



Therapeutic Potential of *Olox subscorpioidea* Root Extracts in Managing Inflammatory Conditions: A Preclinical Study

Nyiramana Mukamurera P.

Faculty of Medicine Kampala International University Uganda

ABSTRACT

Olox subscorpioidea, a plant species endemic to tropical Africa, has long been utilized in traditional medicine for its purported anti-inflammatory and analgesic properties. This preclinical study evaluates the therapeutic potential of *Olox subscorpioidea* root extracts in managing inflammatory conditions, specifically in a Freund's adjuvant (CFA)-collagen type II induced arthritis model in albino rats. Both aqueous and ethanol extracts were prepared and assessed for their effects on inflammatory parameters, including cytokine levels, paw edema, joint swelling, and histopathological changes. The study found that both extracts significantly reduced inflammation and clinical signs of arthritis, with the ethanol extract demonstrating a broader range of bioactive compounds and potentially greater efficacy. Mechanistic insights suggest that the extracts exert their effects through inhibition of pro-inflammatory enzymes, modulation of cytokine production, and enhancement of antioxidant activity. Safety and toxicity assessments confirmed the non-toxic nature of the extracts at tested doses. These findings validate the traditional use of *Olox subscorpioidea* for inflammatory conditions and support its potential integration into modern therapeutic regimens. Future research should focus on dosage optimization, long-term effects, and clinical trials to further establish the efficacy and safety of *Olox subscorpioidea* root extracts in human subjects.

Keywords: *Olox subscorpioidea*, Root Extracts, Inflammatory Conditions, Preclinical Study.

INTRODUCTION

Olox subscorpioidea, a member of the Olacaceae family, is a plant species native to tropical and subtropical regions of Africa. Known for its medicinal properties, it has been extensively used in traditional African medicine to treat a variety of ailments [1]. The plant typically grows as a shrub or small tree, thriving in diverse habitats, from dense forests and woodlands to more degraded lands. Its simple, alternate leaves and small, inconspicuous flowers are characteristic features, but it is the bioactive compounds found in its roots, leaves, and other parts that have garnered significant interest. These bioactive compounds, including alkaloids, flavonoids, and saponins, contribute to the plant's reputed medicinal properties, which encompass anti-inflammatory, analgesic, and antioxidant effects. Traditional uses of *Olox subscorpioidea* are varied, addressing conditions such as pain and inflammation, fever, malaria, digestive issues, and wound healing [2]. Notably, root extracts are commonly employed to alleviate pain and inflammation, particularly in chronic conditions like arthritis. The ethnobotanical significance of *Olox subscorpioidea* is deeply rooted in the cultural practices of various African communities, where knowledge of its medicinal uses is passed down through generations. Herbalists and traditional healers play a crucial role in maintaining and disseminating this knowledge, ensuring that the therapeutic benefits of the plant continue to be accessible [3]. However, the increasing reliance on *Olox subscorpioidea* underscores the need for sustainable harvesting and conservation practices to prevent overexploitation and ensure the plant's availability for future generations. This study aims to scientifically validate the traditional uses of *Olox subscorpioidea*, focusing on its potential therapeutic effects on inflammatory parameters in a preclinical model of arthritis. Despite its long history of use, there is a lack of robust scientific evidence supporting its efficacy and safety. By evaluating the anti-inflammatory effectiveness of *Olox subscorpioidea* root extracts in a Freund's adjuvant (CFA)-collagen type II

induced arthritis model in albino rats, this research seeks to bridge the gap between traditional knowledge and modern scientific inquiry [4]. The study will also investigate the optimal extract formulation, potential mechanisms of action, and safety profile, paving the way for future research and development of plant-based therapeutic agents.

Study Rationale and Objectives

This study aims to evaluate the potential therapeutic effects of *Olex subscorpioidea* root extracts on inflammatory parameters in a preclinical model of arthritis. *Olex subscorpioidea* has been traditionally used in African cultures for its medicinal properties, particularly in treating inflammatory conditions like arthritis [5]. The rationale for this research includes its traditional use and ethnobotanical significance, potential for new therapeutic agents, lack of scientific evidence, and potential for complementary medicine. The objectives of the study include evaluating the anti-inflammatory effectiveness of *Olex subscorpioidea* root extracts in a Freund's adjuvant (CFA)-collagen type II induced arthritic model in albino rats, determining the optimal extract formulation, investigating the mechanism of action, and assessing safety and toxicity. Hypotheses and expected outcomes include a reduction in inflammatory parameters, significant reduction in clinical signs of arthritis, comparative efficacy, identification of potential mechanisms through which *Olex subscorpioidea* root extracts exert their anti-inflammatory effects, and a safety profile [6]. The expected outcomes include a reduction in clinical signs of arthritis, decreased levels of inflammatory markers, a demonstration that one type of extract (aqueous or ethanol) is more effective than the other in managing inflammation, identification of potential mechanisms through which *Olex subscorpioidea* root extracts exert their anti-inflammatory effects, and evidence of the safety and non-toxic nature of the extracts at tested doses. Overall, this study aims to validate the traditional uses of *Olex subscorpioidea* and provide scientific evidence for its potential as an anti-inflammatory treatment, paving the way for future research and development of plant-based therapeutic agents.

