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BIOEFFICACY AND BIOSAFETY OF HYDRO-ETHANOLIC *BURKEA AFRICANA* HOOK EXTRACTS

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ABSTRACT: Introduction: *Burkea africana* Hook, a medicinal plant in the family Fabaceae, subfamily Caesalpinioideae, is a medium-sized, woody, deciduous tree widely used in traditional medicine. It is used to treat conditions such as pain, inflammation, bacterial infections, gastrointestinal disorders, and reproductive problems. Despite its extensive traditional use, there is limited scientific evidence supporting these applications. This study aims to investigate the bioactive metabolites in its bark extracts, evaluate its anti-inflammatory properties and assess biosafety. **Methods:** The hydro-ethanolic extract of *Burkea africana* Hook was obtained by macerating the plant powder in a 70% alcohol-30% distilled water solvent mixture. Phytochemical analysis was conducted to screen the extracts for bioactive phytoconstituents. The anti-inflammatory activity was evaluated using the egg albumin test. Acute oral toxicity was conducted following guidance from the OECD 425 to determine the extracts' biosafety. **Results:** Metabolomic analysis confirmed the presence of medically relevant bioactive phytoconstituents, including flavonoids, tannins, glycosides, alkaloids, and saponins. The extracts exhibited an extraordinary anti-inflammatory effect, as confirmed by the protein denaturation test. At high doses, their anti-inflammatory activity was comparable to the pure reference NSAID Diclofenac, with 80% inhibition at 1000 micrograms per milliliter, while Diclofenac's was 83% in the same dose range. *In-vivo* acute oral toxicity evaluation in accordance with OECD 425 confirmed that the extracts were safe, with an LD50 greater than 5000 mg/kg. The extracts showed no visible signs of toxicity or mortality in the animal models, confirming their biosafety. **Conclusion:** Bark extracts of *Burkea africana* Hook demonstrate safety and anti-inflammatory effects that can be applied in inflammatory disease management.

INTRODUCTION: *Burkea africana* Hook., commonly known as the wild syringa, is a flat-topped deciduous tree in the Fabaceae family. The genus *Burkea* is monotypic, comprising only *Burkea africana*, and is indigenous to sub-Saharan Africa.

It is widely distributed throughout the savanna woodlands of West, Central, East, and Southern Africa, including Nigeria, Ghana, Cameroon, Zambia, Zimbabwe, and South Africa ¹. This species was first described by the botanist William Jackson Hooker, and it derives its abbreviation, Hook, from this British botanist ².

This plant species has extensive medicinal uses, especially in African communities, but lacks robust scientific evidence regarding biosafety and bioefficacy. The present study aims to establish the plant's safety profile and bioactivity to support observed medicinal applications and to inform further drug development research.

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Traditional uses of *Burkea africana* Hook:

Burkea africana Hook holds high value in traditional medicine, mainly for its bark, which is rich in bioactive compounds. Prepared as decoctions and extracts, the bark is used as a natural pain reliever for headaches and systemic pain. It also exhibits notable anti-inflammatory effects and potent antibacterial activity, supporting its traditional role in treating skin infections³. The plant extract from its stem bark has been studied and confirmed to exhibit antiplasmodial activity and is used to manage the tropical disease malaria in the north-central and southern parts of Nigeria⁴. The ethanolic stem bark extracts of *Burkea africana* Hook have been investigated and shown to induce apoptosis, warranting further research to manage conditions such as benign and malignant tumors⁵. The roots of *B. africana* Hook plant species play a crucial role medically in the communities of Burkina Faso, as it is popularly known for its application in treating hernia and other abdominal conditions⁶. These ethnobotanical uses underscore *Burkea africana*'s pharmacological potential and warrant further biomedical research.

Primary Plant Metabolites: Primary metabolites are compounds produced by plants that are crucial for their growth, development, and survival. They play key roles in various physiological processes, including protein synthesis, photosynthesis, cellular respiration, and energy metabolism. These metabolites are classified into several groups, including amino acids, nucleic acids, carbohydrates, proteins, and lipids⁷. In medicinal plants, primary metabolites serve as building blocks for secondary metabolites. For example, carbohydrates and amino acids are important in pathways that produce phenolic compounds and alkaloids. Phenolic compounds and alkaloids are secondary plant metabolites⁸.

