Trop J Nat Prod Res, October 2025; 9(10): 4868 - 4878 ISSN 2616-0684 (Print)
ISSN 2616-0692 (Electronic)

Tropical Journal of Natural Product Research

Available online at https://www.tjnpr.org

Original Research Article

Natural Therapeutics Against Prostate Disorders in Guinea: An Ethnobotanical Survey and Biological Activities of Some Medicinal Plants

Tanou V. Bah[1,2,3]*, Véronique Mégalizzi[3], Séré Diané[1], Mamadou S.T. Diallo[1,2], Mohamed K. Camara[1,2], Ansoumane Oularé[1], Ian Tietjen[4], Elhadj S. Baldé[1,2]

[1]*Guinea Institute for Research and Development of Medicinal and Food Plants, BP 6411, Dubréka, Guinea.*
[2]*Department of Pharmacy, University Gamal Abdel Nasser of Conakry, BP 1017, Guinea.*
[3]*Departement of Microbiology, Bioorganic and Macromolecular Chemistry, Université Libre de Bruxelles, Bd du Triomphe BP 1050, Brussels, Belgium*
[4]*The Wistar Institute, 3601 Spruce St., Philadelphia, PA 19104 USA*

ARTICLE INFO

Article history:
Received 09 September 2025
Revised 22 September 2025
Accepted 23 September 2025
Published online 01 November 2025

ABSTRACT

Limited access to healthcare has led many Guineans, particularly in rural areas, to rely on medicinal plants to treat health issues, including prostate disorders. This study aimed to collect information on medicinal plants traditionally used in Guinea to manage prostate diseases and investigate their *in vitro* antioxidant and anti-inflammatory activities. An ethnobotanical investigation was conducted in three Guinean regions, where 277 traditional healers were interviewed and medicinal plants were collected for study. A total of 55 plant species belonging to 29 botanical families were identified. Fifteen plant species were evaluated for their antioxidant and anti-inflammatory activities. Among the 15 plants tested, the highest polyphenol content was found in the methanol extract of *Alchornea cordifolia* (335.7 ± 19.3 mg EAG/g extract). Promising antioxidant activity, including the ability to scavenge free radicals and reduce metal ions, was observed in Khaya senegalensis A.Juss. and Alchornea cordifolia (Schumach.). Müll.Arg., and *Anonychium africanum* (Guill. & Perr.), at a concentration of 500 µg/mL. The highest anti-inflammatory activity was exhibited by *Azadirachta indica* A.Juss., *Paullinia pinnata* (L.), *Tamarindus indica* L., and *Milicia excelsa* (Welw.) C.C.Berg, and *Harungana madagascariensis* Lam. Ex Poir. with IC_{50} ≥50%. This study provides a comprehensive overview of the medicinal plants used by Guinean traditional healers in the management of prostate diseases. Several plant species have also demonstrated significant antioxidant and anti-inflammatory activities, suggesting their potential as sources for developing new therapeutic leads to target non-communicable diseases, such as cancer.

Keywords: Ethnobotanical, Antioxidant, Anti-inflammatory, Prostate, Guinea

Introduction

Prostate diseases, including prostatitis, cancer, and benign prostatic hyperplasia (BPH), are among the most prevalent clinical conditions affecting men today and continue to be a major concern in countries with limited resources.[1] Recent data indicate a rising prevalence of BPH in older populations, with incidence rates exceeding 70% by age 60 and surpassing 90% by age 70.[2] Prostate cancer is the most frequently diagnosed cancer among men in West Africa, with an incidence rate of 31.9 cases per 100000 men.[3] In 2020, the Korle-Bu Teaching (KTB) hospital in Ghana recorded 1.063 cases,[4] while Togo reported an average of 77 cases per year, [5] and Guinea 29 cases annually.[6] Many of these cases are diagnosed at an advanced stage, as patients often rely on herbal treatments before seeking medical care.
Guinea has only a single urology and andrology department located at the Ignace Deen University Hospital in the capital city of Conakry. In this department, benign prostatic hyperplasia constitutes 55% of urological emergencies.[6] The management of prostate conditions requires surgical procedures with or the use of medications such as alpha-blockers, 5-alpha-reductase inhibitors, anticholinergics, and/or beta-3 agonists.[7,8] However, as hospital access and medications are largely unavailable outside of Conakry, in more rural areas, Guinean men frequently rely on traditional medicines to address prostate diseases as well as more common ailments such as other urinary disorders, skin diseases, and oral health issues.[9] Over the past decade, the use and acceptance of natural remedies have grown significantly worldwide. This trend is largely attributed to the perceived effectiveness of these treatments, as well as their reputation for being gentler and better tolerated than conventional medicine.[10]
However, despite their widespread use, these remedies, generally in the form of medicinal plant preparations, remain largely unstudied from pharmacological and toxicological perspectives, highlighting the need for scientific evidence of their efficacy, safety, and tolerability.[11]
In this first study conducted in Guinea, ethnobotanical surveys proved to be an essential tool for collecting and documenting traditional knowledge related to plants used for managing prostate disorders. Excessive production of reactive oxygen species (ROS) leads to DNA damage and promotes the proliferation of malignant cells, while persistent inflammation creates a microenvironment that is favorable for carcinogenesis. In addition, the activation of pro-inflammatory cytokines, such as TNF-α and IL-6, further stimulates tumor growth and resistance to treatment.[12] Given that antioxidants can counteract oxidative damage and plant-derived anti-inflammatory compounds may help mitigate these pathological processes, investigating these activities is crucial for identifying natural strategies to prevent or manage prostate

*Corresponding author. E mail: tvbah@irdpmag.edu.gn
Tel: +224 625 51 47 20

Citation: Bah TV, Mégalizzi V, Diané S, Diallo MS, Camara MK, Oularé A, Tietjen I, Baldé ES. Natural Therapeutics Against Prostate Disorders in Guinea: An Ethnobotanical Survey and Biological Activities of Some Medicinal Plants. Trop J Nat Prod Res. 2025; 9(10): 4868 – 4878 https://doi.org/10.26538/tjnpr/v9i10.24

Official Journal of Natural Product Research Group, Faculty of Pharmacy, University of Benin, Benin City, Nigeria

 ISSN 2616-0684 (Print)
ISSN 2616-0692 (Electronic)

cancer. To provide partial scientific support for the use of plant species by traditional healers, their antioxidant activities were evaluated by determining the total phenolic content, the ability of the plant extracts to reduce Fe^{3+} to Fe^{2+}, and their free radical scavenging activity. In parallel, the possible anti-inflammatory potential was assessed by measuring the ability of the extracts to inhibit the denaturation of serum albumin.
This study aimed to collect information on medicinal plants traditionally used in Guinea to manage prostate diseases and to investigate their *in vitro* antioxidant and anti-inflammatory activities.

Materials and Methods

Study area
Guinea is a coastal West African country located between 7°30' and 12°30' of northern latitude and 8° and 15° of western longitude. It consists of four ecological regions, which include Low Guinea, an area of littoral plains; Middle Guinea, with mountainous solid masses and lateritic high plateaus; Upper Guinea, a vast plateau; and Forest Guinea, which contains a large mountain chain. The global population was estimated at 12,771,246 inhabitants in 2019, with an average density of 51.91 per km^2.[13] Ethnobotanical surveys were carried out in at least one prefecture per region, except for Middle Guinea (Figure 1). These include Boffa (Lower Guinea), Faranah, Kankan, and Kouroussa (Upper Guinea), and N'zérékoré (Forest Guinea).