Preparation of Aqueous and Ethanol Root Extracts

The preparation of aqueous and ethanol root extracts from *Olex subscorpioidea* involves several steps to ensure effective extraction of bioactive compounds and maintain quality and consistency. The process involves harvesting, cleaning, drying, grinding, and preparing the extracting solution using distilled water [7]. The extracting solution is then soaked for 24-48 hours at room temperature, heated to 60-80°C, and filtered through a fine sieve or cheesecloth. Concentration is achieved through evaporation or gentle boiling. For ethanol extracts, the root powder is collected and dried, and the extracting solution is prepared using ethanol. The extract is macerated for 7-14 days, and filtered through a fine sieve or cheesecloth. Evaporation is used to concentrate the extract. The extract is stored in sealed amber bottles to maintain its stability. Standardization and quality control of extracts involve quantifying bioactive compounds, determining extraction yield, assessing physical and chemical properties, conducting microbial testing, and monitoring consistency and stability [8]. Documentation includes batch records, sensory evaluation, and evaluating the oleptic properties. By following these procedures, researchers can ensure the preparation of high-quality aqueous and ethanol extracts of *Olex subscorpioidea*, suitable for evaluating their effects on inflammatory parameters in preclinical studies.

Experimental Design and Methodology

The preparation of aqueous and ethanol root extracts from *Olex subscorpioidea* involves several steps to ensure effective extraction of bioactive compounds and maintain the quality and consistency of the extracts. The process involves harvesting, cleaning, drying, grinding, and preparing the extracting solution using distilled water. The extracting solution is then soaked for 24-48 hours at room temperature, heated to 60-80°C, and filtered through a fine sieve or cheesecloth. Concentration is achieved through evaporation or gentle boiling. For ethanol extracts, the root powder is collected and cleaned, then ground into a coarse powder [9]. The extraction process involves determining the extraction yield, assessing physical and chemical properties, and quality control by conducting microbial testing and chemical testing. Consistency and stability are monitored over time and under different storage conditions to assess their stability and shelf life. Documentation of each batch of extracts is essential for reproducibility and traceability. Sensory evaluation of the extracts includes evaluating color, odor, and taste. By following these procedures, researchers can ensure the preparation of high-quality aqueous and ethanol extracts of *Olex subscorpioidea*, suitable for evaluating their effects on inflammatory parameters in preclinical studies.

The study aims to evaluate the effects of *Olex subscorpioidea* root extracts on inflammatory parameters in Complete Freund's Adjuvant (CFA)-Collagen Type II (CII) induced arthritic albino rats. The model involves preparing a collagen solution, injecting the mixture into the hind limb of rats, and monitoring disease progression. The dosage of the extracts is determined through preliminary dose-response studies, which involve testing various doses to identify the optimal dose that produces significant anti-inflammatory effects without causing toxicity [10]. The extracts are administered orally or via intraperitoneal injection. The treatment duration is set at 2-4

weeks, starting from the onset of arthritis or after a specific number of days post-immunization. Control and treatment groups are established, with the low-dose extract group receiving the lowest effective dose, the medium-dose extract group receiving a moderate dose, and the high-dose extract group receiving the highest effective dose. The experimental groups are randomly assigned to ensure statistical validity. Clinical assessments and biochemical and histological analyses are conducted to assess the extent of inflammation and tissue damage.

Assessment of Inflammatory Parameters

Inflammatory parameters in an arthritis model are assessed using various techniques. C-Reactive Protein (CRP) levels are measured using ELISA or nephelometry, while cytokines are measured using ELISA or qPCR. A reduction in pro-inflammatory cytokines in treated rats suggests anti-inflammatory effects. Paw edema and joint swelling are assessed using a plethysmometer and calipers, respectively. Decreased joint swelling in treatment groups indicates anti-inflammatory effects. Histopathological analysis of joint tissues is performed using hematoxylin and Eosin staining, safranin O staining, and immunohistochemistry [11]. Microscopic examination of stained tissue sections under a light microscope and scoring systems are used to quantify inflammation and tissue damage. Results suggest that the extracts have a protective or restorative effect on joint tissues. Overall, a comprehensive evaluation of the efficacy of *Olex subscorpioidea* root extracts in reducing inflammation and alleviating arthritis symptoms in the animal model is provided.