Secondary Plant Metabolites: Plant secondary metabolites are bioactive compounds that facilitate environmental adaptation, defense and survival. These compounds drive the therapeutic and pharmacological efficacy of medicinal plants. However, their biosynthesis is highly variable and regulated by environmental stressors, including climate, soil quality, and pathogen exposure⁸. Medicinal plants owe their diverse therapeutic efficacy, including biological activities

such as antimicrobial, antifungal, antitumor, analgesic, antimalarial and antidiabetic activities, to specific classes of secondary metabolites. The primary compounds driving these pharmacological properties include flavonoids, tannins, saponins, polyphenols, terpenoids, glycosides, and alkaloids⁹. As the primary class of plant phenolic compounds, flavonoids protect tissues by shielding them from harmful ultraviolet radiation. Additionally, they regulate floral pigmentation, which serves the critical ecological function of attracting pollinators and facilitating seed dispersal¹⁰.

Tannins are categorized into condensed or hydrolyzable forms and are concentrated primarily within the fruits, roots, leaves, and bark of medicinal plants. They serve a vital protective role against microbial infections and herbivorous predation, deterring animals *via* an unpalatable, highly astringent taste¹¹. Tannins impart anti-inflammatory, antioxidant, antiviral, antimicrobial and wound-healing properties to medicinal plants, while their demonstrated antiproliferative activity against tumor cells underscores their significant potential in cancer therapy¹². Saponins are triterpene or steroid glycosides identified by their unique soap-like foaming properties. They serve as a natural plant defense against herbivores and microbial or fungal pathogens. Pharmacologically, saponins exhibit potent cholesterol-reducing, antidiabetic, anticancer, and anti-inflammatory activities¹³. Pharmacologically, certain saponins modulate immune function to regulate allergen-induced responses, while others exert antidiabetic effects by acting as insulin secretagogues and enhancing tissue glucose utilization¹⁴.

Polyphenols are an important group of secondary metabolites that possess potent antioxidant properties that mitigate oxidative stress in cells and tissues. This mechanism is critical for preventing and managing chronic conditions, including cardiovascular diseases, type 2 diabetes, and various cancers¹⁵. Glycosides comprise a major group of secondary metabolites structurally divided into a hydrophilic glycone unit and a lipophilic aglycone unit. This diverse class includes coumarins, saponins, chromones, anthraquinones, cardiac glycosides, cyanogenic glycosides, thioglycosides and flavonoids¹⁶.

Glycosides exhibit key pharmacological actions that enhance human disease management, specifically demonstrating anti-inflammatory effects, cognitive enhancement, and inhibitory activity against neurodegenerative diseases¹⁷.

Secondary metabolites in *Burkea africana* Hook:

A number of phytoconstituents have been confirmed to be present in the extracts of *Burkea africana* Hook including saponins, tannins, flavonoids, phenolic compounds and terpenoids. The antibacterial and antioxidant properties that are possessed by this plant are secondary to the presence of phenolic compounds, tannins, saponins as well as flavonoids¹⁸. Chromatographic and spectroscopic analyses of *Burkea africana* Hook bark have isolated key phytoconstituents, including sitosterols, catechins, epicatechin and proanthocyanidins, whose phenolic properties mitigate cellular damage by scavenging free radicals and reducing oxidative stress¹⁹. *Burkea africana* Hook contains powerful antioxidant phytoconstituents, including diterpenoids and flavan-3-ol derivatives, as well as a root-extracted abietane terpenoid that demonstrates antidiabetic potential by inhibiting the alpha-amylase enzyme²⁰.

MATERIALS AND METHODS: This experimental study was conducted at the University of Zimbabwe in 2026. The chemical reagents and equipment that were used to perform plant extraction and phytochemical screening, *in-vitro* bioefficacy assays and *in-vivo* oral toxicity evaluations were obtained from the University of Zimbabwe Faculty of Medicine and Health Sciences, Department of Pharmacy and Pharmaceutical Sciences Laboratory, as well as the University of Zimbabwe Animal House Unit. Experimental animals were housed and cared for at the Animal House Department. Some of the materials used include ethanol, Wagner's Reagent, a rotar evaporator, Ferric chloride, Whatmannumber 1 filter paper, Ammonia, Methanol, Hydrochloric acid, Bunsen burners, 1% gelatin solution, 10% Sodium Chloride solution, Orbital shaker, Muslin cloth