Figure 1: Geographical location of the study area

Ethical considerations
The study was conducted in accordance with the requirements of the Helsinki Declaration.[14] Each participant gave verbal informed consent to participate in the study and divulge the information from this research.

Recruitment and survey of traditional healer study participants
Traditional healers were recruited based on their community's recognition of them and their knowledge of prostate diseases management. The survey was conducted in the participants' preferred local languages: Soussou, Maninka, or Guerzé. Ethnobotanical data were collected through a series of surveys conducted from July 2023 to April 2024. Semi-structured questionnaires and oral interviews lasting 30 to 60 minutes were used to gather relevant ethnomedical information. The questionnaires focused on three aspects: sociodemographic data (age, gender, level of education, and years of experience); knowledge of prostate diseases (disease name, diagnostic methods, and ethnomedical symptoms); and recommended herbal remedies (vernacular plant names, parts used, preparation methods, and modes of administration).[15] At the end of the survey, based on the vernacular names of plants mentioned by the traditional healers, species herbaria were collected.
Plant identification was performed by botanists from the Guinea Institute for Research and Development of Medicinal and Food Plants (IRDPMAG), where each plant specimen was assigned a voucher number. The botanical families and scientific names of the plants were verified by consulting the website www.worldfloraonline.org.

Literature review
A literature review on the traditional uses, pharmacological activities, and toxicological properties of the collected plant species was conducted in 2024. According to the method described by Tanou Valdez *et al*.[16], this review involved consulting scientific databases such as PubMed, ScienceDirect, and Google Scholar. The scientific name of the plant was used as a search term, combined with "prostate," "anti-inflammatory," or "antioxidant."

Data analysis
The ethno-therapeutic symptoms, according to traditional healers, were examined using simple descriptive statistical methods, including percentages and frequencies, using SPSS Statistics v. 21 (IBM, Armonk, USA). We used Excel 2016 to analyze the ethnobotanical quantitative value indices: Family Use Value (FUV) and Use Value (UV) as described below. The correlation analysis was performed using GraphPad Prism 8 (GraphPad, La Jolla, USA), employing simple linear regression on the tested variables with a 95% confidence interval for the biological activities. The results were reported as IC_{50} values and presented as the mean ± standard deviation, based on four independent experiments.

Use Value (UV)
To evaluate the relative importance of plants in indigenous healthcare systems, UV was used as a micro-statistical tool, which reflects people's interaction with specific plants as the best treatments for prostate diseases. It is a quantitative method that can be used to prove the relative importance of species known locally. It can be calculated according to the following equation:[17]
Equation 1: $UV = \frac{\sum U}{N}$
Where UV is the use value of a species, U is the number of citations per species, and N is the number of informants.

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 taxa and identify the significance of plant families.[18] The following equation was used to calculate.
Equation 2: $FUV = \frac{UVs}{Ns}$
where UVs is the number of informants mentioning the family, and Ns is the total number of species within each family.

Preparation of plant extracts
Plant samples were shade-dried, powdered, and successively extracted with ethyl acetate (Carl Roth, Germany) and methanol (Carl Roth, Germany) at room temperature. To 10 g of powdered dried plant material was added 100 mL of ethyl acetate, which was then stirred for 24 h. This series of actions was carried out 3 times. After filtration, 100 mL of methanol was added to the residual plant material and stirred for 24 h; again, this action was carried out 3 times. A total of 30 samples were tested for their antioxidant and anti-inflammatory activities. Aliquots of 10 mg/mL dissolved in dimethylsulfoxide (DMSO) (Carl Roth, Germany) were then submitted for *in vitro* testing.[13] The *in vitro* assays were conducted from August 1 to October 30, 2024, at the Laboratory of Microbiology, Bioorganic, and Macromolecular Chemistry at the Université Libre de Bruxelles.

Estimation of Total Phenol Content
The total phenolic content of selected extracts was determined by the Folin-Ciocalteu method with a few adjustments.[19] The diluted extract (500 µg/mL, 50 µL) was mixed with Folin-Ciocalteu reagent (Merck, Germany) (0.2 N, 50 µL). This mixture was allowed to stand at room temperature for 5 min, at which point sodium carbonate solution

ISSN 2616-0684 (Print)
ISSN 2616-0692 (Electronic)

(Merck, Germany) (10%, 50 µL) was added. After 1 hour of incubation, absorbances were measured using a UV/Vis spectrophotometer (Agilent BioTek, Epoch 2, USA) at 760 nm. A standard calibration curve was plotted using gallic acid (Merck, Germany) (0-100 µg/mL). The results were expressed as mg of gallic acid equivalents (GAE)/g of extract. All the assays were performed in triplicate.

Free radical scavenging method

The antioxidant effect using the 2,2-diphenyl-1-picrylhydrazyl (DPPH) (Sigma-Aldrich, USA) was assessed according to the procedure described by Sanchez *et al.*[20] with minor modifications. The antioxidant power was determined against a standard of gallic acid (Merck, Germany) (0 to 100 µg/mL). 5 µL of each extract solution (500 µg/mL) was added to 195 µL of a methanolic DPPH solution (25 mg/L). After 60 minutes of incubation in the dark at room temperature, absorbance was measured using a UV/Vis spectrophotometer (Agilent BioTek, Epoch 2, USA) at 517 nm. Results were expressed as a percentage of inhibition (I%) in the following equation:

Equation 3: $I\% = 1 - \left(\frac{\text{Abs test}}{\text{Abs control}}\right) \times 100$

The percentage of inhibition was then expressed as the IC_{50} value, representing the concentration of extract required to achieve 50% of the reduced form of the DPPH radical. All the assays were performed in triplicate.

Iron (III) to iron (II) reduction activity (FRAP)

The total antioxidant capacity of the extract was determined using the iron (III) reduction method with some modifications.[21] The diluted solution of extract (500 µg/mL, 20 µL) was mixed with phosphate buffer (Merck, Germany) (0.2 M, pH 6.6, 50 µL) and 1% aqueous potassium hexacyanoferrate $[K_3Fe(CN)_6]$ (Merck, Germany) solution (50 µL). After 30 min incubation at 50 °C, trichloroacetic acid (Merck, Germany) (10%, 50 µL) was added, and the mixture was centrifuged at 3000 rpm for 10 min. Then, the upper layer solution (50 µL) was mixed with water (50 µL) and an aqueous $FeCl_3$ (Merck, Germany) solution (0.1%, 10 µL). The absorbance was read using a UV/Vis spectrophotometer (Agilent BioTek, Epoch 2, USA) at 700 nm, and gallic acid (0–100 µg/mL) was used to produce the calibration curve. The iron (III) reducing activity determination was expressed as mg of gallic acid equivalents (GAE)/g of extract. All the assays were performed in triplicate.

