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Ethnomedicinal survey of *Gavdé* (*Acacia nilotica*): a medicinal plant used in sahelian zone of Cameroon, Central Africa

Juliette Koubé[1-2], Sélestin Sokeng Dongmo[2], Valentin Désiré Guiama[3], and Elisabeth Ngo Bum[2]

[1]Department of Pharmaceutical sciences, University of Douala, Douala City, Littoral Region, Cameroon

[2]Department of Biological sciences, University of Ngaoundere, Ngaoundere City, Adamawa Region, Cameroon

[3]Department of Food Sciences and Nutrition, University of Ngaoundere, Ngaoundere City, Adamawa Region, Cameroon

ABSTRACT: An ethnobotanical survey of *Gavdé* (*Acacia nilotica*) used in traditional pharmacopeia was carried out in the sahelian zone of Cameroon. To obtain relevant ethno-medicine information, semi-structured questionnaire was used to interview 100 respondents (traditional healers). The respondents were mostly male (83%), elderly (63%) and illiterate (81%). The majority of traditional healers (91%) had used *A. nilotica* as source of medicine for more than 15 years. Almost all organs of *A. nilotica* used, and half of them were collected from the forest galleries, and the rest from the home gardens (34%) and sellers of medicinal plants (26%). More than half of the respondents (56%) recognized the magico-religious virtues of *A. nilotica.* However, this species is exposed with extinction (72% of respondents) in this area. The fruit was the most commonly used plant organ while decoction and maceration were the most common type of preparation. Remedies were mostly prepared with water as solvent and taken orally or topically. They were mostly used for the treatment of inflammatory diseases. The duration of treatment was variable with disease and exceeded sometimes 28 days. For the treatment of the same disease, the frequency varied with organ of plant used. Fifty species belonging to eight families were associated with *A. nilotica* within the recipes. The traditional healers used dietary, behavioural and spiritual recommendations to accompany treatment of diseases with *A. nilotica*. This plant occupies an important place in the pharmacopeia of Cameroon sahelian area. The cultivation of *A. nilotica* should be encouraged among the youth.

KEYWORDS: *Acacia nilotica*, ethno-medicine information, traditional healers, sahelian area, Cameroon.

INTRODUCTION

Ethnobotany can be defined as the traditional knowledge of indigenous communities, about surrounding plant diversity and how various people make use of indigenous plants found in their localities [1]. It involves the study of how communities of a particular region make use of indigenous plants in the region for food, clothing and medicine. Ethnobotanical survey of medicinal plants is a tool to attain medical knowledge on how plants are used against diseases in specific regions or ethnic groups.

Medicinal plants are a major source of biodynamic compounds of therapeutic values and are the basis of many traditional medicines throughout the world. The use of medicinal plants is a lower cost natural resource than occidental pharmaceutical remedies [2]. Recently, it has been recognised that medicinal plants are used by 75-80% of the world's population for health care [3]. The failure of conventional medications has been noticed by Olorunnisola et al. [4]. The field of traditional phytotherapy is of growing interest in Africa due to their natural origin, availability, cultural acceptability, efficacy, safety and less side effects. Here, it is a history of eco-friendly relations between humans and their flora.

Gavdé is the name of Arabic gum (*Acacia nilotica*) in *"Fulfuldé",* a local language of sahelian zone of Cameroon. Native to Egypt, this plant belongs to the Fabaceae family, and widely distributed throughout the tropical and subtropical areas. It is a

Corresponding Author: Valentin Désiré Guiama

multiuse tree legume described by Malviya et al. [5]. Experimental studies have proven that *A. nilotica* plant is rich in phytochemicals. It has been used since ancient times to treat a wide range of diseases in traditional medicine. Ethnopharmacological claims of *Gavdé* indicated that it possesses various activities such as antibacterial, antifungal, antiviral, antidiabetic (hypoglycaemic effect), antimalarial, antioxidant, antidiarrheal, abortifacient, antiinfertility, antihypertensive, antispasmodic, antimutagenic [3] properties.

In sahelian region of Cameroon as in the other low-income regions 90% of people use herbal medicine. *Gavdé* is a frequently used plant for medical care. Since knowledge on the usage of medicinal plants in this region is very often transmitted from one generation to the next verbally [6], so it is not documented. Because of invasion of desert and migration of traditional medicinal healers, this rich knowledge on medicinal plants is subjectto rapid erosion [7].