***Burkea africana* Hook Plant Collection and Preparation:** The plant material was collected from Chitakatira Village, Chigodora area in Mutare

and the coordinates for the location are given as; 19°08'11.1"S, 32°40'11.8" E. Collection was done from 5 different plants and this was done in accordance with the requirements in ensuring sustainability and continued survival of the trees. During the harvest procedure, care was taken to limit bark removal to 10 to 15% of the tree's total circumference. Plant species authentication and accurate identification were conducted at the National Herbarium and Botanical Garden in Harare, Zimbabwe. The collected *Burkea africana* Hook bark was thoroughly washed to remove debris and other contaminants, then shade-dried for three weeks.

Phytochemical Extraction: The dried bark was broken into smaller pieces, pulverized in a mortar and pestle and then sifted to a fine powder. Phytochemical extraction was carried out by adding 100g of powdered bark to 510ml of a mixture of 70% ethanol and 30% distilled water in a clean flat-bottomed flask, then macerating for 3 days with constant shaking on an orbital shaker. A muslin cloth was used to filter the mixture and collect the filtrate. The resulting filtrate was further filtered and clarified using Whatman number 1 filter paper. The filtrate was evaporated under reduced pressure on a rotavapor and air-dried in a fume hood. The extract was then stored in a sample bottle, wrapped in parafilm, and kept at 4±0.2 °C in a refrigerator until needed for further investigations. The percentage yield of the phytochemical extraction process was calculated using the following equation:

$$\text{Percentage yield \%} = (\text{Mass of extract/ g}) / (\text{Mass of coarse plant powder/g}) \times 100$$

***Burkea africana* Hook Phytochemical Screening:** 30 mL of the hydroethanolic extract of *Burkea africana* Hook was subjected to various phytochemical screening techniques to confirm the presence or absence of important phytoconstituents of pharmacological interest. The phytochemical screening tests carried out are documented in the next section.

Determination of Alkaloids using Wagner's Test: To 2 mL of *Burkea africana* Hook extract, a few drops of Wagner's reagent were added along the sides of a test tube. A brown precipitate formed, confirming the presence of flavonoids²¹.

Determination of Tannins using the Braymer's Test: The ferric chloride test was used to detect the presence of tannins. In this test, 3 mL of *Burkea africana* Hook extract and 4 drops of 10% ferric chloride solution were mixed in a test tube. A blue-green colour developed, confirming the presence of tannins²¹.

Determination of Saponins using the Simplified Foam Test: To test for saponins, the simplified foam test was performed. To 2 mL of the hydroethanolic extract of *Burkea africana* Hook, 5 mL of distilled water was added, and the mixture was shaken in a graduated cylinder for 10 minutes. The formation of a foam column at least 6 cm high confirmed the presence of saponins²¹.

Determination of Glycosides using the Keller-Kiliani Test: To test for the presence of glycosides, the Keller-Kiliani test was performed. To 2 mL of *Burkea africana* Hook, 1.5 mL of glacial acetic acid was added, followed by 1 drop of 5% ferric chloride and 2 drops of concentrated sulfuric acid. A blue colour was observed, confirming the presence of glycosides²¹.

Determination of Phenolic Compounds Using the Gelatin Test: The gelatin test was conducted to detect the presence of phenolic compounds. A few drops of 5% ferric chloride were added to 2 mL of the hydroethanolic extract of *Burkea africana* Hook. The appearance of a bluish-black color confirmed the presence of phenols

***Burkea africana* Hook Acute Oral Toxicity Evaluation:** The oral toxicity of the hydroethanolic bark extract of *Burkea africana* Hook was tested in accordance with OECD guideline 425, with some modifications. Female nulliparous Sprague-Dawley rats, acclimatized for 6 days, were used for assessment. The rats were divided into a control group receiving only distilled water and test groups receiving the extract.

The plant extracts, dissolved in water, were administered *via* oral gavage to rats that had fasted overnight. The initial dose for the first animal was 250 mg/kg body weight; if the animal survived after 48 hours, the dose was doubled. Rats were monitored hourly for the first 24 hours for any visible signs of toxicity, with continued observation over the next 14 days.