Evaluation of possible in vitro anti-inflammatory activity

The *in vitro* anti-inflammatory activity was determined using the inhibition of denaturation of bovine serum albumin (BSA) following the method previously reported by Benchika *et al.*[22] with slight modifications. It relied upon the inhibition of the denaturation of BSA caused by heat (72 °C). Briefly, 100 µL of extract (500 µg/mL) or standard diclofenac sodium (Merck, Germany) was added to 100 µL of 0.2% BSA (Sigma-Aldrich, USA) solution prepared in tris-HCl (pH = 6.6). The solutions were incubated at 37 °C for 15 min in an oven, then in a water bath at 72 °C for 5 min. After cooling, the turbidity was measured using a UV/Vis spectrophotometer (Agilent BioTek, Epoch 2, USA) at 660 nm. Different blanks consisted of 100 µL MilliQ water + 100 µL BSA, 100 µL DMSO 5% + 100 µL BSA, 100 µL ethyl acetate + 100 µL BSA, and 100 µL methanol 0.5% + 100 µL BSA. The purpose of these blanks was to subtract the absorbance of the extract from the results obtained. The protective effect of samples against the denaturation of BSA was presented as inhibition percentages calculated using the following equation:

Equation 4: $I\% = \left(\frac{Ac - As}{As}\right) \times 100$

Where I% is the inhibition percentage, Ac is the absorbance of the control, and As is the absorbance of the tested sample. All the assays were performed in triplicate.

Results and Discussion

Ethnobotanical survey

Several local terms for prostate disorders were identified, which varied by locality and language. The terms "*Korossinan*" and "Lakhanfougny" in Soussou, "*Tchouètchouè*" and "Korossinin" in Maninka, referred to conditions like difficult urination or low urine flow. "*Sounakèdjankaro*" and "*Sounafreintè*" in Maninka were used to describe urinary incontinence. In Manon, the condition was called "*Weinkoungue*," meaning men's diseases, and in Guerzé, the term "*Weiaadjongoi*" was used to describe men's urinary tract disease.

Two hundred and seventy-seven (277) traditional healers were interviewed. Our main ethno-medical indicators of prostate diseases were abdominal pain (137/277, 49.5%), difficult urination (137/277, 49.5%), urinary incontinence (130/277, 46.9%), and low urine flow (106/277, 38.3%) (Table 1). These symptoms are consistent with benign prostate disorders described by De la Taille *et al.* and Lebdai *et al.* [23,24]

Fifty-five plant species belonging to 29 botanical families were used to manage prostate disorders. Leaves were the most commonly used plant part for preparing remedies (118/277, 42.5%), followed by roots (94/277, 33.9%) (Table 2). This preference for leaves may be attributed to the ease of harvesting and use by traditional practitioners in the region. These results are similar to those of other studies.[25–27]

The most common preparation method for these plants was decoction (158/277, 58.0%), followed by grinding (76/277, 27.4%) and maceration (46/277, 16.6%) (Table 2). These results are consistent with those of Youssef *et al.*[28] in Morocco, who observed that 31.37% of preparations were made using a decoction. According to Salhi *et al.*[29], decoction may be the best preparation method for obtaining maximum active ingredients. Almost all recipes were administered orally (276/277, 99.6%) (Table 2).

Table 1: Ethno-therapeutic symptoms according to traditional healers

Symptoms	N= 277	Percentages %
Painful ejaculation	78	28.2
Presence of blood in urine and sperm	31	11.2
Backache	16	5.8
Genital itch	6	2.2
Constipation	26	9.4
Urinary incontinence	130	46.9
Urinary retention	48	17.3
Low urine flow	106	38.3
Abdominal pain	137	49.5
Difficulty urinating	137	49.5
Frequent need to urinate	95	34.3

ISSN 2616-0684 (Print)
ISSN 2616-0692 (Electronic)

Table 2: List of plants cited by traditional healers and their botanical indexes

Family	FUV	Scientific names	Used part	Local names	Aministration	Preparation method	Voucher number	FC	UV
Anacardiaceae	0.043	*Spondias mombin* L.	L	Louhouré (S)	O	Ma, I	D3HK3	3	0.011
		Mangifera indica L.	Stb	Mangué khounkhouri (S)	Ba	D	D3HK2	1	0.004
Annonaceae	0.032	*Annona senegalensis* (Pers)	R	Sounsouningbé, Sougni (S)	O	Ma, D	D5HK2	3	0.011
Apocynaceae	0.043	*Landolphia heudelotii* (DC)	L	Foré (S)	O	D	D7HK1	3	0.011
		Landolphia hirsuta (Hua) Pichon	L	Woyényi (S)	O	D	8HK67	1	0.004
Bromeliaceae	0.098	*Ananas comosus* (L.) Merr.	L, F	Djabibi (M), Fougnè (S)	O	D	M146HK1	9	0.032
Caricaceae	0.141	*Carica papaya* L.	L, R, S	Yirigué (M), Fofia (S)	O	Ma, D	D29HK1	13	0.047
Chrysobalanaceae	0.010	*Parinari excelsa* Sabine	L	Sougué (S)	O	D	35HK438	1	0.004
Combretaceae	0.054	*Combretum micrathum* (G.Don)	L, R	Kankilibangni (S)	O	Ma, D	D36HK1	2	0.007
		Terminalia albida Scott Elliot	L, R	Yimbèfihè (S)	O	D	D36HK4	3	0.011
Costaceae	0.011	*Costus afer* Ker Gawl.	L	Sonka (S)	O	Ma, D	141HK718	1	0.004
Dilleniaceae	0.011	*Tetracera potatoria* Afzel. Ex G.Don	L	Gban nana lee (G)	O	D	44HK471	1	0.004
Euphorbiaceae	0.185	*Alchornea cordifolia* (Schumach.) Müll.Arg.	L, Stb	Bolonta (S)	O	D, Ma	D50HK1	6	0.022
		Euphorbia polygalifolia subsp. hirta (Lange) M.Laínz	Wp	Dembasingui (M)	O	Ma, D	52HK498	11	0.040
Fabaceae	0.750	*Detarium microcarpum* Guill. & Perr.	L	Boto (S)	O	I	27HK403	1	0.004
		Afzelia africana Sm.	L, R	Linké (S)	O	Ma, D	D51HK 1	1	0.004
		Cassia sieberiana var. macrocarpa Pellegr.	L, R	Sindjan (M), Gbangba (S)	O	Ma, Gr, D	D25HK4	27	0.097
		Daniellia oliveri (Rolfe) Hutch. & Dalziel	Wp	Sendan doumalo (M)	O	D, Ma	27HK433	2	0.007
		Detarium senegalense J.F.Gmel.	L, Stb, R	Tabaningbadi (M)	O	Ma, D	27HK404	10	0.036
		Erythrina senegalensis (DC)	L, R	Tilimigni (S)	O	Ma, D	D51HK6	2	0.007
		Piliostigma thonningii (Schumach.) Milne-Redh.	L, R	Gnaman (M), Yorogué (S)	O	D, Ma	D51HK 9	5	0.018
		Pterocarpus erinaceus Fern.-Vill.	R	Hari (S)	Ba	D	53HK5115	1	0.004
		Senna occidentalis var. andhrica (P.V.Ramana, J.Swamy & M.Ahmed.) K.W.Jiang	L, R, Stb	Souloukoumolon (M)	O, Ba	Ma, D	27HK430	3	0.011

 ISSN 2616-0684 (Print)
ISSN 2616-0692 (Electronic)

