Journal of King Saud University - Science 36 (2024) 103350

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Journal of King Saud University - Science

journal homepage: www.sciencedirect.com

Full Length Article

Ethnobotanical survey of medicinal plants used to treat icterus in Labé administrative district (Republic of Guinea)

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ARTICLE INFO

Keywords:
Ethnobotany
Icterus
Guinea
Medicinal plants

ABSTRACT

Introduction: Diseases leading to icterus are prevalent in the Republic of Guinea, and access to treatment is limited in rural areas. Traditional Guinean healers use the diversified and rich local flora to meet the health needs of the population. The study's objectives were to identify the medicinal plants used by traditional healers to treat icterus, describe the ethnomedical symptoms of icterus according to traditional healers and describe how recipes are prepared and administered.

Material and methods: A cross-sectional survey of 37 traditional healers was carried out, and the plants listed were identified by the botanists of the Institute of Research and Development for Medicinal and Food Plants of Guinea (IRDPMAG).

Results: 37 traditional healers (24 men / 13 women) were surveyed. However, the knowledge of plant species and their use is not dependent on sex (P=0.115). Yellow eyes, pallor, lack of appetite, and swelling belly were the main signs of the disease. Thirty-eight plant species were recorded, identified, and classified into 24 botanical families. The most cited families are Combretaceae (FUV=0.447), Bixaceae (FUV=0.342), and Apocynaceae (FUV=0.289). The most frequently cited plants were *Cochlospermum tinctorium* Perrier ex A.Rich (PUV=0.243). Leaves 69.4 % were the most frequently cited plant parts, and decoction 41.7 % was the primary recipe preparation method.

Conclusion: These results serve as a basis for anti-icteric plants in Guinea. Bio-guided fractionation of plants of high therapeutic interest will be the next step in this work.

1. Introduction

Liver disease is a significant cause of morbidity and mortality worldwide. Icterus or jaundice is a yellow colouration of the skin, sclera, and mucous membranes caused by bilirubin. It is a common manifestation of hepatobiliary disease (Abbas et al. 2016; Winger and Michelfelder, 2011). It is one of the most common conditions affecting men of all ages. In conventional medicine, icterus is not considered a disease but a visible symptom of liver disease, which occurs when the amount of bilirubin circulating in the blood is high due to abnormal metabolism, resulting in yellow discolouration of the eyes and integuments (Tewari et al. 2017).

The prevalence of pathologies linked to liver dysfunction leading to icterus is increasing worldwide and is mainly caused by viruses (1.4 million deaths), malaria, toxic substances such as carbon tetrachloride, drugs, and alcoholic ethylism (Roy et al. 2014). World Health Organization (WHO) estimates that 325 million people worldwide will be living with hepatitis B and(or) C for the year 2023, of which 32 million are in Africa. For the majority, screening and treatment remain out of reach (OMS 2023), leading to liver cirrhosis or cancer.

In Guinea, people face large liver diseases, and icterus represents 51.5 % of the reasons for hospital consultations in the gastro-enterology-hepatology department (Diallo et al. 2023). Many Guinean people still use traditional herbs to treat a variety of diseases, including liver

Abbreviations: Mg, milligram; ml, milliliter; CI_{50}, 50 % inhibitory concentration; GPT, Alanine Aminotransferase; GOT, Aspartate Aminotransferase; CCl_4, carbon tetrachloride; WHO or OMS, World Health Organisation.

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https://doi.org/10.1016/j.jksus.2024.103350
Received 24 October 2023; Received in revised form 15 January 2024; Accepted 15 July 2024
Available online 18 July 2024

disease, despite the availability of modern medicines, which remain expensive and inaccessible, especially in *peri*-urban and rural areas.

However, little data exists on the plants and their use by the population for the Icterus management. This study aims to collect and document information on how traditional healers living in Labé diagnose and treat icterus.