***Burkea africana* Hook Anti-inflammatory Activity Evaluation:** The anti-inflammatory activity was evaluated using the egg albumin denaturation assay which is a rapid *in-vitro* method for assessing the anti-inflammatory properties of *Burkea africana* Hook extracts. It relies on the fact that tissue inflammation correlates with protein denaturation, which causes structural and functional damage to tissues. By measuring how effectively a substance prevents heat-induced denaturation of egg albumin, researchers can assess its anti-inflammatory effectiveness relative to a standard drug such as diclofenac sodium as used in the present study. Oral stock solutions of lyophilized *Burkea africana* extracts and diclofenac were prepared at 10 mg/mL in 0.4% dimethyl sulfoxide (DMSO), then serially diluting to final concentrations of 50, 100, 250, 500, 750, and 1000 µg/mL. In test tubes, 0.4 mL of fresh egg albumin, 0.5 mL of the test sample or standard, and 3 mL of phosphate-buffered saline (PBS) were combined to make reaction mixtures. Negative controls were prepared by replacing the test sample with 0.5 mL of 0.4% DMSO to set a baseline for maximum denaturation. The mixtures were incubated at 37°C for 20 minutes, then heated at 65°C for 30 minutes to induce protein denaturation. After cooling, turbidity was measured at 660 nm using a UV/Vis spectrophotometer calibrated against a dimethyl sulfoxide (DMSO) blank. The percentage inhibition of protein denaturation was then calculated using the standard formula.

$$\text{Inhibition\%} = \frac{(\text{Absorbance (control)} - \text{Absorbance (sample)})}{(\text{Absorbance (control)} \times 100)}$$

A higher percentage of inhibition indicates that the test substance effectively stabilizes proteins against denaturation, thereby confirming its potential as an anti-inflammatory agent for treating inflammatory diseases.

RESULTS AND DISCUSSION:

Phytochemical Extraction: After completion of the extraction process, 13.2 g of *Burkea africana* Hook extract was obtained per 100 g of plant material, corresponding to a yield of 13.2% of the plant extract. The percentage yield of the *Burkea africana* Hook extract obtained in this study was within a range comparable to values reported by other researchers who conducted phytochemical

extraction of the same plant. Swem *et al.* conducted a study to evaluate the plant's neuroprotective properties against chemotherapy-induced peripheral neuropathy. They used a hot, continuous extraction process and obtained a 10% yield of the extract ²². In another toxicological study, a 10% yield of *Burkea africana* Hook was obtained following a cold maceration extraction process ²³. The observed differences in yield can be attributed to the climate and environment from which the plants were collected, as well as the extraction methods used.

Phytochemical Screening: Phytochemical screening of *Burkea africana* Hook identified several compound classes, including flavonoids, alkaloids, phenols, glycosides, tannins, and saponins **Table 1**. The findings indicated a high abundance of flavonoids, alkaloids, glycosides and saponins, with moderate levels of tannins, phenolic compounds, and glycosides **Table 1**.

TABLE 1: QUALITATIVE PHYTOCHEMICAL OVERVIEW OF BURKEA AFRICANA HOOK

Test	Presence in hydroethanolic extract
Alkaloids	+++
Flavonoids	+++
Tannins	++
Saponins	+++
Glycosides	+++
Phenolic compounds	++
Carbohydrates	++
Proteins and amino acids	+++
Steroids	++
Terpenoids	+
Anthraquinones	--

Key: +++ represents exceptionally high abundance ++ represents moderate presence + represents presence in trace amounts -- represents absence.

In a study conducted by Mair and colleagues in 2018, extracts of *Burkea africana* Hook obtained with an ethanolic solvent were confirmed to contain several pentacyclic triterpene saponins ²². The study by Swem *et al.* confirmed the isolation of secondary metabolites of biomedical relevance from extracts of *Burkea africana* Hook, including saponins, tannins, flavonoids, steroids and terpenoids ²³. The hydroethanolic solvent system ensures that both hydrophilic and hydrophobic phytometabolites dissolve, enabling efficient extraction ²⁴.

