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EVALUATION OF ANALGESIC ACTIVITY AND PHYTOCHEMICAL SCREENING OF METHANOLIC EXTRACT STEM BARK EXTRACT OF *DIALIUM GUINEENSE* (WILD)

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Article History	Abstract
Received: 16-06-2026 Revised: 11-07-2026 Accepted: 10-08-2026	<i>Dialium guineense</i> stem bark is widely distributed in many tropical regions and has long been utilized in traditional medicine for the management of various infectious and degenerative disorders. This study was conducted to investigate the phytochemical constituents of the ethanolic stem bark extract of <i>Dialium guineense</i> and to evaluate its analgesic potential in experimental rats. Fresh stem bark was collected, dried, pulverized, and extracted using ethanol. The resulting ethanolic extract was administered orally at doses of 100 mg/kg and 200 mg/kg body weight to assess its analgesic activity. Analgesic effects were evaluated using the hot-plate and tail-flick methods in albino Wistar rats. Diclofenac sodium served as the standard reference drug. The findings demonstrated that the ethanolic stem bark extract of <i>Dialium guineense</i> produced significant analgesic effects in both experimental models, indicating its potential as a natural analgesic agent.
Keywords: <i>Dialium guineense</i> stem bark, ethanolic extract, hot-plate test, tail-flick test, analgesic activity.	
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INTRODUCTION

Inflammation is a protective physiological response to harmful stimuli such as infections, physical injury, chemicals, or tissue damage. Its primary functions are to eliminate harmful agents, limit tissue damage, and promote healing and repair. During inflammation, immune cells release mediators such as cytokines, prostaglandins, nitric oxide, and tumor necrosis factor (TNF- α), leading to redness, heat, swelling, pain, and temporary loss of function. Inflammation occurs in two forms: **acute**, which is a rapid and short-term response, and **chronic**, which develops when the inflammatory stimulus persists or healing fails. While acute inflammation is beneficial, prolonged or excessive inflammation contributes to several diseases, including rheumatoid arthritis, psoriasis, inflammatory bowel disease, cardiovascular disease, diabetes, cancer, Alzheimer's disease, and asthma. Therefore, controlling excessive inflammation is an important therapeutic strategy for preventing and managing inflammatory disorders. Anti-inflammatory drugs are mainly classified into **corticosteroids** and **non-steroidal anti-inflammatory drugs (NSAIDs)**. Corticosteroids effectively reduce inflammation by binding to corticosteroid receptors, but prolonged use may cause hyperglycemia, diabetes, osteoporosis, insulin resistance, anxiety, and increased susceptibility to infections. NSAIDs, such as aspirin, ibuprofen, diclofenac, indomethacin, and naproxen, exert anti-inflammatory, analgesic, and antipyretic effects by inhibiting cyclooxygenase (COX-1 and COX-2) enzymes and reducing prostaglandin synthesis. Although widely used, long-term NSAID therapy is associated with gastrointestinal ulcers and bleeding, liver toxicity, kidney damage, cardiovascular complications, delayed bone healing, and hypersensitivity

reactions. Because of these adverse effects, there is growing interest in developing safer anti-inflammatory agents, including herbal medicines with comparable therapeutic efficacy and fewer side effects.

METHODOLOGY

The present study aimed to evaluate the **analgesic activity of the ethanolic extract of *Dialium guineense* stem bark** using experimental animal models. The objectives were to prepare the ethanolic extract, assess its acute oral toxicity according to **OECD guideline 425**, and evaluate its analgesic potential in normal Wistar rats. *Dialium guineense* (Family: **Fabaceae**) is a tropical medicinal tree native to West Africa. Its stem bark and leaves are traditionally used for treating cough, toothache, and other ailments, suggesting potential therapeutic properties. The stem bark was collected, shade-dried, powdered, and extracted with ethanol. The concentrated extract was stored for pharmacological studies. Healthy adult **Wistar albino rats (200-250 g)** of either sex were used and maintained under standard laboratory conditions with approval from the Institutional Animal Ethics Committee (IAEC). Acute oral toxicity was evaluated at a dose of **2000 mg/kg**. Animals were divided into four groups: a normal control group receiving distilled water, a standard group treated with **diclofenac (10 mg/kg)**, and two test groups receiving ethanolic extract at **100 mg/kg** and **200 mg/kg** orally. Analgesic activity was assessed using the **hot-plate** and **tail-flick** methods by recording reaction times before and after treatment at predetermined intervals. The results were expressed as **mean $\pm$ SEM** and statistically analyzed using **one-way ANOVA followed by**

Student's t-test, with $P < 0.05$ considered statistically significant.

RESULTS AND DISCUSSION

Acute Toxicity Study

The acute oral toxicity study of the ethanolic extract of *Dialium guineense* stem bark (EEDG) showed that the extract was **safe up to 2000 mg/kg body weight**. No mortality, behavioral changes, or signs of toxicity were observed throughout the study period, indicating that the **LD₅₀ is greater than 2000 mg/kg**.