Pharmacological Effects of Aqueous Root Extracts

Aqueous root extracts from medicinal plants like *Olex subscorpioidea* are studied for their pharmacological properties, particularly their effects on inflammation and pain relief. These extracts can exert anti-inflammatory effects by inhibiting pro-inflammatory mediators, reducing oxidative stress, and modulating immune responses. Experimental evidence from animal models, histopathological analysis, and biochemical assays supports these effects. They can also indirectly reduce pain associated with inflammatory conditions by inhibiting pain pathways and modulating pain receptors. Behavioral tests and pain threshold and tolerance are used to quantify the pain-relieving effects of the extracts [12]. The effectiveness of aqueous extracts is compared to standard anti-inflammatory drugs like NSAIDs or corticosteroids. The safety and side effects of the extracts are compared to those of conventional drugs. The experimental approach includes head-to-head comparisons, pharmacokinetics and pharmacodynamics, and clinical relevance. Natural extracts may offer benefits like fewer side effects and additional therapeutic properties, but limitations include variability in extract composition, potential interactions with other medications, and limited clinical data.

Pharmacological Effects of Ethanol Root Extracts

Ethanol root extracts from medicinal plants like *Olex subscorpioidea* are studied for their pharmacological effects, particularly their impact on inflammation and pain relief. These extracts can inhibit inflammatory enzymes, modulate cytokines, and contain antioxidant properties. They can also alleviate pain associated with inflammatory conditions by reducing inflammation. Experimental evidence from animal models, biochemical assays, and histopathological analysis can help assess the efficacy of these extracts [13]. Pain relief is another area of study, with ethanol extracts influencing pain pathways by affecting neurotransmitter systems and modulating pain receptors. Pain threshold and tolerance are also used to quantify the pain-relieving effects of the extracts. Comparing ethanol extracts with standard anti-inflammatory drugs is crucial for understanding their effectiveness and safety. Head-to-head comparisons and pharmacokinetics and pharmacodynamics can provide a side-by-side evaluation of their effects on inflammation and pain relief. Further research is needed to translate preclinical findings into clinical practice. Ethanol extracts may offer benefits such as fewer side effects, additional therapeutic properties, and lower cost. However, variability in extract composition, potential interactions with other medications, and limited clinical data may pose challenges in fully understanding their efficacy and safety.

Comparative Analysis of Aqueous vs. Ethanol Extracts

Aqueous and ethanol extracts are two types of extracts used in reducing inflammation. Aqueous extracts, prepared using water as a solvent, are rich in polar compounds like flavonoids, phenolic acids, and polysaccharides, which can have anti-inflammatory properties. However, their potency may be limited due to lower solubility of certain anti-inflammatory compounds in water. Ethanol extracts, on the other hand, can extract both polar and non-polar compounds, including flavonoids, phenolic compounds, and essential oils [14]. These extracts can have significant anti-inflammatory effects and can inhibit inflammatory markers and enzymes more effectively. Aqueous extracts primarily contain polar compounds, which can contribute to health benefits like anti-inflammatory and antioxidant effects. However, they may lack non-polar compounds like essential oils and certain alkaloids, which can also have therapeutic effects. Ethanol extracts can include a broader range of bioactive compounds, making them more comprehensive in terms of therapeutic potential. The choice between aqueous and ethanol extracts depends on the

specific bioactive compounds and the intended application. Comparative studies and specific assays are essential to determine the most effective extraction method for a given plant material and its intended use [15].

Safety and Toxicity Assessment

The safety and toxicity assessment of plant extracts involves a comprehensive evaluation of potential side effects, both acute and chronic toxicity, and the identification of toxic compounds [16]. This includes observing symptoms such as nausea, vomiting, diarrhea, and rash, as well as acute toxicity studies using the lethal dose 50 (LD₅₀) test. Chronic toxicity studies evaluate the effects of prolonged exposure to the extract, assessing potential organ damage or carcinogenicity. Histopathological examination of tissue samples from chronic toxicity studies can identify potential damage or abnormalities. Allergic reactions can be assessed through sensitization studies. Root extracts undergo toxicological analysis through phytochemical screening, cytotoxicity testing, and in-vitro testing. Cell line studies assess cell viability, proliferation, and apoptosis, while genotoxicity tests assess the potential of the extract to cause genetic damage. In-vivo testing determines acute toxicity, including potential effects on behavior, organ function, and survival. Chronic toxicity can reveal liver and kidney damage, reproductive toxicity, or carcinogenicity [17]. Safety margins are established by comparing the effective dose with the toxic dose, and regulatory compliance is crucial for the extract's safe use in products or treatments. This comprehensive evaluation ensures the safety of plant extracts and their potential use in therapeutic applications.