Though numerous publications showed the efficacy of *Gavdé* against various diseases, there has been no work done to study the traditional uses of this plant in the sahelian region of Cameroon. Therefore, an ethnobotanical survey was carried out to know how *Gavdé* is used within the traditional pharmacopoeia of the sahelian zone of Cameroon.

METHODOLOGY

STUDY ZONE

The study zone falls within latitude 12°30' to 7°30'N and longitude 12°30'E to 15°E. It borders the Republic of Chad to the East, the Federal Republic of Nigeria to the West, Lake Chad to the North, and the Adamawa administrative Region of Cameroon to the South. The annual precipitation is ranged from 400 to 1200 mm per year, and vegetation is steppe type. *Fulfuldé* is common language spoken in this multi-ethnic area of 100,353 km^2, which consists of two geo-administrative regions of Cameroon, notably the North and Far-North regions. In this study zone, ten towns were visited namely: Kousséri, Mora, Mokolo, Maroua, Yagoua, Kaélé, Guider, Garoua, Poli and Tcholiré.

ETHNOMEDICAL DATA COLLECTION

Prior to the survey, respondents (traditional healers) were selected with the help of traditional rulers and the seniors of localities. To obtain pertinent ethnomedicinal information, the semi-structured questionnaire was used to interview the traditional healers (TH). In most cases, the questionnaire was translated and interpreted to them orally in *Fulfuldé* (local language) or in Arabic and responses were filled into the questionnaire after each interview. Monetary incentives used as examination fees were given to the selected TH. The questionnaires were administered to the 100 respondents (10 from each town) by trained interviewers. Ethnomedical information on *Gavdé* was obtained from 98 informants out of the total selected. It was divided into three sections. The information collected included (1) the personal data of the TH such as age, sex, religion, and educational background; (2) knowledge about *Gavdé* used within the traditional pharmacopoeia: professional experience, protection and production of plant, remedies conservation and origin of raw material; (3) recipes and plants combined, organs of *Gavdé* used, diseases treated, type of preparation, traditional solvent, route of administration, duration of treatment and frequency of recipes used.

Plants were authenticated in the Department of Biological Sciences, University of Ngaoundéré, Cameroon.

ETHICAL APPROVAL

Prior to the interviews, the purpose of the study was explained to the informants (TH). With verbal consent that this research shall not be used for commercial purposes but to edify and document the uses of *A. nilotica* in sahelian zone of Cameroon against many diseases, the interview was approved.

RESULTS AND DISCUSSION

PERSONAL INFORMATION OF TRADITIONAL HEALERS

The results show that the traditional healers were mostly male (83%). All sex confused, youth (25-35 years) were poorly represented (2%), while those over 65 were the most numerous (63%). This suggests that this activity is controlled by the elderly. A similar trend on the age of the TH were observed in the Lagos State in Nigeria [8]. Islam (48%) and Christianity (45%) were the predominant religions of the traditional healers, who were essentially illiterate (81%). Kevin *et al*. [9] reported similar information on the schooling of the TH in an ethnobotanical survey conducted in the Central- North of the

Morocco. The illiteracy of the traditional healers can be a serious hindrance to the documentation of the practices used with *A. nilotica* in particular and traditional medicine in general.