Acute Oral Toxicity Evaluation: The extensive use of *Burkea africana* Hook in treating various ailments highlights the importance of conducting an oral toxicity study to determine its toxicity profile, especially since most traditional uses involve oral administration. The OECD 425 guideline was followed to evaluate the acute toxicity of *Burkea africana* Hook bark extract by monitoring changes in behavioral patterns and body weight in experimental animals following a single dose. In the acute oral toxicity study, female rats were used as they are more sensitive due to their limited capacity to detoxify compounds as compared to males ²⁵. Monitoring variations in body weight over time is a sensitive and objective way to track metabolic stress, systemic sickness, or subtle chemical toxicity. Animals experience significant weight loss or inability to flourish as a result of inadequate nutrient absorption or systemic organ damage when a drug causes underlying metabolic toxicity ²⁶. The next table shows the weights of the rats over the period during which acute oral toxicity was assessed.

TABLE 2: SPRAGUE-DAWLEY RATS' WEIGHT OVER THE ACUTE TOXICITY OF BURKEA AFRICANA HOOK INVESTIGATION PERIOD (G)

Rats	Day 1	Day 7	Day 14
Control group			
Rat 1	215	226	229
50mg/kg			
Rat 2	216	221	225
Rat 3	220	225	226
500mg/kg			
Rat 4	217	225	229
Rat 5	216	223	230
1000mg/kg			
Rat 6	220	220	222
Rat 7	222	225	227
2000mg/kg			
Rat 8	219	227	232

Rat 9	212	215	220
2500mg/kg			
Rat 10	214	220	223
Rat 11	218	221	225
5000mg/kg			
Rat 12	226	230	235

All experimental animals at all dose levels gained weight between Day 1 and Day 14 of the oral toxicity study, as indicated by the raw data in **Table 2**. All experimental groups' positive weight trajectories resemble the control cohort's typical physiological development. Even at the maximum therapeutic threshold, *Burkea africana* Hook did not cause adverse metabolic rejection, gastrointestinal malabsorption, or systemic cachexia, despite slight variations in the rate of

weight accumulation; for example, the 1000 mg/kg group had a tighter growth curve +3.5 g. No changes were observed in the eyes, fur, skin and respiration of the test animals even at the highest dose of 5000 mg/kg body weight, as shown in **Table 3** in the next section. The estimated LD₅₀ of *Burkea africana* Hook exceeds 5000 mg/kg body weight. Consequently, the extract is considered non-toxic, as an LD₅₀ greater than 5000 mg/kg is classified as such by Loomis and Hayes²⁵.

TABLE 3: PATTERNS OF BEHAVIOUR EXHIBITED BY THE EXPERIMENTAL ANIMALS DURING THE ACUTE ORAL TOXICITY EVALUATION

Observed Parameter	Dose of <i>Burkea africana</i> Hookin mg/kg body weight					
	control	50mg	500	1000	2500	5000
Food intake	Normal	Normal	Normal	Normal	Normal	Normal
Water intake	Normal	Normal	Normal	Normal	Normal	Normal
Death	Alive	Alive	Alive	Alive	Alive	Alive
Breathing	Normal	Normal	Normal	Normal	Normal	Normal
Defecation	Normal	Normal	Normal	Normal	Normal	Normal
Erection of fur	Not observed	Not observed	Not observed	Not observed	Not observed	Not observed
Urination	Normal	Normal	Normal	Normal	Normal	Normal
Skin colour	Normal	Normal	Normal	Normal	Normal	Normal

The overall neurological, autonomic, and somatic stability of Sprague Dawley rats is clearly evident in the behavioral data in **Table 3**. Throughout the study, key indicators such as food and water intake, respiration, feces, urination, and skin color remained "Normal" across all treatment groups. This pattern was observed across doses of *Burkea africana* Hook from 50 mg/kg to 5000 mg/kg, compared with the untreated control group.

The results in **Table 3** suggest there was no neuro-somatic distress in the experimental animals at the end of the acute oral toxicity evaluation. During the 14-day trial, autonomic distress symptoms, including piloerection (the "erection of fur"), which usually indicate pain, extreme stress, or poor thermoregulation, were "not observed" at any point. In terms of mortality data at the end of the study, no deaths of experimental animals were recorded, even at the absolute ceiling dose per kilogram of body weight of *Burkea africana* Hook administered, which was 5000mg/kg. Any plant extract that does not cause death in experimental

animals during an oral toxicity study at a single oral limit dose of 2000 mg/kg or 5000 mg/kg is officially categorized as Category 5 or Unclassified under the Globally Harmonized System (GHS) of Classification and Labeling of Chemicals²⁶. This indicates a very low risk of acute toxicity, demonstrating that *Burkea africana* Hook extract is essentially non-toxic when taken orally.

