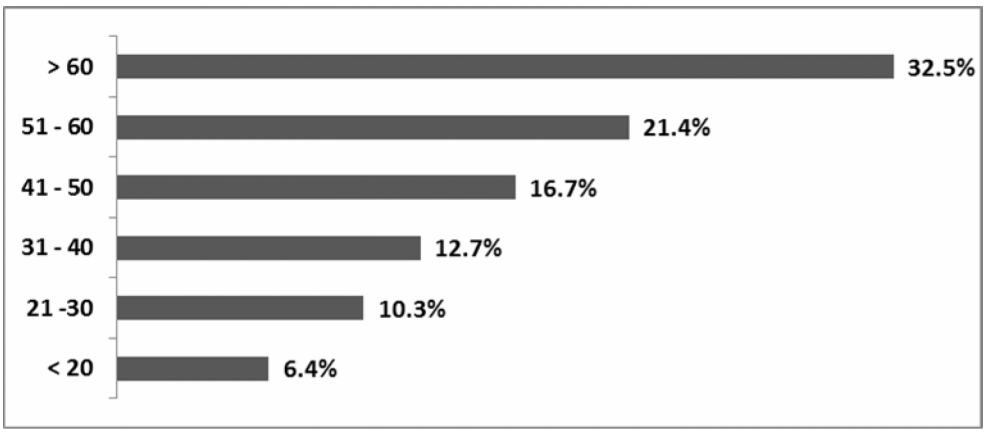

Fig. 2. Frequency of use of antihemorrhagic plants by age of patients

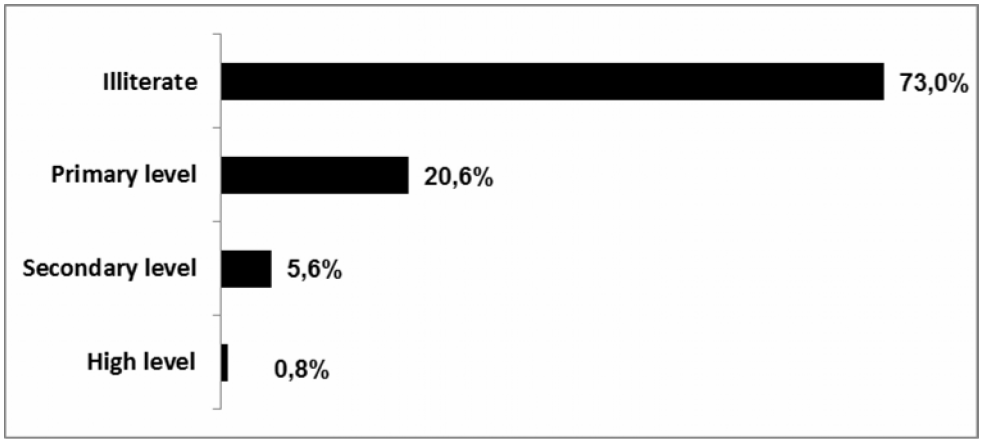

Fig. 3. Frequency of use of antihemorrhagic plants by level of study

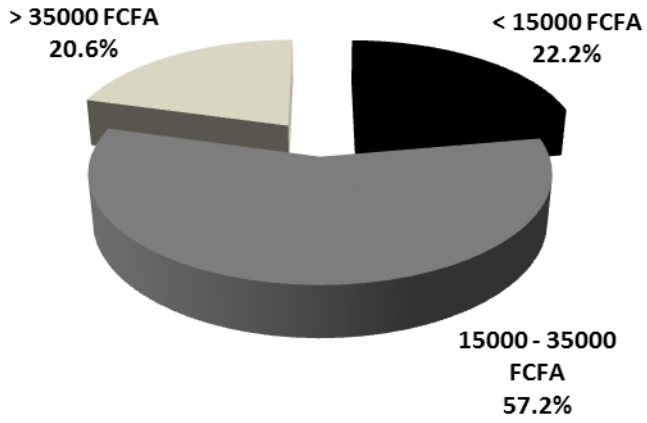

Fig. 4. Frequency of use of antihemorrhagic plants by monthly income

A total of 55 plant species belonging to 48 genera and 28 botanical families were identified on the basis of 106 recipes given by traditional healers. Plants mostly used against hemorrhages are *Musa sapientum* L. (55.6%), *Jatropha multifida* L. (35.8%), *Rauvolfia vomitoria* Afzel. (32.1%), *Annona senegalensis* L. (26.4%), *Macrosphyra longistyla* DC. (18.3%), *Newbouldia leavis P. Beauv.* (16.0%).

Hemostatic remedies are used in cases of obstetric hemorrhage (50.1%), external (45%) and digestive (4.9%) (Table 1). They are frequently obtained from the leaves (38.2%), bark (23.6%), roots (12.7%) and plant sap (11.9%). Other plant parts used count for 13.6%. These fresh or dried plant parts, from one species or a combination of plants, are orally (56.8%) or locally (43.2%) administered, mainly as a product of various extraction methods [latex sap, juice (31.9%), aqueous decoction (22.7%), aqueous maceration (17.6%), powder (13.5%), aqueous infusion (7.4%), poultice (6.4%) and others (0.5%)]. Some non-herbal substances such as kaolin are occasionally added to various preparations (Table 2). The preparations are administered 1-3 times a day and with the exception of powders, their shelf life is less than 72 hours.

Table 1. Distribution of the frequency plant using according to the type of bleeding

Type of bleeding	Causes	Frequency of plants use	Total frequency
External hemorrhage	Snake bites	7%	
	Scarification	22%	45%
	Circumcision	13%	
	Wounds and cuts	3%	
Obstetrical bleeding	During pregnancy	1.3%	
	Post-partum hemorrhage	45.8%	50.1%
	After child birth	3%	
Gastro-intestinal bleeding	Various	4.9%	4.9%

Table 2. Medicinal plants used in southern Benin against hemorrhages