2. Material and methods

2.1. Study area

This cross-sectional study with a snowball effect was carried out in Labé prefecture from 01/08/2019 to 30/10/2019. The Labé Prefecture is one of the five prefectures within the Administrative Region of Labé. It is in the northwest of the Republic of Guinea at an altitude of around 1026 m between longitude 12°18 west and latitude 11°19 north. The prefecture is bordered to the north by the Mali prefecture, to the west by the Lelouma prefecture, to the south by Pita and Dalaba, and to the east by Tougué and Koubia. It is subdivided into an urban commune and twelve (12) sub-prefectures, namely Dalein, Tountouroun, Sannoun, Dionfo, Kaalan, Nousssi, Dara-Labé, Hafia, Garambé, Diarri, Kouramangui, and Popodara. The Commune Urbaine (CU) of Labé is divided into 28 districts, 12 of which are urban (Daka 1, Daka 2, Doghora, Dow Saré, Konkola, Kouroula, Mairie / Ley Saré, Madina, Mosquée, Pounthioun, Tata 1, and Tata 2) and 16 *peri*-urban (Bambaya, Companya, Dongol, Dayébhé, Fady, Fafabhé, Falo Bowé, Horé Saala, Koulidara, Lombonna, Nadhel, Petewel, Poreko, Saala Douye, Safatou 1, and Safatou 2) (Foutapédia 1998).

2.2. Study population

The present research focused mainly on traditional healers' residents in Labé prefecture. Traditional healers over 20 years old, known by their community as capable of managing jaundice, who agreed to participate voluntarily and help collect plant samples, were included.

2.3. Data collection and plant identification

Semi-structured questionnaires and oral interviews were adopted to obtain the relevant ethnomedical data. The questionnaires were administered by trained interviewers in the local language "Poular" for 30 to 60 min, and consent was obtained from the respondents. The semi-structured questionnaire was designed to obtain the following information: the 1st part addressed personal information such as age, sex, and experience. In the 2nd part, the local names of the plant species, the disease causes and symptoms, plant parts used to prepare remedies, and mode of preparation and administration. Plant materials, including specimens of the cited plants, were collected during the survey. The samples from each plant species were pressed, dried, and mounted on herbarium sheets for identification. The plant species were botanically identified by the botanists from the Institute of Research and Development for Medicinal and Food Plants of Guinea, authenticated by the Guinea National Herbarium and updated on *https://www.worldfloraonline.org*.

2.4. Data analysis

Our study's data were statistically analysed using SPSS (System Package for Social Sciences, version 21). Data concerning the socio-demographic profile of traditional healers were examined by a simple descriptive statistical method using percentages and frequencies. We used the chi-square test to determine whether there was a difference between male and female informants on the number of medicinal plant species they listed and associated uses reported (p-value ≤ 0.05 were considered statistically significant). The ethnobotanical and ethnopharmacological data were analysed using the quantitative value indices: Family Use Value (FUV) and Plant Use Value (PUV).

2.4.1. The family use value (FUV)

The FUV is an index of cultural importance that can be applied in ethnobotany to calculate the value of biological plant taxon and identify the significance of plant families (Chaachouay et al. 2019). The following formula was used to calculate FUV:

$$FUV = UVs/Ns$$

UVs: number of informants mentioning the family; Ns: total number of species within each family.

2.4.2. Plant use value (PUV)

The PUV represent the relative importance of each species known locally. A high PUV indicates the potential importance of the plant species reported. The PUV was determined according to the following formula (Benkhaira et al. 2021):

$$PUV = U/N$$

U: number of citations per species; N: number of herbalists interviewed. A high PUV indicates the potential importance of the plant species reported.

2.5. Literature review

Bibliography research of the collected plant species was performed by searching scientific databases (Scifinder, PubMed, Web of Science, ScienceDirect), thus covering international peer-reviewed journals. As search terms, the scientific plant name was used, in combination with, "icterius" or "jaundice", "antiviral", or "antimalarial", or "anti-plasmodial", "antioxidant", or "analgesic", or "anti-inflammatory", "traditional medicine", or "herbal medicine", to obtain information on the related pharmacological activities of the collected plant species.

2.6. Ethical consideration

Each traditional healer interviewed gave verbal informed consent to participate in the study and divulge the information from this research.