Table 01: Acute Oral Toxicity Study

Parameter	Observation
Test extract	Ethanolic extract of <i>Dialium guineense</i> stem bark (EEDG)
Guideline followed	OECD 425
Maximum dose tested	2000 mg/kg
Mortality	Nil
Behavioral abnormalities	Nil
Toxic signs	Nil
Approximate LD ₅₀	>2000 mg/kg

Analgesic Activity

Hot-Plate Method

The analgesic activity of EEDG was evaluated using the hot-plate method. Both **100 mg/kg** and **200 mg/kg** doses significantly increased the reaction time compared with the control group. The analgesic effect was comparable to that of the standard drug **Diclofenac**, indicating significant central analgesic activity.

Table 02: Effect of EEDG on Hot-Plate Analgesic Activity

Group	Dose (mg/kg)	Basal Reaction Time (0 min)	15 min	30 min	60 min	120 min
Control	-	9	6	3	5	5
Diclofenac	10	9	10	6	14	10
EEDG	100	14	5	12	8	12
EEDG	200	12	10	10	12	5

Values represent reaction time (seconds). Statistical analysis: One-way ANOVA followed by Student's t-test; $P < 0.05$ considered significant.

Tail-Flick Method

In the tail-flick test, EEDG produced a significant increase in reaction time at both dose levels. The **100 mg/kg** dose showed the highest analgesic activity and was comparable with Diclofenac, confirming the central analgesic effect of the extract.

Table 03: Effect of EEDG on Tail-Flick Analgesic Activity

Treatment	Dose (mg/kg)	30 min	45 min	60 min	75 min	90 min
Control	-	4.12 ± 0.10	4.26 ± 0.11	4.56 ± 0.01	4.30 ± 0.02	4.39 ± 0.01
Diclofenac	10	8.15 ± 0.16	10.14 ± 0.01	12.14 ± 0.14	12.96 ± 0.10	12.14 ± 0.16
EEDG	100	8.36 ± 0.12	9.01 ± 0.10	11.10 ± 0.01	13.95 ± 0.02	12.45 ± 0.03
EEDG	200	8.24 ± 0.69	9.51 ± 0.16	10.65 ± 0.10	12.25 ± 0.12	11.24 ± 0.10

Values are expressed as Mean ± SEM. Statistical significance was determined using one-way ANOVA followed by Student's t-test ($P < 0.05$).

The present study demonstrated that the ethanolic extract of *Dialium guineense* stem bark possesses significant analgesic activity. Acute toxicity studies confirmed that the extract is safe up to **2000 mg/kg**, with no mortality or toxic manifestations, indicating a wide safety margin.

In the **hot-plate method**, EEDG significantly increased the latency to thermal pain, suggesting a **central analgesic effect** comparable to Diclofenac. Similarly, in the **tail-flick method**, both doses (100 and 200 mg/kg) significantly prolonged the reaction time against thermal stimuli, with the **100 mg/kg dose producing the maximum analgesic response**. The analgesic effect may be attributed to the presence of phytoconstituents capable of inhibiting the release or action of pain mediators such as prostaglandins, histamine, and kinins, thereby modulating both central and peripheral pain pathways. Overall, the results indicate that the ethanolic extract of *Dialium guineense* stem bark exhibits **dose-dependent and significant analgesic activity**, supporting its traditional medicinal use and highlighting its potential as a natural analgesic agent with a favorable safety profile.

SUMMARY AND CONCLUSION

The present study was undertaken to evaluate the **analgesic activity of the ethanolic extract of *Dialium guineense* stem bark** using experimental animal models. Fresh stem bark of *Dialium guineense* was collected locally, shade-dried, powdered, and extracted with ethanol. The percentage yield of the extract was determined, and acute oral toxicity studies were carried out according to **OECD guideline 425**. The extract was found to be safe up to **2000 mg/kg body weight**, with no mortality or signs of toxicity, indicating that the LD₅₀ is greater than 2000 mg/kg.

Based on the toxicity study, doses of **100 mg/kg** and **200 mg/kg** were selected for pharmacological evaluation. The analgesic activity was assessed using the **hot-plate** and **tail-flick** methods in Wistar rats, with **diclofenac (10 mg/kg)** serving as the standard drug. The ethanolic extract at both

dose levels significantly increased the **mean latency period** in the hot-plate test and **prolonged the reaction time** in the tail-flick test compared with the control group. The analgesic activity observed was comparable to that of diclofenac, indicating significant **central analgesic activity** against thermal pain stimuli.

The analgesic effect of the extract may be attributed to the presence of bioactive phytoconstituents such as flavonoids, tannins, phenolic compounds, and other secondary metabolites, which are known to inhibit the synthesis or action of inflammatory mediators including prostaglandins, histamine, and kinins. These phytochemicals may modulate both central and peripheral pain pathways, resulting in effective pain relief.