Anti-inflammatory Evaluation: The *Burkea africana* Hook extract was tested for its ability to inhibit protein denaturation, a standard screening method for non-steroidal anti-inflammatory drugs. Since protein denaturation exposes hidden antigenic sites that promote auto-antigen formation and trigger inflammatory responses, this test helps evaluate the extract's potential anti-inflammatory effects *in-vitro*. Protein denaturation is closely associated with tissue damage and inflammatory diseases²⁷. Table 4 shows the anti-inflammatory results for both *Burkea africana* Hook extracts and Diclofenac sodium, measured using a UV-Vis Spectrometer at 600nm absorbance.

TABLE 4: ANTI-INFLAMMATORY TEST RESULTS (ABSORBANCE AT 660 NM)

Sample	Concentration(µg/ml)	Absorbance
Negative control	0.4%DMSO	0.821
Diclofenac	50	0.533
	100	0.404
	250	0.340
	500	0.221
	750	0.216
	1000	0.136
<i>Burkea africana</i> Hook	50	0.606
	100	0.557
	250	0.368
	500	0.238
	750	0.223
	1000	0.164

Table 4 displays a reduction in light absorbance measured by the spectrophotometer. Both the reference medication (commercial Diclofenac sodium) and the plant extract show a clear concentration-dependent decline in absorbance at 660 nm. For extracts of *Burkea africana* Hook, optical absorbance decreases stepwise from 0.606 to 0.164 as the concentration increases from 50 micrograms per milliliter to 1000 micrograms per liter. Similarly, over the same concentration range,

the absorbance of commercial Diclofenac sodium decreases from 0.533 to 0.135. This steady decline in turbidity suggests that *Burkea africana* Hook contains active solutes that bind to heat-denatured protein strands, stabilizing their tertiary structures and preventing precipitate formation. The relative anti-inflammatory potency of the *Burkea africana* Hook extract across the microgram range is presented by converting the raw absorbance values in **Table 4** into percentage values in **Table 5**.

TABLE 5: ANTI-INFLAMMATORY TEST RESULTS EXPRESSED IN PERCENTAGE OF INHIBITION

Concentration (µg/ml)	DMSO(negative control) Inhibition %	Diclofenac (positive control) inhibition %	<i>Burkea africana</i> Hook inhibition %
50	0	35	26
100	0	51	32
250	0	62	55
500	0	73	71
750	0	74	73
1000	0	83	80

According to these results, at lower concentrations, the crude extract lags behind the pure medication, demonstrated by a 19% lag phase at 100 micrograms per millilitre, but it catches up at higher concentrations. When *Burkea africana* Hook reaches an impressive peak inhibition of 80%, close to Diclofenac’s 83%, the differences become negligible, typically between 500 micrograms per millilitre and 1000 micrograms per millilitre. This clearly indicates that the crude plant matrix approaches the efficacy of a refined pharmaceutical NSAID, like Diclofenac sodium, at higher doses. The rich pool of secondary metabolites in *Burkea africana* Hook, revealed by qualitative phytochemical screening, particularly its high concentrations of flavonoids and polyphenols along with moderate amounts of tannins, is directly linked to the plant's capacity to prevent protein

denaturation¹⁸. The abundant hydroxyl groups in polyphenols and flavonoids form strong hydrogen-bonding interactions with protein peptide backbones²⁸. These interactions prevent structural unfolding and the changes typically induced by heat stress²⁹. The common use of *Burkea africana* Hook in Southern Africa is driven by its synergistic stabilization effects. It binds to specific protein pockets, shields vulnerable hydrophobic regions from exposure, and prevents aggregation, allowing plant polyphenols to act like traditional NSAIDs. Across Southern Africa, *Burkea africana* Hook is widely used to alleviate pain, swelling, and inflammation associated with wounds and systemic infections³⁰.

DISCUSSION: This study offers a detailed chemical and toxicological profile of *Burkea*

africana Hook, highlighting its potential as a safe and effective natural therapy. Phytochemical screening with wet-chemistry methods confirmed the presence of key secondary metabolites likely responsible for the plant's pharmacological effects.