3. Results

Thirty-seven (37) traditional healers were interviewed, and their demographic data are summarized in Table 1. The median age was 52, the minimum age of traditional healers was 35 and the maximum was 81; more than half of those interviewed 54.1 % were over 51 years, and the average age was 53 ± 12 years. Most traditional healers were Men (64.86 %; 24/37; p = 0.115). Inheritance (54.1 %; 20/37) was the primary source of knowledge acquisition.

Traditional healers in Fulani cited two types of icterus: "Rèmè" or "Danawel". Yellow colouration of the eyes was described as "Rèmè", and

Table 1
Sociodemographic characteristics for traditional practitioners in Labé Prefecture (N=37).

Characteristics	Numbers (N=37)	Percentages (%)	P-values
Sex			0.115
Male	24	64.86	
Female	13	35.14	
Age			0.420
Under 50	17	45.9	
51 and over	20	54.1	
Knowledge acquisition methods			0.348
Heritage	20	54.1	
Learning	16	43.2	
Individual experience	1	2.7	

N: Total number.

yellow colouration of the eye with a significant deterioration in the patient's condition that could lead to death if not treated immediately as "Danawel".

Traditional healers cited nine symptoms as symptoms of icterus (Table 2): "Guitè nètè" literally means yellow eyes (100 %), "Raouno bhandou" = pallor (29.7 %), "Angal wèlègol" = lack of appetite (27.0 %), "Horagol" = weight loss (13.5 %), "Moussou djiyè" = joint pain (8.1 %), "Woulou bhandou" = fever (8.1 %), chills (2.7 %), "Bhoutou redou" = swelling belly (16.2 %) and "Meto_houndouko" = dull mouth (5.4 %).

Traditional healers use medicinal plants to treat icterus, summarized in Tables 3 and 4. The leaves were the most used plant parts, followed by rhizomes and stem bark, with percentages of 69.4 % (25/37), 55.6 % (20/37), and 41.7 % (15/37), respectively (Table 3). The most commonly used preparation method was decoction, followed by maceration and grinding, with respective percentages of 83.3 % (30/37) and 58.3 % (21/37). Traditional practitioners used combinations of three plants (32.4 %) or more (29.7 %) to prepare their recipes.

Thirty-eight plant species belonging to 24 botanical families were used to treat icterius (Table 4). Despite Fabaceae (5 species) being the most represented family, Combretaceae (FUV=0.447), Bixaceae (FUV=0.342), and Apocynaceae (FUV=0.289) were the most influential families based on the FUV index. *Cochlospermum tinctorium* Perrier ex A. Rich (PUV=0.243) exhibited the highest value of the PUV index. *Landolphia heudelotii* ADC and *Combretum micranthum* G.Don had the same value (PUV=0.216), followed by *Persea americana* Mill (PUV=0.135) (Table 4).

4. Discussion

This study aimed to collect and document information on anti-icteric plants and their uses in Labé Prefecture from traditional healers.

Studies showed that men have a greater knowledge of plant species and their use, but it is no different for women (P=0.115). This could explain the male predominance, which is that men in African society are often the first to be involved in transmitting traditional knowledge. These results align with several ethnobotanical investigations in Guinea (Magassouba et al. 2007; Traore et al. 2013). The high number of ageing traditional healers could be explained by the rural exodus and the emigration of young people to industrialized countries for well-being (El Hachlafi et al. 2022; Mohamed S. Traore et al. 2022).

Inheritance was the most frequently cited means of acquiring knowledge, as shown by the results of some earlier studies carried out in Africa (M.S. Traore et al. 2013; Mohamed S. Traore et al. 2022; Benkhaira et al. 2021). It is advocated that knowledge of treatment of the disease acquired by inheritance and training must be documented for future generations.

Icterus was considered a disease and not a symptom in traditional medicine. Yellow eyes, pallor, lack of appetite, swelling belly, fever, and weight loss were the main ethno-medical signs of the disease. These symptoms could be similar to those of liver disease (Milner 2018; Langan and Goodbred, 2021; Ravi et al. 2022) but also of malaria, which is endemic in Guinea.