		Tamarindus indica L.	R	Tombé (M), Tombigny (S)	O	Ma, D	D51HK11	1	0.004
		Anonychium africanum (Guill. & Perr.) C.E.Hughes & G.P.Lewis	R	Gbelen (M), timè (S)	O	D, Ma, Gr	86HK597	14	0.051
		Dichrostachys cinerea R.Vig.	R	Santè (S)	O	D	86HK590	2	0.007
Gentianaceae	0.413	*Anthocleista nobilis* G.Don	L, Stb, R	Faritaninyiri (M), Dissawouri(S), Gon yili (G)	O	Ma, D, Gr	D73HK1	38	0.137
Hyperiaceae	0.022	*Harungana madagascariensis* Lam. Ex Poir.	L, R	Soungbalanin yiri (M)	O	Ma, D, Gr	63HK559	2	0.007
Lamiaceae	0.033	*Clerodendrum capitatum* Hook.	L	Karinyi (S)	O	Ma	D66HK2	1	0.004
		Vitex doniana Sweet	R	Foutaitai (S)	O	Gr, D	138HK710	2	0.007
Lythraceae	0.011	*Lawsonia inermis* L.	L	Djebé (M)	O	D	76HK573	1	0.004
Malvaceae	0.054	*Gossypium barbadense* L.	L	Guaissèbali (M), Guèssè (S)	O	D, I	D77HK1	3	0.011
		Ceiba pentandra (L.) Gaertn.	Stb	Codén cobolé (S), Gun yili (G)	Ba	D	D20HK2	2	0.007
Meliaceae	0.054	*Azadirachta indica A.Juss.*	L	Cassia hounhouri (S)	O	D	82HK577	1	0.004
		Khaya senegalensis A.Juss.	L, Stb, S	Djala (M)	O	Ma, D, Gr	D80HK2	4	0.014
Moraceae	0.087	*Ficus sur Forssk.*	L	Hodè (S)	O	D	88HK622	1	0.004
		Milicia excelsa (Welw.) C.C.Berg	L, Stb, R	Simè yélé (S)	O, Ba	D, Ma, I, Gr	52HK496	7	0.025
Myrtaceae	0.011	*Myrthus communus* L.	L	Maleraha (S)	O	D	53HK46	1	0.004
Ochnaceae	0.022	*Ochna schweinfurthiana* F. Hoffm.	R	Konkomananin (M)	O	Gr	96HK630	2	0.007
Passifloraceae	0.033	*Smeathmannia laevigata* Sol. Ex R.Br.	L	Tokhee khalè (S)	O	D	105HK2	3	0.011
Phyllantaceae	0.087	*Bridelia micrantha (Hochst.) Baill.*	R, L	Tolinyi (S)	O	Ma, D	D172HK1	6	0.022
		Hymenocardia acida (Tul)	L	Simbarahambi (S)	O	D	D172HK2	1	0.004
		Uapaca heudelotii Baill.	L	Wadossomo (M)	O	D	D172HK4	1	0.004
Plantaginaceae	0.033	*Scoparia dulcis* L.	L	Séréré (S)	O	D	127HK691	3	0.011
Rubiaceae	0.674	*Citrus limon (L.) Osbeck*	R, F	Lemounounkoumoun (M),	O	D	D118HK3	12	0.043
		Crossopteryx febrifuga (Afzel. Ex G.Don) Benth.	L	Tientien (M)	O	D	121HK74	28	0.101

 ISSN 2616-0684 (Print)
ISSN 2616-0692 (Electronic)

		Sarcocephalus esculentus Afzel. Ex Sabine	L, Stb, R	Doundèhè (S), badi (M)	O	Ma, D	D117HK3	22	0.079
Rutaceae	0.261	*Citrus medica* f. aurantifolia (Christm.) M.Hiroe	L, F, R	Moulouhougny (S)	O	D, Ma, I	D118HK2	14	0.051
		Fagara leprieurii Engl.	R	Kankai (S)	O	D, Ma, I, G	121HK82	9	0.032
		Gardenia erubescens Stapf & Hutch.	R	Tanhè (S)	Ba	Ma	121HK69	1	0.004
Sapindaceae	0.011	*Paullinia pinnata* (L.)	L	Bèlèhè soulé souli (S)	O	D	D121HK	1	0.004
Simaroubaceae	0.109	*Hannoa undulata* (Guill. & Perr.) Planch.	R	Djéfelékétai (M)	O	Ma, D	D124HK2	10	0.036
Solanaceae	0.011	*Dialium guineense* Willd.	L	Moquè (S)	O	Ma	D51HK4	1	0.004
Zingiberaceae	0.120	*Aframomum melegueta* K.Schum.	L, Stb	Duandy (G), Gogoe (S)	O	D, Gr	M171HK1	3	0.011
		Zingiber officinale Roscoe	R	Gnamankoun (M), Gnokhomy (S)	O	D	D171HK3	9	0.032

ISSN 2616-0684 (Print)
ISSN 2616-0692 (Electronic)

Based on the FUV index, Fabaceae (FUV = 0.750), Rubiaceae (FUV = 0.674), Gentianaceae (FUV = 0.413), and Rutaceae (FUV = 0.261) were found to be the most important families of plants (Table 2). According to Tanou Valdez *et al.*[16], the dominance of these plant families can be attributed to their wide distribution in Guinea, where ecological factors favor the growth of species in these families. Additionally, most nationwide surveys suggest that Guinean healers extensively use these plant families in the treatment of various diseases.[15,25,30]

Anthocleista nobilis G.Don (UV = 0.137), *Crossopteryx febrifuga* (Afzel. Ex. G.Don) Benth. (UV = 0.101), *Cassia sieberiana* var. macrocarpa Pellegr. (UV = 0.097), and *Sarcocephalus esculentus* Afzel. Ex Sabine (UV = 0.079) exhibited the highest use value index in our survey (Table 2). These four plants are well-referenced in the African literature for their use in different pathologies. For example, *A. nobilis* is traditionally used in Guinea to manage non-communicable diseases.[31] It is also used for its antimicrobial and antifungal properties in diseases in Nigeria.[32] *S. esculentus* is widely used in traditional medicine to treat a variety of diseases, including infectious diseases, colic, and dysentery in Benin,[33] as well as malaria and liver diseases in Guinea and Mali.[30,34] Ngaha *et al.*[35] showed that *S. latifolius* at 200-400 mg/kg increased sperm count in the testes and epididymis and significantly improved sperm motility and morphology. Chika *et al.*[36] showed that *C. sieberiana* is one of the most widely used plants for the treatment of benign prostatic hypertrophy in Nigeria, while earlier studies showed that *C. sieberiana* is traditionally used against viral diseases.[25,37,38] This new documentation from our study significantly enhances the existing ethnobotanical knowledge of the traditional use of medicinal plants in Guinea.

Biological activities

Prostate disorders, including those that can progress to prostate cancer, are often linked to inflammatory processes.[12] The plant species were selected based on a literature review focusing on their anti-inflammatory and cytotoxic activities.