LINKS BETWEEN *ACACIA NILOTICA* AND INTERVIEWED HEALERS

Only 2% of the surveyed traditional healers were unaware of *A. nilotica*. They were mostly the young traditional healers from the Equatorial part of Cameroon. On the other hand, most of the TH (98%) claimed to know *A. nilotica*, indicating that it was a plant resource that belongs to their cultural heritage. The know-how with respect to this plant were primarily transmitted from generation to generation (87%). This can be explained by a limited schooling custodians of that knowledge. The overwhelming majority of these TH (91%) reported having used *A. nilotica* as source of medicine for more than 15 years, so 42% had more than 25 years, 35% more than 21 years and 14% over 16 years of professional experience with this plant in traditional medicine. Almost all of the organs of the plant were used including fruit, bark, root and leaves as the sources of traditional remedies. The same observation was reported by Malviya *et al.* [5]. However, the use of bark and roots can easily put it in a situation of vulnerability. Bush fires, firewood cutting and the operation of the organs (roots and barks) in traditional medicine and tannery are factors that can explain the situation of vulnerability of the plant at this time. 72% of respondents declared that this species is threatened with extinction. Bargali and Bargali [10] reported the ability of this legume to rehabilitate arid soils and agroforestry systems. The soil enhancing property of *A. nilotica* was known by 67% of the TH. Yet, 79% of the traditional healers were unaware of the methods of production of this plant. So, the survival of this species is dependent on a program of cultivation of *A. nilotica*. Half of these organs were collected from the forest galleries, and the rest came from the home gardens (34%) and sellers of medicinal plants (26%). More than half of the traditional healers (56%) recognized the magico-religious *A*. *nilotica* virtues. Other plants can be associated with *A. nilotica* for the treatment of certain diseases. Therefore, 14% of the TH associated *A. nilotica* with other plants. The TH of this area associated their treatment with spiritual (40%), dietary (31%) and behavioural (21%) recommendations.

RECIPES AND DISEASES

Table1 shows the organs of *A. nilotica*, the type of preparation, solvent, the route of administration and duration of treatment used to prevent or treat diseases in the sahelian zone of Cameroon. The fruits were most widely used for the treatment of diseases (42%), followed by bark, leaves, roots, seeds and flowers at rates of 26%, 26%, 14%, 2% and 2% respectively. These results are in contradiction to those of Rodrigues [11] who found that the leaves, roots and bark are the most used parts of plant. In some cases, same disease was being treated by several organs of the plant. It was observed that diseases such as dysentery, colds, diarrhoea and skin diseases can be treated by the fruits, leaves and the bark; sexual impotence and malaria by bark and roots; wounds by the flowers and leaves, haemorrhoids by fruit and bark, diabetes by bark and leaves.

Conversely, certain diseases were treated only by a single organ. It was the case of angina, sore teeth, asthma, premature aging, gingivitis and hypertension treated with fruit; While the bark were specialized in the treatment of bronchitis, conjunctivitis, hepatitis and sleeping sickness. These were the seeds that could solve the problems of anorexia and asthenia. For the treatment of low back pain, the traditional healers gather all the above-mentioned bodies.

Water was the solvent most used to prepare the traditional medicines of *A. nilotica*. The proportions of medicinal products prepared with water as solvent varied according to the used organ. That is why water was used for the preparation of 100, 76, 75, 65, 50 and 50% of medicines with various plant organs such as, fruits, roots, barks, flowers and seeds respectively. In addition, solvents such as honey, the local butter called «*Lebol*», porridge, the local wine ("*Bili-Bili*" in "*Fulfulde*") were used in the treatment of colds, dermatitis, sleepping sickness with the bark. Honey was used as a solvent for care against gastroenteritis with leaves of *A. nilotica*. The local wine was also used with the roots of this plant to treat sexual weakness (ejaculation, number and weakness of sperm). Sorghum juice was used as a solvent for the preparation of the drug from the fruit of *A. nilotica* used to promote milk production in lactating women. The powder of *A. nilotica* seeds was mixed with fermented milk to treat anorexia while fresh milk was used as solvent to treat gastric ulcers with the flower powder of this plant. In 5 cases, no solvent was used especially when the leaves of *A. nilotica* are used in the treatment of wounds and eczema, to prevent schistosomiasis or treat mouth and genital ulcerations as well as acne with the fruits of this plant.

Among the diseases treated by *A. nilotica*, inflammatory type were predominant. Indeed, diseases of inflammatory type were 100, 70, 67, 55, 50 and 50% of diseases treated by mixture of organs, fruit, leaves, the barks, roots and seeds respectively. In addition, symptoms or clinical signs of other diseases such as malaria, cancer, typhoid fever, dysentery, hypertension, and diabetes are inflammatory type. Singh and al. [12] reported antioxidant activity of the pods of *A. nilotica*. Anti-inflammatory and analgesic activities have been revealed on the leaves of *A. nilotica* [13].