Plants species	Family name	French name	Locally name	Bleeding type	Part used	Methods of preparation	Methods of administration	Frequency of utilisation
***Musa sapientum* L.**	Musaceae	Bananier	F :Kokwe G : gounkokwe	Delivery External	Stem(p) Leaves	Juice +kaolin (Pressing) Sap	Per os Locally	55.60%
***Jatropha multifida* L.**	Euphorbiaceae	Plante corail	F : Akpawi	External	Stem	Sap	Locally	35.85%
***Rauvolfia vomitoria* Afzel.**	Apocynaceae		F :Lè asu, g :klanklantin	External	Leaves(f)	Maceration (Trituration)	Locally	32.08%
***Annona senegalensis* Pers.**	Annonaceae	Pomme cannelle du Sénégal	F : Nyiglwe ; G: nyankéklé	Delivery External	Leaves Leaves (f)	Decoction+ kaolin Maceration (Expression)	Per os Locally	26.42%
***Macrosphyra longistyla* DC.**	Rubiaceae		F :Zikiti gowun ; G : Conyicerè	External	Bark (s)	Powder	Locally	18.87%
***Newbouldia laevis* P.Beauv.**	Bignoniaceae	Hysope africaine	F :Kpatin, désrégé	Digestive	Leaves(f)	Maceration + kaolin	Per os	16.04%
***Holarrhena floribunda* G. Don.**	Apocynaceae	Faux caoutchouc	F :Akoyixè, Lètin wiwi	Délivrance	Leaves(f)	Maceration (Trituration + water + kaolin)	Locally Per os	13.21%
***Terminalia macroptera* Guill. et Perr.**	Combretaceae	Badamier du Sénégal	F :Pavu	External External	Bark (s) Roots(f)	Powder Poultice	Locally Locally	13.21%
***Crescentia cujete* L.**	Bignoniaceae	Calebassier	F : Ka (tin)	Delivery	Leaves(f)	Maceration	Locally	11.32%
***Chassalia kolly* Schumach.**	Rubiaceae		F :Atinjè ; G :otinjè		Leaves (f)	Maceration + kaolin	Per os	9.43%
***Ceiba pentandra* L.**	Bombacaceae	Fromager	F.G.:Guédéhuns	External	Fruit (f)	Poultice	Locally	8.49%
***Entada africana* Guill. et Perr.**	Mimosoideae	Néré des éléphants	F :Kake, Adakake	Digestive	Leaves	Decoction +kaolin	Per os	8.49%
***Diospyros mespiliformis* Hochst.**	Ebénaceae	Ebène de l'Ouest africain	F :Gubaga ; G : Jè (ma)	External External	Leaves (f) Bark	Paste + shea butter (pounding) Powder	Locally Locally	8.49%
***Piliostigma thonningii* Schumach.**	Caesalpiniadeae	Pied de bœuf	F :Klònloma ; G : Kongbgo	Delivery External	Leaves Bark (s)	Maceration Powder	Locally Locally	8.49%