Thus, 30 extracts representing 15 plant species were tested for their antioxidant and anti-inflammatory activities and polyphenol content (Tables 3 and 4). The highest polyphenol content was measured in the *A. cordifolia* methanol extract (335.7 ± 19.3 mg EAG/g), (IC_{50}DPPH = 82.8%), (FRAP = 215.9 ± 21.5 mg EAG/g), and (IC_{50} BSA = 0%) (Tables 3 and 4). Based on previous research, *A. cordifolia* DPPH values recorded at concentrations of 50, 100, 150, 200, and 250 µg/mL were 8.46±2.05%, 14.90±4.50%, 25.20±2.50%, 36.41±3.05%, and 45.89±3.40%, respectively.[39] Ajibade and Olayemi[40] showed that the polyphenol-rich fraction of *A. cordifolia* is protective against sodium arsenite-induced infertility in male rats through the inhibition of oxidative and apoptotic mechanisms. *A cordifolia* contains compounds that may account for its use in folk medicine to treat inflammation.[41]

Khaya senegalensis A.Juss. (82.3%), *Alchornea cordifolia* (Schumach.) Müll.Arg. (82.8%), *Anonychium africanum* (Guill. & Perr.) (72.5%), *Lawsonia inermis* L. (63.9%), and *Cassia sieberiana* D. C. (58.7%) showed a high capacity to scavenge free radicals at 500 µg/mL. Additionally, these plants showed notable metal-reducing activity at concentrations ≥ 80 mg EAG/g. Previous research reported the capacity to scavenge free radicals of *K. senegalensis* as 68.17%, 66.47%, 67.23%, and 58.38% for water, ethanol, ethyl acetate, and petroleum ether, respectively.[42] These antioxidant activities appear to be related to the high polyphenol content of these extracts ($R^2 = 0.81$; $p < 0.0001$) and $R^2 = 0.73$; $p < 0.0001$, respectively (Figure 2). This could explain the use of these plant species in the treatment of prostate disorders by traditional healers. Well-pronounced correlations were observed between polyphenol content and antioxidant activities: $R^2 = 0.82$ and $R^2 = 0.96$ for DPPH and FRAP, respectively.[19] The crude extracts of *K. senegalensis* showed strong anti-inflammatory activity (500 µg/mL, inhibition = 78. 02±0.23%) through the inhibition of protein denaturation.[43] According to Aodongu *et al.*[44], the anti-inflammatory activity is mainly attributed to the polyphenol content. However, our data show that *K. senegalensis* extracts are rich in polyphenols and display strong antioxidant activity, but their anti-inflammatory activity is limited (5%) (Table 4). Zhou *et al.*[45] reported that the anti-inflammatory activity of *K. senegalensis* is due to a limonoid compound (khayandirobilide A).

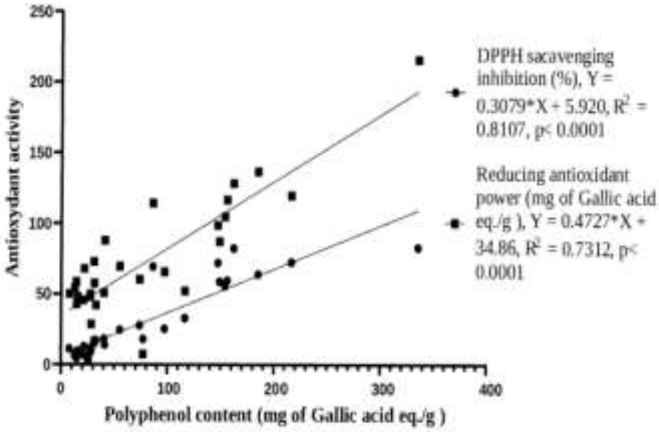

Figure 2: Correlation of Polyphenol content and antioxidant activity

Azadirachta indica A.Juss. (77.9%), *Paullinia pinnata* (L.) (77.3%), *Tamarindus indica* L. (74.1%), *Milicia excelsa* (Welw.) C.C.Berg (69.9%), *Harungana madagascariensis* Lam. Ex Poir. (66.7%), *Carica papaya* L. (61.5%), *Bridelia micrantha* (Hochst.) Baill. (61.3%), and *Hannoa undulata* (Guill. & Perr.) Planch. (60.7%) exhibited significant anti-inflammatory potential by inhibiting bovine serum albumin (BSA) denaturation. This inhibitory effect approached the potency of diclofenac, which achieved over 80% inhibition in the assay (Table 4). The BSA assay is a widely accepted *in vitro* method for evaluating the anti-inflammatory properties of various products. Denatured proteins were generated using BSA at pH 6.8. The anti-inflammatory potential of the extract was determined by adding the plant extract to BSA, which was induced to undergo denaturation (inflammation). The inhibition of protein denaturation by the plant extract indicates its potential anti-inflammatory property. Thus, the higher the degree of inhibition, the higher the potential for anti-inflammatory activity.[46] However, this study suggests that the anti-inflammatory activity of these plants is not linked to the presence of phenolic compounds ($R^2 = 0.2734$; $p = 0.0073$) (Figure 3). This could be attributed to the presence of organic compounds other than phenolic compounds in the extracts. These include azadirachtin, nimbin, nimbolide, nimbidol, gedunin, tannin, quercetin, vitamins, antioxidants, minerals, and amino acids.[47] Based on previous studies, the hydroethanolic extracts of *P. pinnata* at 200 mg/kg and 400 mg/kg showed local anti-inflammatory and anticancer potential by reducing tumor volume in mice.[48] Lamien-Meda *et al.*[19] showed that *Tamarindus indica* possesses high phenolic contents (957.33 ± 13.20 mg GAE/100 g of fruit) responsible for the antioxidant activity. The flowers of *Carica papaya* exhibited moderate antioxidant activity through free radical scavenging (inhibition = 7.62%).[49] They also showed significant inhibitory effects on 5α-reductase (79.36–115.18 mg/g extract equivalent to dutasteride), highlighting their potential therapeutic applications.[49] *B. micrantha* is cited in our survey for the management of prostate disorders. These results align with those of Munayi[50] who reported anticancer activity against leukemia cell lines with an IC_{50} value of 9.43 µg/mL.

This study suggests that extracts with anti-denaturation activities could be a source of promising drugs for treating inflammation and cancer. To the best of our knowledge, this study is the first to investigate the antioxidant and anti-inflammatory activities of Guinean plants through free radical scavenging, iron (III) to iron (II) reduction, and the inhibition of bovine serum albumin denaturation.

Given that the assays were performed using only one concentration (500 µg/mL), the findings remain limited for precisely evaluating the *in vivo* biological activity of these plant extracts.