Table 2
Ethno-therapeutic symptoms according to traditional practitioners.

Symptoms	Effectifs (N=37)	Percentages
Yellow eyes	37	100.0
Paleness	11	29.7
Lack of appetite	10	27
Weight loss	5	13.5
Joint pain	3	8.1
Fever	3	8.1
Chills	1	2.7
Belly swelling	6	16.2
Dull mouth	2	5.4

N: Total number.

Table 3
Method of preparation and use of recipes by traditional practitioners in Labé prefecture N=37.

Parts of the plant used	Mumbers (N=37)	Percentages
Leaves	25	69.4
Stem bark	15	41.7
Roots	4	11.1
Fruits	7	19.4
Rhizomes	20	55.6
Preparation method		
Decoction	30	83.3
Maceration	21	58.3
Infusion	6	16.7
Grinding	8	22.2
Number of plants used to prepare recipes		
One plant	5	13.5
Two plants	9	24.3
Three plants	12	32.4
More than three plants	11	29.7

N: Total number.

Their traditional remedies are mainly plant decoctions taken orally or used as a body lotion. However, some traditional healers suggest maceration to avoid destroying the recipe. These results are similar to those of Diatta et al.(2019) in Senegal, Sharma et al. (2012), and Deb et al. (2016) in India, who indicated that decoction might be the best preparation method for obtaining maximum active ingredients.

Most recipes comprised more than three plants. This could be explained by the fact that in traditional medicine, practitioners often use a combination of several plants, in all likelihood to obtain a synergistic action against several symptoms.

The most cited families were Fabaceae, Combretaceae, Hypericaceae, Bixaceae, and Apocynaceae. The dominance of these families can be explained by their extensive distribution in Guinea, where the ecological factors favour the vegetation of the species belonging to these families. Most nationwide surveys showed that Guinean healers widely use these families to treat many diseases (Camara et al. 2023; Haba et al. 2022; Goumou et al. 2022).

Leaves are the most plant parts used in recipes. This may be due to their easy harvesting and use by traditional practitioners. Using the leaves considers the need of traditional healers to protect their source of supply and the protection of biodiversity.

Several species' anti-inflammatory, antimalarial, antioxidant, and antimicrobial activities have been described in the literature. *Cochlospermum tinctorium* was the plant most cited in our study for treating swollen belly. While this symptom is similar to hepatomegaly, the ethanolic extract of rhizomes showed hepatoprotective activity after CCl_4 administration in rats, and the chemical groups responsible for this activity are gallic and ellagic acids (Diallo et al., 1987). The *in vitro* antiplasmodial activity of 3-O-E-p-coumaroylalphitolic acid, betulinic acid, 3-tetradecanone, and 3-hexadecanone obtained from the plant roots has been previously demonstrated (Ballin et al. 2002; Ahmadu 2014). In Mali, a study by Sangaré showed a significant reduction in transaminases (GPT, GOT) with *C tinctorium* tea (Sangaré 2006). *Cochlospermum planchonii, Carica papaya Mangifera indica*, and *Vernonia colorata* were used by traditional practitioners to treat icterius. Previous studies showed these plant species have high antimalarial activities (Omoya 2016; Toyang et al. 2013; Atanu et al. 2021).

The main chemical constituents isolated from the ethanolic fractions of *C tinctorium* rhizomes are: 3-O-E-p-coumaroylalphitolic acid, cochloxanthin, dihydrocochloxanthin, alphitolic acid, 1-hydroxytetradecan-3-one in the dichloromethane, 3-bisabolen, 2tridecanone, 3-hexadecanone, 1-dodecanol, l-tetradecanol, 2-pentdecanone, 3-octadecanone, 1-hydroxy-3-hexadecanone, 1-nonadecanol, l-O-acetyl-3-hexadecanone, lhydroxy-3-oetadecanone (Diallo et al., 1987).