***Carica papaya* L.**	Caricaceae	Papayer	F :Kpèn (tin) ; G :Gbekpe(tin)	External	Stem	Latex	Locally	7.55%
***Lawsonia inermis* L.**	Lythraceae	Henné	F :Lalitin ;G : Laritin	External	Leaves	Maceration (Trituration)	Locally	7.55%
***Piliostigma reticulata* DC.**	Caesalpinioideae	Pied de chameau	F :Klònloma ; G : Kongbo	External	Bark [(s)]	Powder (Pounding)	Locally	4.72%
***Ageratum conyzioïdes* L.**	Asteraceae	Herbe aux sorciers	Jinu kunsu	External	Leaves+ Stem Leaves[(s)]	Decoction Powder (Pounding)	Per os Locally	3.77%
***Jatropha curcas* L.**	Euphorbiaceae	Pignon d'Inde	F.G. : Gbagidi kpotin	External External	Seeds Stem	Paste Sap	Locally Locally	3.77%
***Strophanthus sarmentosus* DC.**	Apocynaceae		Lagba omode*	External	Stem	Sap	Locally	3.77%
***Boerhavia diffusa* L.**	Nyctaginaceae	Herbe cochon	F :Atancyen ; G : Kacyon ayi asi		Roots Stem	Decoction Sap	Per os Locally	3.77%
***Acacia nilotica* L.**	Mimosoideae	Gommier rouge	F.G. : Gamalwa, Gabaruwa	External External	Leaves [(s)] Bark [(s)]	Powder Powder	Locally Locally	0.94%
Achyranthes aspera L.	Amanranthaceae	Queue de rat	Aboro*	External	Roots[(f)]	Juice	Locally	0.94%
***Aloe buettneri* A. Berger.**	Asphodelaceae	Aloès sauvage	F : Zogah	External	Leaves[(f)]	Gel	Locally	0.94%
Annona muricata L.	Annonaceae	Corossolier Chap-chap	F : Anyiglwe G : vohunte	External Delivery	Leaves[(f)] Leaves	Maceration (Expression) Decoction +kaolin	Locally Per os	0.94%
***Arachis hypogaea* L.**	Papilionoideae	Arachide	F :Aziin	External	Leaves [(f)]	Juice (Expression)	Locally	0.94%
***Berlinia grandiflora* Vahl**	Caesalpinioideae		Bagbé	External	Bark [(s)]	Powder	Locally	0.94%
***Bidens pilosa* L.**	Asteraceae	Aiguilles d'Espagne	F :Vodunga	External External	Leaves [(f)] Leaves	Poultice Decoction	Locally Locally	0.94%
***Bridelia micrantha* Hochst.**	Euphorbiaceae		F : Honsukokwe	External	Roots[(f)]	Juice	Locally	0.94%
***Bryophyllum pinnatum* Lam.**	Crassulaceae	Plante de la résurrection	F :Jòmaku, G :otome	External	Stem	Sap	Locally	0.94%
***Cassia sieberiana* DC.**	Caesalpinioideae	Cassia de Sieber	Aridan tonro*	Digestive	Leaves	Infusion +kaolin	Per os	0.94%
***Combretum micranthum* G. Don.**	Combrétaceae	Vrai kinkéliba	F : Kinikiniba	Digestive	Leaves Leaves	Decoction Decoction	Per os Per os	0.94%