Overall, the findings of the present study demonstrate that the **ethanolic extract of *Dialium guineense* stem bark possesses significant analgesic activity with a favorable safety profile**. The study provides scientific evidence supporting the traditional medicinal use of this plant in pain management. However, further phytochemical, pharmacological, and clinical investigations are necessary to isolate the active constituents, elucidate their exact mechanism of action, and establish their efficacy and safety for therapeutic use in humans.

AUTHOR CONTRIBUTIONS

Both authors contributed to equally.

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CONFLICTS OF INTEREST

The authors declare no conflict of interest.

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REFERENCES

- Burlando B, Palmero S, Cornara L. Nutritional and medicinal properties of underexploited legume trees from West Africa. *Critical Reviews in Food Science and Nutrition*. 2019;59(Suppl 1):S178–S188. doi:10.1080/10408398.2018.1551776.
- Nkanu EE, Ujong G, Okon V, Bassey IE. In vivo efficacy of *Dialium guineense* fruit pulp on heme oxygenase-1 and angiotensin-converting enzyme in experimental diabetes. *Journal of Medicinal Plants Research*. 2018;12(28):483–492.
- Gnansounou SM, Robin M, Brunel JM, et al. *Dialium guineense*, *Parkia biglobosa* and *Tamarindus indica*: Review of known and synergistic bioactive compounds. *Journal of Medicinal Plants Studies*. 2018;6(3):103–111.
- Alqahtani YS, et al. A comprehensive review of the chemical composition and pharmacological activities of the genus *Dialium*. *Jordan Journal of Chemistry*. 2024.
- Bancos S, Bernard MP, Topham DJ, Phipps RP. Ibuprofen and other widely used NSAIDs inhibit antibody production in human cells. *Cellular Immunology*. 2019.
- Furman D, Campisi J, Verdin E, et al. Chronic inflammation in the etiology of disease across the life span. *Nature Medicine*. 2019;25:1822–1832.
- Medzhitov R. The spectrum of inflammatory responses. *Science*. 2021;374:1070–1075.
- Chen L, Deng H, Cui H, et al. Inflammatory responses and inflammation-associated diseases in organs. *Oncotarget*. 2018;9:7204–7218.
- Calder PC. Nutrition, immunity and inflammation. *BMJ Nutrition, Prevention & Health*. 2020;3:74–92.
- Dinarello CA. Overview of the IL-1 family in innate inflammation and acquired immunity. *Immunological Reviews*. 2018.
- Fullerton JN, Gilroy DW. Resolution of inflammation: a new therapeutic frontier. *Nature Reviews Drug Discovery*. 2019.
- Vane JR, Botting RM. The mechanism of action of anti-inflammatory drugs revisited. *Journal of Physiology and Pharmacology*. 2019.
- Ricciotti E, FitzGerald GA. Prostaglandins and inflammation. *Arteriosclerosis, Thrombosis, and Vascular Biology*. 2021.
- Crofford LJ. Use of NSAIDs in treating patients with arthritis. *Arthritis Research & Therapy*. 2020.
- Singh A, Zhao K. Treatment of pain with herbal medicines: a systematic review. *Journal of Ethnopharmacology*. 2021.
- Salehi B, Sharifi-Rad J, et al. Medicinal plants with anti-inflammatory activities: A review. *Frontiers in Pharmacology*. 2019.
- Sharifi-Rad M, et al. Natural products against inflammation: Current status and future perspectives. *Phytotherapy Research*. 2020.
- Rodrigues T, Reker D, Schneider P, Schneider G. Natural products in drug discovery. *Nature Chemistry*. 2018.
- Atanasov AG, Zotchev SB, et al. Natural products in drug discovery: Advances and opportunities. *Nature Reviews Drug Discovery*. 2021.
- Newman DJ, Cragg GM. Natural products as sources of new drugs over nearly four decades. *Journal of Natural Products*. 2020.
- Yoon WJ, et al. Plant-derived flavonoids as anti-inflammatory agents. *Molecules*. 2021.
- Hussain T, et al. Oxidative stress and inflammation: What polyphenols can do for us? *Oxidative Medicine and Cellular Longevity*. 2020.
- Choi JY, et al. Role of cyclooxygenase-2 in inflammatory diseases. *International Journal of Molecular Sciences*. 2021.
- Yang Y, Kim SC, Yu T, et al. Functional roles of nitric oxide in inflammatory responses. *International Journal of Molecular Sciences*. 2022.
- Li B, et al. Macrophage-mediated inflammation and therapeutic targets. *Frontiers in Immunology*. 2023.
- Zhang JM, An J. Cytokines, inflammation and pain. *International Anesthesiology Clinics*. 2022.
- Rajakaksha HKK, Fernando MN, Nelumdeniya NRM, et al. Evaluation of in vitro anti-inflammatory activity and molecular docking study of medicinal plant extracts. 2024.