The traditional healers who cited *Landolphia heudelotii* assumed that its effectiveness was due to the orange colouration of its fruits, similar to

Table 4
List of plants used in the treatment of icterus by traditional practitioners in the Labé prefecture.

Number	Family	FUV	Scientific names	PUV	Number herbarium	Parts used	Local names	Preparation method	Fc
1	Apocynaceae	0.289	*Saba senegalensis* A.D.C Pichon	0.081		L	Larè	D, I	3
			Landolphia heudelotii A.D.C	0.216	8HK57	L, Stb	Porè laman	D	8
2	Annonaceae	0.105	*Uvaria chamae* P.Beauv	0.108	6HK24	L, Stb	Boylè	D, G	4
3	Anacardiaceae	0.052	*Mangifera indica* L.	0.054	3HK31	L, Stb	Mango	D, I	2
4	Asteraceae	0.026	*Vernonia colorata Drake*	0.027	13HK176	L	Bantara bourourè	D, I	1
5	Bignoniaceae	0.131	Markhamia tomentosa K.Schum. ex Engl.	0.108	18HK201	L	Kafawandou	D M	4
			Newbouldia laevis (P. Beauv) Seem	0.027	18HK203	L	Soukoundè	D	1
6	Bixaceae	0.342	*Cochlospermum tinctorium Perrier* ex A. Rich.	0.243	37HK442	Rh	Rèmèrèden	M G	9
			Cochlospermum planchonii Hook.f ex Planch.	0.108	37HK441	L	Diaroundè Rèmèrèdjanè	D M G	4
7	Bromeliaceae	0.026	*Ananas comosus* (L.) Merr.	0.027	24HK207	F	Fougnè	M	1
8	Caricaceae	0.105	*Carica papaya* L.	0.108	31HK430	Stb L	Boudi daridhoun	D	4
9	Combretaceae	0.447	*Combretum micranthum* G.Don	0.216	38HK450	L	Kankaliba Kankilibangny	D	8
			Combretum paniculatum Vent.	0.081	38HK452	L	Yarassafili Yarèsafili	D G	3
			Combretum molle R.Br. ex G.Don	0.081		L	Khagnaka	D M I	3
			Terminalia albida Scott Elliot	0.081	D36HK4	L, Stb	Borribilel	D	3
10	Chrysobalanaceae	0.026	*Parinari macrophylla* Sabine	0.027		L	Sigon	D	1
11	Fabaceae	0.236	*Piliostigma thonningii* (Schumach.) Milne-Redh	0.027	27HK412	L	Barkè	D	1
			Dialium guineense Willd.	0.027	D51HK4	L	Mèko	D	1
			Tamarindus indica L.	0.027	D51HK11	F	Diabhè	M	1
			Erythrina sigmoidea Hua	0.081	53HK506	L	Papatara	D	3
			Parkia biglobosa Benth	0.081	86HK596	L	Nètè	D M G	3
12	Euphorbiaceae	0.026	*Jatropha curcas* L.	0.027	52HK490	Stb	Kidi	D	1
13	Hypericaceae	0.078	*Harungana madagascariensis* Lam. ex Poir.	0.027	63HK554	Stb	Soungala	D	1
			Psorosperum guineense (L.) Hochr.	0.027		L	Ketidjankouma	D	1
			Vismia guineensis (L.) Choisy	0.027	63HK556	L	Soungaladjon	D	1
14	Lauraceae	0.026	*Persea americana* Mill.	0.135	68HK563	L	Piya	D	5
15	Moringaceae	0.026	*Moringa oleifera* Lam.	0.108	D87HK1	L	Nebada	D	4
16	Moraceae	0.026	*Ficus capensis Tunb.*	0.027	88HK600	L	Ghibè	D	1
17	Meliaceae	0.026	*Azadirachta indica* A. Juss.	0.054	82HK577	L	Kacia porto Kacia tchéouko	D I	2
18	Musaceae	0.026	*Musa paradisiaca* L.	0.054	90HK622	L	Banana	D	2
19	Phyllanthaceae	0.026	*Hymenocardia acida* Tul.	0.108	62HK530	L	Pélitoro	D	4
20	Rutaceae	0.131	*Citrus limon* Osbeck.	0.108	D118HK4	L R F	Katchou	D M	4
			Citrus aurantium L.	0.027	122HK670	L	Lémounè	M	1
21	Rubiaceae	0.026	*Sacrocephalus pobeguinii* (Hua ex Pobég.) Merr.	0.054	121HK672	Stb	Popa	M	2
22	Sapindaceae	0.026	*Allophylus africanus* P. Beauv	0.027		L	Kolè yala	D	1
23	Vitaceae	0.026	*Cissus aralioides* Planch.	0.081	140HK713	L R	Fafarou	D M G	3
24	Zingiberaceae	0.078	*Aframomum melegueta* K. Schum.	0.054	141HK716	R	Dhadhi gögö	D	2
			Zingiber oficinalis Rosco.	0.027		Rh	Gnamakouleydi	D	1