***Dialium guineense* Willd.**	Caesalpinioideae	Tamarinier noir	F.G.:Asònswèn , Asiswetin	Externe	Bough	Paste (Chewing)	Locally	0.94%
***Eucalyptus camadulensis* Dehn.**	Myrtaceae	Eucalyptus rouge		Digestive Digestive	Leaves Bark	Decoction Decoction	Per os Per os	0.94%
***Ficus exasperata* Vahl**	Moraceae	Arbre papier de verre	F : Axlosutin ; G : Axlo	Delivery	Leaves (f)	Maceration + kaolin	Per os	0.94%
***Ficus lutea* Vahl**	Moraceae		F : Adakukuan	External	Stem	Latex	Locally	0.94%
***Guiera senegalensis* J.L.Gmel.**	Combrétaceae	Nguère	F : Hlikon	External External	Leaves (s) Leaves (f)	Powder Poultice	Locally Locally	0.94%
***Hibiscus surattensis* L.**	Malvaceae		F :Kpodé agadérou ; G :Kpode Jogbo*	External	Leaves (s)	Powder	Locally	0.94%
***Hyptis pectinata* L.**	Lamiaceae			External	Roots(f)	Juice	Locally	0.94%
***Imperata cylindrica* L.**	Poaceae	Chiendent	F : Sè, Sèkun	Digestive	Whole plants	Juice	Per os	0.94%
***Mangifera indica* L.**	Anacardiaceae	Manguier	F : Manga, Amanga	Delivery	Leaves	Infusion	Per os	0.94%
***Mirabilis jalapa* L.**	Nyctaginaceae	Belle de nuit	F :Azehounzo	External	Fruit (s)	Powder	Locally	0.94%
***Moringa oleifera* Lam.**	Moringaceae	Moringe	F :Kpatima ; G :Ekwe kpatin	External	Stem	Powder	Locally	0.94%
***Nauclea latifolia* L.**	Rubiaceae	Pêcher de Guinée	F :Ko (ma) ;G :Kodo	External	Stem (s)	Powder	Locally	0.94%
***Paullinia pinnata* L.**	Sapindaceae		F.G. : Adakloman ; G: Loko	External	Stem (s)	Powder	Locally	0.94%
***Pterocarpus erinaceus* Poir.**	Papilionaceae	Palissandre du Sénégal	F :Gagbe	External	Stem	Sap	Locally	0.94%
***Spondias mombin* L.**	Anacardiaceae	Prunier mombin	F :Akikontin ;G : Aklikon	Delivery	Roots(f)	Juice	Locally	0.94%
***Stereospermum kunthianum* Cham.**	Bignoniaceae		F :Nyansiasi, G : Ajade	Obstetric	Bark	Decoction+kaolin	Per os	0.94%
***Tamarindus indica* L.**	Caesalpinioideae	Tamarinier de l'Inde	F :Jèvivi, Bokoso	External	Bark (s)	Powder	Locally	0.94%
***Terminalia avicennioides* Guill. et Perr.**	Combretaceae		Alotun	External	Bark (s)	Powder	Locally	0.94%
***Terminalia laxiflora* Engl.**	Combretaceae	Badamier du Sénégal	Pavu	External	Bark (s)	Powder	Locally	0.94%

***Uvaria chamae* P. Beauv.**	Annonaceae		F :Agbanan, G : Awinyaxa	External	Leaves[(f)]	Maceration (Trituration)	Locally	0.94%
***Vernonia amygdalina* Delile**	Asteraceae	Feuille amère	F :Amavivè	External	Bough	Juice (Expression)	Locally	0.94%
***Vernonia colorata* Willd.**	Asteraceae	Feuille amère	F :Dadorizihan ; G : Gblo	External	Roots[(f)]	Juice	Locally	0.94%
***Ximenia americana* L.**	Oleaceae	Olivier sauvage	Klivovwe	External	Leaves[(f)]	Poultice	Locally	0.94%

[(f)] : fresh ; [(s)] : dry.