ISSN 2616-0684 (Print)
ISSN 2616-0692 (Electronic)

Table 3: Antioxidant activity, and polyphenol content of plant extracts

Plant species 500 µg/mL	**Used Part**	**DPPH (IC_{50}) %**		**FRAP mg EAG/g ± SD**		**Poly mg EAG/g ± SD**	
		Ethyle acetate	Methanol	Ethyle acetate	Methanol	Ethyle acetate	Methanol
Alchornea cordifolia (Schumach.) Müll.Arg.	**L**	55.5	82.8	104.7 ± 11	215.9 ± 21.5	154.2 ± 13.6	335.7 ± 19.3
Ananas comosus (L.) Merr.	L	4.4	6.8	42.6 ± 18.5	45.6 ± 22.9	14.7 ± 1.2	21 ± 1.2
Anonychium africanum (Guill. & Perr.)	L	27.8	72.5	60.3 ± 9.5	119.8 ± 26.4	73.8 ± 3.7	216.6 ± 13
Bridelia micrantha (Hochst.) Baill.	L	11.1	17.3	50 ± 6.3	57.5 ± 62.9	7.9 ± 1.4	31.3 ± 1.6
Carica papaya L.	L	9.7	9.6	47.9 ± 9.1	28.6 ± 6.6	15.6 ± 0.4	28.4 ± 1.7
Cassia sieberiana D.C	L	18.2	58.7	50.7 ± 16	87.2 ± 5.7	40.3 ± 1.4	149 ± 3.9
Hannoa undulata (Guill. & Perr.) Planch.	L	13.9	24.5	87.8 ± 43	69.6 ± 19.8	41.1 ± 2.4	55.3 ± 1.6
Khaya senegalensis A.Juss.	L	72	82.3	98.7 ± 17.4	128.3 ± 26.5	147.4 ± 36.4	162.2 ± 13.5
Lawsonia inermis L.	R	59.6	63.9	116.6 ±14.8	136.7 ± 31.7	156.2 ± 7.7	185.2 ± 8.3
Paullinia pinnata (L.)	L	8.3	32.3	80.8 ± 45.1	114.2 ± 21.9	14.4 ± 0.9	86.3 ± 3.2
Milicia excelsa (Welw.) C.C.Berg	L	4.4	18	8.1 ± 6.4	7.4 ± 5.6	25.7 ± 0.8	77.2 ± 20.5
Myrthus communus L.	L	25.3	32.9	65.6 ± 26.4	52.2 ± 4.1	97.2 ± 10.3	116.4 ± 6.1
Tamarindus indica L.	L	11.1	69.3	49.8 ± 5.1	42.1 ± 27.4	27.6 ± 0.7	32.8 ± 3.4
Tapinanthus dodonaeifolius (DC.) Danser	L	12.7	14.7	67.8 ± 7.1	72.8 ± 17.9	21.8 ± 0.2	31 ± 0.8
Azadirachta indica A.Juss.	L	6.2	8.1	54 ± 19.3	47.9 ± 9.8	12.9 ± 0.4	27.2 ± 4.2
Harungana madagascariensis Lam. Ex Poir.	L	41	20.3	58.5 ± 16.5	82.1 ±17.2	71 ± 1.5	194.6 ± 1.8
Gallic acid 50 µg/mL		73.2		726.2		0	
Cafeic acid 50 µg/mL		0		0		1143.3 ± 30	

•Abbreviations • Poly: polyphenol; EAG/g: gallic acid equivalent; SD: standard deviation.

ISSN 2616-0684 (Print)
ISSN 2616-0692 (Electronic)

Table 4: Anti-inflammatory Activity of Plant Extracts

Plant species 500 µg/mL	Used Part	BSA (IC_{50}) %		Plant species 500 µg/mL	Used Part	BSA (IC_{50}) %	
		Ethyle acetate	Methanol			Ethyle acetate	Methanol
Alchornea cordifolia (Schumach.) Müll.Arg.	L	0	0	*Ananas comosus* (L.) Merr.	L	38.3	48.9
Anonychium africanum (Guill. & Perr.)	L	0	0	*Azadirachta indica A.Juss.*	L	39	77.9
Bridelia micrantha (Hochst.) Baill.	L	0	61.3	*Carica papaya* L.	L	43.9	61.5
Cassia sieberiana D.C	L	41.9	0	*Hannoa undulata* (Guill. & Perr.) Planch.	L	0	60.7
Harungana madagascariensis Lam. Ex Poir.	L	66.7	4.7	*Khaya senegalensis* A.Juss.	L	5	5.1
Lawsonia inermis L.	R	0	0	*Milicia excelsa* (Welw.) C.C.Berg	L	69.9	25
Myrthus communus L.	L	27.7	33.3	*Paullinia pinnata* (L.)	L	36.3	77.3
Tamarindus indica L.	L	0	74.1				
Diclofenac 50 µg/mL	84.1						

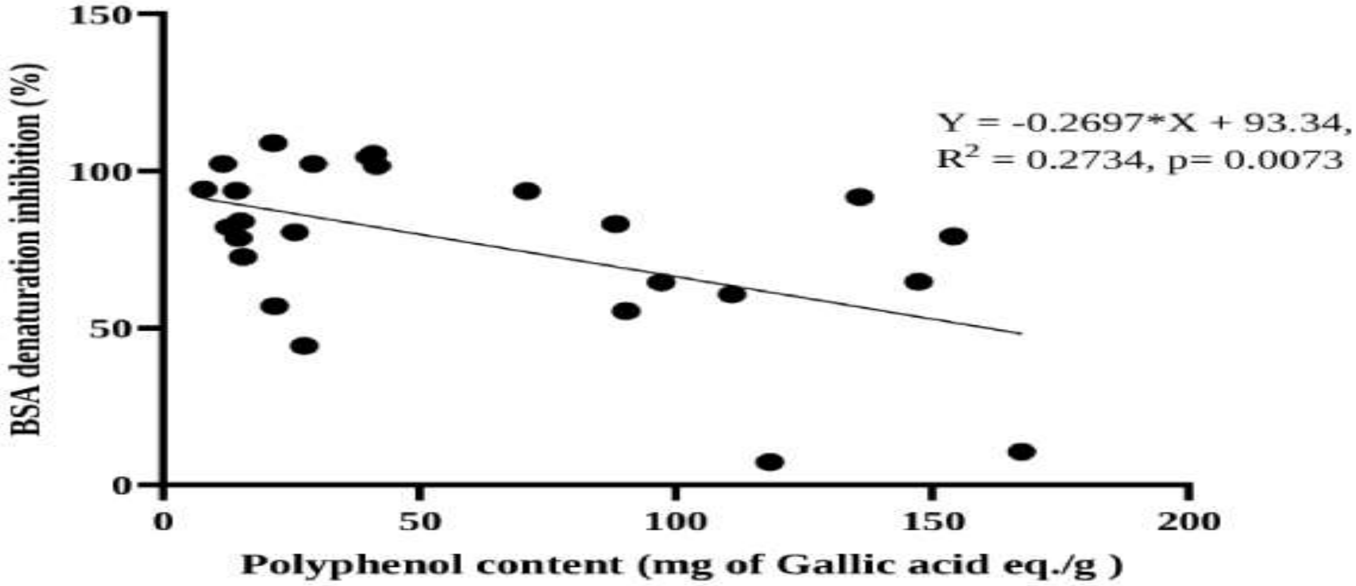

Figure 3: Correlation of polyphenol content and ant-inflammatory activity

 ISSN 2616-0684 (Print)
ISSN 2616-0692 (Electronic)

Conclusion

This study provides a comprehensive overview of Guinean medicinal plants used in traditional medicine for the treatment of prostate diseases. Some studied plant species showed promising antioxidant and anti-inflammatory activities, supporting their traditional use. These findings suggest that compounds other than polyphenols may contribute to anti-inflammatory activity. Further research should focus on two main directions: (1) assessing the anti-inflammatory activity of plants with a high percentage of BSA denaturation inhibition on RAW 264.7 macrophages, and (2) investigating their anticancer potential against prostate cancer cell lines DU145 and PC3, as well as the underlying mechanisms of action.

Conflict of Interest

The authors declare no conflict of interest.

Authors' Declaration

The authors hereby declare that the work presented in this article is original and that any liability for claims relating to the content of this article will be borne by them.