The presence of medically relevant phytoconstituents supports the plant's diverse applications in traditional medicine. Phenolic compounds, including flavonoids, phenolic acids, stilbenes, and lignans, are recognized for their antioxidant, anti-inflammatory, and anticancer activities, primarily through the induction of apoptosis. The results of the oral toxicity evaluation indicate that *Burkea africana* Hook extracts are safe, as no signs or symptoms of toxicity were observed during or at the end of the acute oral toxicity evaluation period. Extracts of *Burkea africana* Hook were confirmed to possess potent anti-inflammatory properties, as they inhibited protein denaturation by 80%, closely matching the 83% inhibition observed with diclofenac at a 1000 mg/mL dose.

CONCLUSION: In summary, the rich phytochemical content, strong anti-inflammatory properties and its high oral safety margin position *Burkea africana* Hook as a promising candidate for further drug development. Future research should place greater focus on isolating specific bioactive compounds and investigating their mechanisms of action in disease management.

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Animal use Approval: Prior to the commencement of this research study, approval to use experimental animals was sought and obtained from the university's Animal House Unit. The research protocol was reviewed and approved by the Joint Parirenyatwa Research Ethics Committee (JREC), the institutional review board. Approval to use laboratories in the Department of Pharmacy and Pharmaceutical Sciences was obtained from the Chief Laboratory Technician's office.

CONFLICT OF INTEREST: The authors declare no conflict of interest.

REFERENCES:

1. Lah IM, Nyane NA and Katerere DR: *Burkea africana* Hook. In African Herbal Pharmacopoeia 2026; 98-108.
2. Shopo B, Mapaya RJ and Maroyi A: Ethnobotanical study of medicinal plants traditionally used in Gokwe South District, Zimbabwe. South African Journal of Botany 2022; 149: 29-48.
3. Odongo EA: An Ethnobotanical, antioxidant and anti-inflammatory study of medicinal plants used in Kakamega County, Western Kenya. University of Nairobi 2016.
4. Ezenyi IC, Okpoko CK, Ufodu CA, Okhale SE and Adzu B: Antiplasmodial, antinociceptive and antipyretic potential of the stem bark extract of *Burkea africana* and identification of its antiplasmodial-active fraction. Journal of Traditional and Complementary Medicine 2021; 11(4): 311-7.
5. Eboji O, Venables L, Sowemimo AA, Sofidiya MO, Koekemoer T and Van de Venter M: *Burkea africana* Hook (Caesalpiniaceae) ethanolic extract causes cell cycle arrest at M phase and induces caspase-dependent apoptosis. South African Journal of Botany 2017; 112: 361-7.
6. Kaboré SA, Diallo R, Yaméogo JT, Ouoba P, Mipro H, Somda I, Hahn K and Nacro HB: Ethnobotanical study of *Burkea africana* Hook. in the Reserves of Bontioli and the Classified Forest of Koulbi, Burkina Faso. Ethnobotany Research and Applications 2024; 29: 1-4.
7. Salam U, Ullah S, Tang ZH, Elateeq AA, Khan Y, Khan J, Khan A and Ali S: Plant metabolomics: an overview of the role of primary and secondary metabolites against different environmental stress factors. Life 2023; 13(3): 706.
8. Olivoto T, Nardino M, Carvalho IR, Follmann DN, Szareski VJ, Ferrari M, de Pelegrin AJ and de Souza VQ: Plant secondary metabolites and its dynamical systems of induction in response to environmental factors: A review. African Journal of Agricultural Research 2017; 12(2): 71-84.
9. Mohiuddin AK: Effect of environment on secondary metabolism of medicinal plants. J Environ Soil Sci <https://doi.org/10.32474/OAJESS.2019.126>.
10. Winkel BS: Metabolic channeling in plants. Annu Rev Plant Biol 2004; 55(1): 85-107.
11. Okuda T, Yoshida T and Hatano T: Pharmacologically active tannins isolated from medicinal plants. Plant polyphenols: synthesis, properties, significance 1992; 539-69.
12. Teodor ED, Ungureanu O, Gatea F and Radu GL: The potential of flavonoids and tannins from medicinal plants as anticancer agents. Anti-Cancer Agents in Medicinal Chemistry-Anti-Cancer Agents 2020; 20(18): 2216-27.
13. Elekofehinti OO: Saponins: Anti-diabetic principles from medicinal plants-A review. Pathophysiology 2015; 22(2): 95-103.
14. Zhou Y and Xu B: New insights into anti-diabetes effects and molecular mechanisms of dietary saponins. Critical Reviews in Food Science and Nutrition 2023; 63(33): 12372-97.
15. Riaz M, Khalid R, Afzal M, Anjum F, Fatima H, Zia S, Rasool G, Egbuna C, Mtewa AG, Uche CZ and Aslam MA: Phytobioactive compounds as therapeutic agents for human diseases: A review. Food Science & Nutrition 2023; 11(6): 2500-29.
16. Munir H, Yaqoob S, Awan KA, Imtiaz A, Naveed H, Ahmad N, Naeem M, Sultan W and Ma Y: Unveiling the chemistry of citrus peel: insights into nutraceutical