The frequency or the number of traditional healers who use a medicinal preparation against a given pathology was one of the ethnopharmacological parameter. This ethnopharmacological parameter may be used as an indicator of the effectiveness of a medicinal preparation. Taking into account the number of TH who participated in the survey, preparations used by at least 5 of them against a particular disease were assumed to be effective. The highest scores were registered with preparations against bronchitis (25), followed by one against angina (24) and (22) toothache. The frequency was variable when several preparations could be used for the treatment of a disease. For example to treat diarrhoea, a preparation fruit of *A. nilotica* had a frequency of 21, while it was 13 with a decoction of the bark of this plant. Conversely, the low frequencies were recorded against acne with the powder of the fruits of *A. nilotica* (2), and low back pain with a decoction of a mixture of organs(2). Several factors can explain these variations, namely: the lack of a network of knowledge-sharing between the traditional healers, their illiteracy, the competition between them or the results mixed with certain medicinal preparations.

Medicinal preparations of several types were used namely: decoction (51%), powder (19%), maceration (17%), pulp (6%), the infusion (4%) and juices (2%). The decoction of the plant material fresh, dry powder or not is the most used [14].

The routes of administration varied depending on the type of preparation and the disease to be treated. The preparations such as decoctions, powders, maceration, pasta and infusions were mostly via the oral route (68%), while 28% were used topically and 2% through the anal route. Depending on the type of preparation, 79% of decoctions were taken orally; others took through anal route (4%), 17% were applied directly to wounds or the parts affected by a disease. It is the case of the baths of mouth for toothaches and gingivitis. All infusions were taken orally, while most of the paste were applied locally (67%) except for leave paste against gastroenteritis which was taken orally. Concerning the maceration, 63% of them were administered by the oral route, while the rest were applied locally. 50% of powder were taken by oral route, 38% applied locally and 12% used as a prophylactic against bilharzia. The juice of the leaves was applied to the parts of the skin affected by eczema.

The duration of treatment ranged from 2 to 28 days for all types of preparation or diseases. However, it was indefinite for diseases like asthma, dermatitis and wound, it was expected the healing to stop processing. Doses were variable and could evolve during treatment and with respect to the reaction of the patient. The concepts of dose and toxicity were not known among surveyed healers. Therefore, the adverse effects of drugs prepared by *A. nilotica* could be confused in the process of reversal of the pathological state. Nausea, constipation, fatigue, the volume of urine, the intensity of urination and itching were rather signs of healing, thus the effectiveness of their treatment.

Table1 organs of A. nilotica used for the treatment of diseases in the sahelian zone of Cameroon

Organs used	Diseases	Solvent	Type of Preparation[b]	Route of administration	Duration of treatment	Frequency[a]
Fruits	Angina	Water	De	Oral	2 to3 days	24
	Toothaches	Water	De	Topical	3 to 5 days	22
	Dysentery	Water	De	Oral	3 to 5 days	15
	Internal Haemorrhoids	Water	De	Oral	21 days	5
	Diarrhoea	Water	De	Oral	2 to 3 days	21
	intestinal Parasites	Water	De	Oral	3 time per week	9
	Asthma	Water	De	Oral	3 time per week	6
	Gingivitis	Water	De	Topical	5 days	11
	Prevention of bilharziasis	-	Po	In water containing bilharzias	3 days	5
	Fever aphtous	Water	De	Oral	5 days	13
	Influenza	Water	De	Oral	3 to 5 days	8
	Buccal and genital ulcerations	-	Po	Topical	7 days	15
	Acne	-	Po	Topical	5 days	2
	Precocious aging	Water	In	Oral	3 time per week	7
	Obesity	Water	In	Oral	3 time per week	12
	Hypertension	Water	De	Oral	6 to 9 days	9