Acknowledgements

The Guinea Institute for Research and Development of Medicinal and Food Plants is kindly acknowledged for providing a PhD mobility fellowship to Tanou Valdez BAH.

References

1. Yebes A, Toribio-Vazquez C, Martinez-Perez S, Quesada-Olarte JM, Rodriguez-Serrano A, Álvarez-Maestro M, Martinez-Piñeiro L. Prostatitis: A Review. Curr Urol Rep. 2023; 24(5): 241–251.
2. Schalken JA. Inflammation in the Pathophysiology of Benign Prostatic Hypertrophy. Eur Urol Suppl. 2015; 14(9): 1455–1458.
3. Ferlay J, Colombet M, Soerjomataram I, Parkin DM, Piñeros M, Znaor A, Bray F. Cancer statistics for the year 2020: An overview. Int J Cancer. 2021; 149(4): 778–789.
4. GNA. KBTH records over 1, 000 cases of prostate cancer in 2020 | Ghana News Agency. [Online]. 2021 [cited 2025 Feb 2]. Available from: https://gna.org.gh/2021/11/kbth-records-over-1-000-cases-of-prostate-cancer-in-2020/
5. Tengue K, Kpatcha TM, Botcho G, Leloua E, Amavi AK, Sikpa K, Sewa E, Anoukoum T, Amegbor K, Dosseh E. Epidemiological, diagnostic, therapeutic, and prognostic profile of prostate cancer in Togo. Afr J Urol. 2016; 22(2) :76–82.
6. Bobo Diallo A, Bah I, Diallo TMO, Bah OR, Amougou B, Bah MD, Guirassy S, Bobo Diallo M. The profile of urological emergencies at the University Hospital of Conakry, Guinea. Prog En Urol. 2010; 20(3): 214–218.
7. Baboudjian M, Pradere B. Management of BPH in outpatient consultation: an update on new minimally invasive therapies. Prog En Urol. 2021; 31(14) :931–936.
8. Vouga L, Benamran D, Iselin CE. Drug treatment of male urinary disorders: essentials for the general practitioner. Rev Médicale Suisse. 2017; 13(585): 2069–2073.
9. Traore MS, Camara A, Balde MA, Diallo MSt, Barry NS, Balde ES, Balde AM. Ethnobotanical survey of medicinal plants used to manage hypertension in the Republic of Guinea. J Pharm Pharmacogn Res. 2022; 10(5):938–951.
10. Siti IM, Sri RL, Sineenat S, Moch Y, Alif RE, Dewi SM, Muhaimin R, Warsito, Muhammad SD. Phytochemical screening and antioxidant potential of ethanol extract from *Piper crocatum* Leaves. Trop J Nat Prod Res. 2025; 7(9): 3114–3119.
11. Kobangue L, Mozouloua D. The Decade of Traditional Medicine: Progress and Perspectives. Conference–Debate, 8th African Congress on Traditional Medicine, Central African Republic; 2010. 5P.
12. Binsaleh NK, Sherwani S, Eltayeb R, Qanash H, Bazaid AS, Althobiti M, Hazzazi MS, Rajendrasozhan S. Increased inflammatory cytokines and oxidative stress enhanced antibody production in breast and prostate cancer patients with COVID-19 related depression. Front Chem. 2023; 20(11): 1192074
13. Baldé MA, Tuenter E, Traoré MS, Matheeussen A, Cos P, Maes L, Camara A, Haba NL, Gomou K, Diallo MST, Baldé ES, Pieters L, Balde AM, Foubert K. Antimicrobial investigation of ethnobotanically selected guinean plant species. J Ethnopharmacol. 2020; 263: 113232.
14. World Medical Association. Declaration of Helsinki. [Online]. 2008 [cited 2024 Jan 27]. Available from: https://www.wma.net/what-we-do/medical-ethics/declaration-of-helsinki/doh-oct2008/
15. Balde ES, Traoré MS, Balde MA, Baldé AO, Bah F, Camara AK, Kéita SM, Baldé AM. Traditional Guinean management of breast diseases in low and Middle Guinea. J Herb Med. 2022; 31: 100520.
16. Tanou Valdez B, Mory G, Aboubacar Kadiatou C, Salifou Talasson B, Mohamed Kerfala C, Séré D, Mohamed Sahar T, Elhadj Saidou B. Ethnobotanical survey of medicinal plants used to treat icterus in Labé administrative district (Republic of Guinea). J King Saud Univ - Sci. 2024; 36(9): 103350.
17. Jaradat NA, Zaid AN, Al-Ramahi R, Alqub MA, Hussein F, Hamdan Z, Mustafa M, Qneibi M, Ali I. Ethnopharmacological survey of medicinal plants practiced by traditional healers and herbalists for treatment of some urological diseases in the West Bank/Palestine. BMC Complement Altern Med. 2017; 17(1): 255.
18. Chaachouay N, Benkhnigue O, Fadli M, Ibaoui HE, Zidane L. Ethnobotanical and ethnopharmacological studies of medicinal and aromatic plants used in the treatment of metabolic diseases in the Moroccan Rif. Heliyon. 2019; 5(10): 02191
19. Lamien-Meda A, Lamien CE, Compaoré MMY, Meda RNT, Kiendrebeogo M, Zeba B, Millogo JF, Nacoulma OG. Polyphenol content and antioxidant activity of fourteen wild edible fruits from Burkina Faso. Mol Basel Switz. 2008; 13(3): 581–594.
20. Sánchez-Moreno C, Larrauri JA, Saura-Calixto F. A procedure to measure the antiradical efficiency of polyphenols. J Sci Food Agric. 1998; 76(2): 270–276.
21. Karagözler AA, Erdağ B, Emek YÇ, Uygun DA. Antioxidant activity and proline content of leaf extracts from Dorystoechas hastata. Food Chem. 2008; 111(2): 400–407.
22. Benchikha N, Messaoudi M, Larkem I, Ouakouak H, Rebiai A, Boubekeur S, Ferhat MA, Benarfa A, Begaa S, Benmohamed M, Almasri DM, Hareeri RH, Youssef FS. Evaluation of possible antioxidant, anti-hyperglycaemic, anti-Alzheimer and anti-inflammatory effects of *Teucrium polium* aerial parts (Lamiaceae). Life. 2022; 12(10): 1579.
23. De La Taille A, Bardin L, Castagné C, Auges M, Capronnier O, Chalret Du Rieu Q. Alpha-blockers or phytotherapy as first-line treatment of LUTS/BPH in general practice: the non-interventional PERSAT study. Prog En Urol. 2020; 30(10): 522–531.