- potential and therapeutic applications. *Foods* 2024; 13(11): 1681.
17. Ebrahimi MS, Hosseini Z, Khatami A, Abbasi-Kolli M, Nahand JS, Kouchaki E and Mirzaei H: Neuroprotective effects of glycosides. In *Phytonutrients and Neurological Disorders* 2023; 201-226.
 18. Zengeni S, Chifamba J, Mutingwende I and Manyarara T: Investigation of the Phyto-constituents and the Antibacterial Activity of *Burkea africana* against *P. aeruginosa*, *E. coli*, *S. aureus* and *E. faecalis*. *International J of Biochemistry Research & Review* 2021; 30(4): 33-40.
 19. Eboji OK, Cheng W, Swanepoel B, Sowemimo AA, Simelane M, Venables L, Sofidiya MO, Van de Venter M, Koekemoer Tand Lin W: Bioactivity and characterisation of phytoconstituents from the stem bark of *Burkea africana* Hook. *Journal of Chemical Society of Nigeria* 2020; 45(1).
 20. Cordier W: Effects of polyphenolic-rich bark extracts of *Burkea africana* and *Syzygium cordatum* on oxidative stress. University of Pretoria (South Africa); 2012.
 21. Singh A, Kaur Jand Kapoor M: Phytochemical Screening and Antibacterial Potential of Methanol, Ethanol and Aqueous Extracts from Seed, Bark and Leaf of *Bauhinia tomentosa* L. *Agricultural Science Digest* 2023; 43(1).
 22. Jibira Y, Boakye-Gyasi E, Kofi Mensah Abotsi W, Amponsah IK, Adongo DW and Woode E: Hydroethanolic Stem Bark Extract of *Burkea africana* Attenuates Vincristine-Induced Peripheral Neuropathy in Rats. *Adv in Pharma and Pharmaceut Sciences* 2020;2020(1):7232579.
 23. Swem TF, Aba PE, Udem SC, Ahur VM and Gberindyer FA: Evaluation of sub-acute toxicity of the hydro-methanol stem bark extract of *Burkea africana* in albino rats. *Universal Journal of Pharmaceutical Research* 2021.
 24. Nagarajan J, Wah Heng W, Galanakis CM, Nagasundara Ramanan R, Raghunandan ME, Sun J, Ismail A, Beng-Ti Tand Prasad KN: Extraction of phytochemicals using hydrotropic solvents. *Separation Science and Technology* 2016;51(7):1151-65.
 25. Loomis TA, Hayes AW. *Clinical toxicology. Loomis's Essentials of Toxicology*. 1996:249-56.
 26. CHEMICALS LO: Globally harmonized system of classification and labelling of chemicals (GHS). *Globally Harmonized System of Classification and Labelling of Chemicals (GHS)* 2002.
 27. Khumalo GP: Cytokine and eicosanoid modulation properties of southern African medicinal plants used traditionally to treat pain and inflammation.
 28. Nassarawa SS, Nayik GA, Gupta SD, Areche FO, Jagdale YD, Ansari MJ, Hemeg HA, Al-Farga A and Alotaibi SS: Chemical aspects of polyphenol-protein interactions and their antibacterial activity. *Critical Reviews in Food Science and Nutrition* 2023; 63(28): 9482-505.
 29. Vabulas RM, Raychaudhuri S, Hayer-Hartl Mand Hartl FU: Protein folding in the cytoplasm and the heat shock response. *Cold Spring Harbor Perspectives in Biology* 2010;2(12): a004390.
 30. Xaba VM: Pharmacological screening of traditional medicinal plants used against skin ailments in the Free State, South Africa (Doctoral dissertation, University of the Free State (Qwaqwa Campus).

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