The results obtained from this study showed that the frequency of plant use as antihemorrhagic plants increases based on age (Fig. 2) and it is the males (66.7%) which predominate. This could be explained by the fact that the virtues of plants are ancient knowledge passed down from generation to generation, usually from father to son [10]. Over 75% of our study population is illiterate with a monthly income less than the minimum wage. These results are near from national data and showed that the use of medicinal plants remains is preferred by poor people [13].

The existence in the study area of an original formation of plateaus, consisting of the rainforest where semi-deciduous forest is found in the form of fragments: botanical reserve forests and sacred forests allow people to have the medicinal plants throughout the year [13].

55 plant species were identified during our investigations. To our knowledge, no detailed study has so far focused in Benin on the inventory of hemostatic plants. In West Africa, the few existing data on these plants are from ethnobotanical surveys that were conducted in Niger, Mali, Togo, Benin and Nigeria by Adjanohoun et al. [10,16,17,18,19]. In other areas, the work of some authors have briefly touched on the subject [20,21,22,23,24,25,26,27]. Our work is a preliminary study, contributed, from ethnobotanical surveys conducted in traditional healers, to obtain a database on hemostatic plants in Benin.

The use of the sap of *J. multifida* as local hemostatic is widespread in southern Benin where it operates in certain ritual practices (voodoo). Adjanohoun et al. [10] have already reported about “Kokoussi” (Kokou fetish enthusiasts).

Musa sapientum is the most frequently species indicated by the traditional healers, especially in cases of postpartum hemorrhage. Its use has also been reported in Brazil [28]. But this plant has never been documented as a haemostatic in Benin [9,10,11]. This result could be explained by the fact that previous ethnobotanical surveys conducted in Benin have never specifically addressed the antihemorrhagic plants, but rather on medicinal plants as a whole. This work has helped develop a more comprehensive list of plants used as hemostatic in southern Benin and it would be interesting to perform the same investigations in northern Benin.

Hemostatic remedies are commonly used in the form of direct products of plant extracts (sap, latex, juices), especially in external bleeding. This could be explained by the simplicity and speed of preparation [29]. But it should be noted that some non-herbal substances are sometimes added to other types of preparation (maceration, decoction, infusion). Kaolin is a vehicle used by preference. Its frequent use could be justified by its neutral character and power activation of hemostasis factors.

4. CONCLUSION

This study identified 55 species of plants used in traditional medicine as Beninese antihemorrhagics of which only 16 were documented previously. Frequency of use of these plants and their mode of administration vary with the type of bleeding. The species most commonly used are: *Jatropha multifida* L. (Euphorbiaceae) and *Macrosphyra longistyla* DC. (Rubiaceae) for external bleeding; *Musa sapientum* L. (Musaceae) and *Annona senegalensis* L. (Annonaceae) for obstetric hemorrhage; *Rauvolfia vomitoria* Afzel.(Apocynaceae) and *Newbouldia leavis P. Beauv*. (Bignoniaceae) for gastrointestinal bleeding. In villages and urban neighborhoods where people have very limited resources for

treatment, these plants could be used in the manufacture of improved traditional medicines to cope with the emergency posed by hemorrhage. But it is necessary, above all, to realize hemostatic testing on extracts of these plants to confirm or refute their effectiveness. Similarly, toxicological tests are required to demonstrate the safety of these plants.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

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