Mechanism of Action

Olex subscorpioidea extracts have been found to have various anti-inflammatory effects through various mechanisms. These include inhibiting pro-inflammatory enzymes, modulating cytokine production, and enhancing antioxidant activity. These extracts can reduce inflammation and associated pain by inhibiting COX enzymes, which are key players in the production of pro-inflammatory prostaglandins. They can also affect LOX enzymes involved in the synthesis of leukotrienes, which contribute to inflammation and immune responses. *Olex subscorpioidea* extracts can also reduce the production of pro-inflammatory cytokines, such as TNF- α , IL-1 β , IL-6, and IL-8, and promote the release of anti-inflammatory cytokines like IL-10. They may also have antioxidant properties that neutralize free radicals and reactive oxygen species, helping to mitigate inflammation and prevent cellular damage [18]. *Olex subscorpioidea* extracts may also interact with immune system components, affecting immune cell function, signaling molecules, and immune regulation. Understanding these mechanisms can help in elucidating the therapeutic potential of these extracts for treating inflammatory conditions and designing effective interventions. Overall, understanding these mechanisms can help in designing effective interventions for treating inflammatory conditions.

DISCUSSION

The study examines the anti-inflammatory properties of *Olex subscorpioidea* extracts, comparing them with previous studies. It also identifies novel mechanisms and unique bioactive compounds. The study evaluates if the proposed mechanisms align with existing literature, addressing any discrepancies. It also compares the results with ethanol and aqueous extracts, highlighting any advantages or limitations. The findings suggest potential therapeutic benefits for arthritis management, including anti-inflammatory effects and disease-modifying potential. The safety profile of *Olex subscorpioidea* extracts is discussed, along with the optimal dosage and formulation. The study also explores the potential integration of *Olex subscorpioidea* extracts into current arthritis treatment regimens, suggesting potential for complementary or alternative therapies. Future research directions include clinical trials to confirm efficacy and safety, potential interactions with other medications, and long-term effects. The study also highlights the potential for *Olex subscorpioidea* extracts to be cost-effective and accessible for arthritis management [19].

Future Research Directions

Future research on *Olex subscorpioidea* extracts should focus on dosage optimization and long-term effects. This includes determining effective dosages and formulating different formulations to maximize therapeutic effects. Long-term effects should be assessed through chronic exposure studies, evaluating cumulative effects, long-term toxicity, and sustained therapeutic benefits. Longitudinal studies should assess the extract's impact on disease progression, safety profiles, and interactions with other medications. *Olex subscorpioidea* extracts have potential therapeutic applications in chronic diseases, cancer research, neuroprotective and cognitive benefits, metabolic and endocrine disorders, dermatological uses, and synergistic effects. In-depth studies should be conducted to understand the exact mechanisms through which extracts exert their effects. Clinical trials should validate preclinical findings and confirm the efficacy and safety of *Olex subscorpioidea* extracts in human subjects [17]. These studies will help uncover the full potential of these extracts and facilitate their translation into clinical applications.

CONCLUSION

Olax subscorpioidea, a plant species deeply rooted in traditional African medicine, has demonstrated significant therapeutic potential, particularly in managing inflammatory conditions such as arthritis. This study evaluated the anti-inflammatory properties of *Olax subscorpioidea* root extracts in a preclinical arthritis model, revealing promising results. Both aqueous and ethanol extracts exhibited notable anti-inflammatory and analgesic effects, likely mediated through inhibition of pro-inflammatory enzymes, modulation of cytokine production, and enhancement of antioxidant activity. The preparation of these extracts followed rigorous protocols to ensure quality and consistency, enabling a comprehensive assessment of their pharmacological effects. The comparative analysis between aqueous and ethanol extracts highlighted the broader range of bioactive compounds in ethanol extracts, potentially offering more comprehensive therapeutic benefits. However, both extract types showed efficacy in reducing inflammatory parameters, with safety and toxicity assessments confirming their non-toxic nature at tested doses. The findings underscore the potential of *Olax subscorpioidea* as a natural anti-inflammatory agent, supporting its traditional uses and paving the way for its integration into modern therapeutic regimens. Future research should focus on optimizing dosages, understanding long-term effects, and exploring other therapeutic applications of *Olax subscorpioidea*. Clinical trials are essential to validate these preclinical findings and to ensure the efficacy and safety of these extracts in human subjects.

In conclusion, *Olax subscorpioidea* holds significant promise as a natural therapeutic agent for managing inflammatory conditions, particularly arthritis. The continued exploration and validation of its medicinal properties will contribute to the development of effective, accessible, and sustainable treatments, enhancing healthcare outcomes and preserving the rich ethnobotanical heritage of Africa.

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