Barks	Fever	Water	De	Oral	3 to 5 days	7
	Milk production	Juice of sorghum	Po	Oral	3 days	12
	Dysentery	Water	De	Oral	5 to 8 days	18
	Diarrhoea	Water	De	Oral	3 to 5 days	13
	Cold	Honey and lime juice	Po	Oral	5 to 6 days	6
	Bronchitis	Water	Ma	Oral	10 to 21 days	25
	Hepatitis	Water	De	Oral	14 to 28 days	7
	Haemorrhoidal bleeding	Water	Pa	Topical	4 to 6 days	15
	Dermatitis	Local butter : *Lebol*	Pa	Topical	Until healing	9
	Diabetes	Water	Ma	Oral	7 to 21 days	13
	Infertility	Hot porridge	Po	Oral	3 days	5
	Conjunctivitis	Water	De	Topical	5 days	3
	Sleep diseases	local wine: *"bili-bili"*	Ma	Oral	3 days	4
Leaves	Diabetes	Water	Ma	Oral	21 days	4
	Skin diseases	Water	Ma	Topical	5 days	8
	Injured Wound	-	Po	Topical	Until healing	15
	Eczema	-	Ju	Topical	Until healing	10
	Gastroenteritis	Honey	Pa	Oral	3 to 5 days	5
	Malaria	Water	De	Oral	7 to 13 days	13
Roots	Sexual weakness	local wine	Ma	Oral	3 days	8
	Malaria	Water	De	Oral	Up to 7 days	5
	Headaches	Water	De	Oral	Up to 3 days	3
	Rheumatic pain	water	De	Oral	6 to 9 days	7
Seeds	Anorexia	Fermented milk	Po	Oral	5 to 7 days	7
	Asthenia	Water	De	Oral	Up to 7 days	4
Flowers	Gastric ulcer	Milk	Po	Oral	3 to 5 days	3
	Wound	Water	Ma	Topical	Until healing	5
Organs mixed (6)	Influenza state	Water	De	Oral fumigation	3 to 5 days	8
	Itching	Water	De	Bath	5 to 7 days	5
	Gastroenteritis	Water	Ma	Oral	3 to 5 days	3
	Back pain	Water	De	Anal	3 days	2

[a] *the number of traditional healers using a medicinal preparation against a given pathology*
[b] *De: decoction; Ma: maceration; Pa: paste; Po: powder; In: infusion; Ju: juice*

ASSOCIATION OF *ACACIA NILOTICA* WITH OTHER PLANT SPECIES

The table 2 shows that the TH combined *A. nilotica* with other plants for the treatment of over 18 diseases. Though, details on the recipes were not disclosed for reasons of protection. Information on the solvent, the type of preparation, the method of administration and the duration of treatment was given by respondents. Water was the predominant solvent used (83%). decoction was the most used type of preparation (44%), followed by maceration (22%), pulp (17%), infusion (11%) and powder (6%). The duration of treatment ranged from 3 to 28 days. 89% of these recipes were taken orally, and 11% topically (the treatment of haemorrhoids and toothache).

Table 2 Diseases treated by recipes using combination of A. nilotica and other species

Recipes	Diseases	Solvent	Type de Preparation[b]	Route of administration	Duration of treatment	Frequency[a]
A. nilotica fruits, pellicles of *Arachis hypogaea* and bulbs of *Allium sativum*	Hepatitis	Water	Ma	Oral	21 days	2
A. nilotica fruits and leaves *Vernonia amygdalina*	Diabetes, cancer and viral diseases	Water	Ma	Oral	14 to 28 days	5
A. nilotica fruits and leaves of *Bidens pilosa*	Fever typhoid	Water	De	Oral	7 to 14 days	3
A. nilotica fruits and leaves of *Taraxacum officinale*	External Haemorrhoid	Water	Pa	Topical	7 days	2
A. nilotica fruits and fruit of *Citrus aurantiifolia*	Hypertension	Water	De	Oral	Until healing	5
A. nilotica fruits and fruits of *Solanum aethiopicum* Gilo	Prostatitis	Water	In	Oral	14 days	3
A. nilotica Fruits and barks of *Mangifera indica*	Toothaches	Water	De	Topical	14 days	3
A. nilotica fruits and leaves of *Euphorbia hirta*	Fungi diseases	Water	Ma	Oral	3 to 5 days	1
A. nilotica Fruits and fruits of *Solanum melongena*	Oedema	Water	Ma	Oral	5 to 7 days	2
A. nilotica roots and barks of *Garcinia kola*	Sexual infections	Water	De	Oral	Up to10 days	2
Feuilles de *A. nilotica* and seeds of *Carica papaya*	Fever typhoid	Water	In	Oral	3 days	3
A. nilotica roots and seeds of *Garcinia kola*	Cardiac diseases	Water	Po	Oral	Up to 3 days	2
A. nilotica leaves and leaves of *Carica papaya*	Malaria	Water	De	Oral	14 days	4
A. nilotica fruits and barks of *Moringa oleifera*	General fatigue	Water	De	Oral	3 days	3
A. nilotica fruits and leaves of *Allium cepa*	Precocious aging	Honey	Pa	Oral	5 time per week	2
A. nilotica fruits and bulbs of *Allium sativum*	Intoxication	-	Pa	Oral	Up to 10 days	4
de *A. nilotica* fruits, fruits of *Solanum aethiopicum* Shum	Maladies du rein	Water	De	Oral	7 to 14 days	3
A. nilotica fruits and leaves of *Euphorbia hirta*	Nervous breakdown	Water	De	Oral	3 to 5 days	4