Fc: Frequency of citation; L: leave; Stb: stem bark; R: roots; Rh: rhizomes; F: fruits; D: decoction; M: maceration; I: infusion; G: grinding.

the main symptom of icterus. Its aqueous and ethanolic extract showed promising antimalarial activity on Plasmodium NF 54 and K1 strains. These results could justify the use of this plant in the traditional treatment of icterus (Kipré et al. 2018). *L. heudelotii* leaves, *Combretum paniculatum*, and *Combretum glutinosum,* which are used for the management of icterus, were found to be highly active against *P. falciparum in vitro*, with CI_{50} values of 1.3 and 3.6 µg/ml, 0.5 and 3.5 µg/ml, and 1.3 and 3.6 µg/ml, respectively (Baldé et al. 2020). Some traditional healers asserted that the complications of malaria led to the yellow colouration of the eye (M.S. Traore et al. 2013a).

Persea americana is cited in our survey to manage joint pain, weight loss, fever, and lack of appetite associated with icterus. These symptoms are like those of acute malaria. The study by Uzor et al. showed that Quercetin is the most prevalent flavonoid in the plant and is responsible for its antimalarial activity (Uzor et al. 2021). Oil from *P americana* seeds showed antioxidant potential thanks to its reducing power. This property is attributable to the flavonoids present in the seed. This shows avocado seeds are intended for nutrition and cosmetics and could have tremendous therapeutic potential. (Banji et al., 2019). Ethyl acetate extracts of *P. americana* stem bark and leaves showed similar anti-

inflammatory activity to indomethacin, with inhibition percentages of 41.45 %, 25.78 %, and 21.08 %, respectively. The petroleum ether extract of the leaves also showed high anti-inflammatory activity, with an inhibition percentage of 38.55 %. The total stem extract, aqueous, and petroleum ether fractions of leaves showed analgesic activities close to those of acetylsalicylic acid (Mahmoud et al. 2021).

Combretum micranthum leaf extract has demonstrated intense antioxidant activity by scavenging free radicals (Kpemissi et al. 2019). A study on *C micranthum* herbal tea showed a significant transaminase drop (Haidara et al. 2016). Free radicals are known to be hemolytic (rupture of the red cell membrane through lipid peroxidation). Paleness is one of the symptoms cited by traditional healers in our survey, which often occurs when hemolysis is present. Also, previous studies showed the antiplasmodial activity of these species (Zofou et al., 2013; Baldé et al. 2020), which could justify the high FUV value of the Combretaceae family in our study.

5. Conclusion

This ethnobotanical study made it possible to highlight two types of icterus that traditional healers manage. The traditional remedies mainly focused on plant species, most of which have been described to possess antimalarial, hepatoprotective, anti-inflammatory, and(or) antimicrobial properties. However, traditional recipe standardization and bioassay-guided fractionation will be carried out to provide proof of efficacy, safety, and tolerance of these recipes or plants.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Acknowledgment

The authors would like to thank the Center for Research and Training in Infectious Diseases of Guinea (CERFIG) and the African Center of Excellence for the Prevention and Control of Transmissible Diseases (CEA-PCMT) for their contribution to this manuscript.

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