 ISSN 2616-0684 (Print)
ISSN 2616-0692 (Electronic)

24. Lebdai S, Descazeaud A. Management of lower urinary tract symptoms related to benign prostatic hyperplasia. Prog En Urol. 2014; 24(14): 929–933.
25. Goumou K, Haba NL, Traoré MS, Bah F, Balde MA. Ethnobotanic survey on the use of medicinal plants in the traditional treatment of dermatosis in Guinea. Pharmacopée Médecine Tradit Afr. 2022; 21(1): 50–65.
26. Katemo M, Mpiana PT, Mbala BM, Mihigo SO, Ngbolua KN, Tshibangu DST, Koyange PR. Ethnopharmacological survey of plants used against diabetes in Kisangani City (DR Congo). J Ethnopharmacol. 2012; 144(1): 39–43.
27. Traoré MS, Diallo MST, Bah TV, Camara AK, Baldé MA, Camara T, Camara A, Diane S, Guilavogui M, Sacko S, Balde AM. Plants traditionally used to manage malaria in the Guinean prefecture of Macenta: An Ethnobotanical Survey. 2022; 7(3): 33-50.
28. Youssef EA, El-Mehdi EA, Mahraz MA, Amine MI, Fatima M, Mouna EK, Sara B, Eloutassi N, Amin L, Amal L. Ethnobotanical and ethnopharmacological studies of medicinal plants in the southern mediterranean: Tangier-Tétouan Region, northern Morocco. Trop J Nat Prod Res. 2025; 9(3): 1039–1057.
29. Salhi S, Fadli M, Zidane L, Douira A. Floristic and ethnobotanical studies of medicinal plants in the city of Kénitra (Morocco). Lazaroa. 2011; 31: 133-146.
30. Haba NL, Goumou K, Camara A, Traoré MS, Balde ES, Balde AM. Contribution to the knowledge of medicinal plants used in the traditional treatment of malaria in forest Guinea. Pharmacopée Médecine Tradit Afr. 2022; 21(1): 78–88.
31. Diallo A, Traore MS, Keita SM, Balde MA, Keita A, Camara M, Miert SV, Pieters L, Balde AM. Management of diabetes in Guinean traditional medicine: An ethnobotanical investigation in the coastal lowlands. J Ethnopharmacol. 2012; 144(2): 353–361.
32. Esimone CO, Ikegbunam MN, Anagu LO, Nwakile CD, Afunwa R. Antimicrobial activity of selected medicinal plants of south-eastern Nigeria on *Pseudomonas* species expressing extended spectrum beta-lactamase (ESBL). Eur. J. Med. Plants. 2014;4(11):1367–1377.
33. Chabi-Sika K, Mama-Sirou I, Sina H, Boya B, Roko G, Kpangon L, Salami HA, Amogou O, Dah-Nouvlessounon D, Tohoyessou MG, Baba-Moussa L. Ethnobotanical survey on *Sarcocephalus latifolius* Smith and antioxidant activity of its root extracts. Res J Phytochem. 2023; 17(1): 11–18.
34. Haidara M, Bourdy G, De Tommasi N, Braca A, Traore K, Giani S, Sanogo R. Medicinal Plants Used in Mali for the treatment of malaria and liver diseases. Nat Prod Commun. 2016;11(3): 339-352.
35. Ngaha Njila MI, Massoma Lembè D, Koloko BL, Yong Meng G, Ebrahimi M, Awad EA, Hasan Baiee F, Kenmogne H, Hambe M, Mandenguè SH. Sperm parameters quality and reproductive effects of methanolic extract of *Alchornea cordifolia* leaves on senescent male rats. Andrologia. 2019; 51(9): 13359.
36. Chika A, Bello S, Yunusa A, Yahaya A, Sadiq A. Ethnobotanical survey of medicinal plants used as remedies for benign prostatic hyperplasia in Sokoto North Western Nigeria. Natl J Physiol Pharm Pharmacol. 2022; 12(4): 511-518.
37. Kpodar MS, Karou SD, Katawa G, Anani K, Gbekley HE, Adjrah Y, Tchacondo T, Batawila K, Simpore J. An ethnobotanical study of plants used to treat liver diseases in the maritime region of Togo. J Ethnopharmacol. 2016; 181: 263–273.
38. Zongo E, Nâg-Tiero R, Roland M, Sami Eric K, Koama K, Ouoba H, Ouedraogo G. Ethnobotanical study of medicinal plants used for viral hepatitis treatement hauts-bassins areas of Burkina Faso. 2021; 10(3): 76-92.
39. Banso A, Dachi S, Usman J, Ajewole A, Nma E. Assessment of bioactive phytochemical and free radical scavenging analysis of leaf extract of *Alchornea cordifolia* (Schumach & Thonn) Mull. Arg. Pharma Innov. 2024; 13(4): 20–25.
40. Ajibade TO, Olayemi FO. Polyphenol-rich fraction of *Alchornea cordifolia* leaf ameliorates arsenite-induced infertility in male rats. Andrologia. 2020; 52(10): 13754.
41. Mavar-Manga H, Haddad M, Pieters L, Baccelli C, Penge A, Quetin-Leclercq J. Anti-inflammatory compounds from leaves and root bark of *Alchornea cordifolia* (Schumach. & Thonn.) Müll. Arg. J Ethnopharmacol. 2008; 115(1): 25–29.
42. Gunda HJ. Cytotoxicity and antioxidant evaluation of *Khaya senegalensis* Stems Bark. Int J Innovative Med & Med Plants Res. 2021; 3(9): 1–6.
43. John JA, Bulama GH. The in vitro anti-inflammatory and anti haemolytique activity of the stem bark methanol extract of *Kaya senegalensis*. World J Pharm Res. 2022; 9(6): 2242-2254.
44. Aondongu Tyoapine D, Victory PC, Yusuf A, Badamasi AM. A Review of the Phytochemistry and Pharmacology of the Medicinal Plant: Khaya Senegalensis (Desr.) A. Juss. Int J Res Publ Rev. 2022; 3(8): 1239–1246.
45. Zhou MM, Zhang WY, Li RJ, Guo C, Wei SS, Tian XM, Luo J, Kong LY. Anti-inflammatory activity of Khayandirobilide A from Khaya senegalensis via NF-κB, AP-1 and p38 MAPK/Nrf2/HO-1 signaling pathways in lipopolysaccharide-stimulated RAW 264.7 and BV-2 cells. Phytomedicine Int J Phytother Phytopharm. 2018; 15(42): 152–163.
46. Ashwini T, Elizabeth AA, Aishwarya S, Josephine IG, Brigida S, Srinivasan R. *Sinapis arvensis*-Wild Mustard as an anti-inflammatory Agent: An *in vitro* Study. J Clin Diagn Res. 2022; 16(12) : 06 - 08.
47. Banerjee K, Chatterjee M, Sandur V R, Nachimuthu R, Madhyastha H, Thiagarajan P. *Azadirachta indica* A. Juss (Neem) oil topical formulation with liquid crystals ensconcing depot water for anti-inflammatory, wound healing and anti-methicillin resistant *Staphylococcus aureus* activities. J Drug Deliv Sci Technol. 2021; 64: 102563.
48. Kola P, Manjula SN, Metowogo K, Madhunapantula SV, Eklu-Gadegbeku K. Four Togolese plant species exhibiting cytotoxicity and antitumor activities lightning polytherapy approach in cancer treatment. Heliyon. 2023; 9(3): 13869.
49. Manalo-Cabalinan RAM, Torre GLTD, Atienza AA, Arollado EC. *Carica papaya* flower extracts possess antioxidant and 5α-reductase inhibitory activities. Acta Med Philipp. 2023; 58(19): 83-92.
50. Munayi RR. Phytochemical investigation of *Bridelia micrantha* and *Tabernaemontana ventircosa* for cytotoxic principles against drug sensitive leukemia cell Lines. (Thesis). Kenya: University of Nairobi; 2016. 116P.