[a] *the number of traditional healers using a medicinal preparation against a given pathology*

[b] *De: decoction; Ma: maceration; Pa: paste; Po: powder; In: infusion; Ju: juice*

PLANTS ASSOCIATED WITH *A. NILOTICA* IN TREATMENT OF DISEASES

The TH associated 15 other species of plants belonging to 11 families (table 3). The family of the Solanaceae was represented by 3 species, those of the Alliaceae and Asteraceae by 2 species each. The other 8 families were represented by one species each namely: Fabaceae, Phyllanthaceae, Caricaceae, Rutaceae, Euphorbiaceae, Guttifereae, Anacardiaceae and Moringaceae. These plants came from the home gardens (80%), forest galleries (13%) and market (7%). The therapeutic virtues of some number of them have been documented. These plants possess pharmacological proprieties, such as the antimicrobial activity of leaves of *Bidens pilosa* [15], the anxiolytic effect of the leaves of *Euphorbia hirta* [16], anti-diabetic, anti-cancer and antiviral activities of the leaves of *Vernonia amygdalina* [17], antiviral and detoxifying effects of the bulbs of *Allium sativum* [18], anti-fatigue function of *Moringa oleifera* [19], cadioprotecteur and antimicrobial effects of the seeds of *Garcinia kola* [20, 21], anti-oedematous activity of the barks of *Mangifera indica* [22]. These plants were used to optimise the therapeutic effect of the traditional medicines using *A. nilotica*.

Table Plants associated with A. nilotica in traditional medicine in the Sahelian zone of Cameroon

Botanical name	Family	Common name	Local name	Origin
Allium cepa L.	Alliaceae	Onion	Tignéré	HG[a]
Allium sativum L.	Alliaceae	Garlic	Ar'ngaladjé	HG
Arachis hypogaea	Fabaceae	Peanut	Biridji	HG
Bidens pilosa L.	Phyllanthaceae	Broom stick	Gnakamré	FG[b]
Carica papaya L.	Caricaceae	Pawpaw	Doukoudjé	HG
Citrus aurantiifolia	Rutaceae	Lime	Lemu lamudum	HG
Euphorbia hirta L.	Euphorbiaceae	Asthma plant	Indam'hi	HG
Garcinia kola Heckel	Guttifereae	Bitter Kola	Mindjin goro	M[c]
Mangifera indica L.	Anacardiaceae	Mango	Mangoro	FG
Moringa oleifera	Moringaceae	Moringa	Legi-lakii	HG
Solanum aethiopicum Gilo	Solanaceae	Gilo	Kuitadjé	HG
Solanum aethiopicum Shum	Solanaceae	Mock tomato	Ngago	HG
Solanum melongena	Solanaceae	Eggplant	Kuitadjé nassara	HG
Taraxacum officinale L.	Asteraceae	Dandelion	Gnie'babaladé	HG
Vernonia amygdalina Delile	Asteraceae	Bitter leaf	Katkadé	HG

[a] HG: Home gardens, [b] FG: Forest gallery, [c] M: market

CONCLUSION

The present ethnobotanical survey revealed that *Gavdé* plays an important role on the health of people living in sahelian zone of Cameroon. So, this plant is widely used traditionally to fight against various illnesses including metabolic, infectious and parasitic diseases. To the best of our knowledge, this paper is the first report on the ethno-medicine values of *A. nilotica* in this region. It can contribute to preserve knowledge on the use of *Gavdé* in this region and also inspire the youth on traditional healing practices. However, the therapeutic claims related to this plant need to be evaluated through toxicological and pharmacological investigations.

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