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# Antioxidant and anti-inflammatory activities of decoction from a Saharan plant

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# Abstract

*Haloxylon. sp*, commonly known as Remth, is a halophytic shrub belonging to the Amaranthaceae family which is used for its therapeutic properties, particularly its anti-inflammatory effect. The present study aimed to evaluate the antioxidant and anti-inflammatory activities of the aqueous extract of the aerial parts of *H. sp* using both *in vitro* and *in vivo* approaches. The extract demonstrated notable antioxidant capacity, exhibiting $IC_{50}$ values of 0.36 mg/ml in the hydrogen peroxide scavenging assay and 0.07 mg/ml in the ferrous ion chelating assay. Furthermore, *in vitro* anti-inflammatory evaluation via the egg albumin denaturation assay revealed a high inhibition rate of 94.98% at a concentration of 1 mg/ml. In the *in vivo* carrageenan induced rat paw edema model, the extract significantly suppressed inflammation by 77.57% at a dose of 200 mg/kg. These findings support the traditional medicinal use of *H. sp* and highlight its potential as a natural source of bioactive compounds with promising antioxidant and anti-inflammatory properties for future pharmaceutical applications.



Keywords: *Haloxylon. sp*, Antioxidant activity, Anti-inflammatory activity, Chelation, Protein denation

## الملخص

*Haloxylon .sp* المعروفة باسم الرمث، هي شجيرة ملحية تنتمي إلى الفصيلة القطيفية، وتستخدم تقليديًا في الطب الشعبي لخصائصها العلاجية، ولا سيما تأثيرها المضاد الالتهابات. تهدف هذه الدراسة إلى تقييم فعالية المستخلص المائي للجزء الهوائي لـ *H. sp* كمضاد للأكسدة ومضاد للالتهابات مخبريا وعند الحيوان الحي. تم تقييم النشاطية المضادة للأكسدة باستخدام اختبار إزاحة بيروكسيد الهيدروجين واختبار استخلاب الحديد. أظهر المستخلص فعالية ملحوظة كمضاد للأكسدة، حيث بلغت قيم $IC_{50}$ 0.36 ملغ/مل في اختبار إزاحة بيروكسيد الهيدروجين و0.078 ملغ/مل في اختبار استخلاب الحديد. تم تقييم النشاطية المضادة للالتهاب في المختبر باستخدام اختبار تخريب ألبومين البيض، حيث أظهر المستخلص نسبة تثبيط عالية بلغت 94.98% عند التركيز 1 ملغ/مل. كما تم التحقق من النشاط المضاد للالتهاب في الحيوان الحي باستخدام نموذج وذمة كف الجرذ المُحفزة بالكاراجينان حيث أظهر المستخلص نسبة تثبيط ملحوظًة بلغت 77.57 % عند جرعة 200 ملغ/كغ. تدعم هذه النتائج الاستخدام الطبي التقليدي لنبات *H .sp*، وتُبرز إمكاناته كمصدر طبيعي للمركبات النشطة بيولوجيًا ذات الخصائص المضادة للأكسدة والالتهابات، مما يجعله مناسبًا للتطبيقات الصيدلانية المستقبلية.



**الكلمات المفتاحية**:*Haloxylon . sp*، النشاطية المضادة للأكسدة، النشاطية المضادة للالتهاب، استخلاب الحديد، تخريب ألبومين البيض

# Résumé

*Haloxylon. sp*, communément connu sous le nom de Remth, est un arbuste halophyte appartenant à la famille des Amaranthaceae qui est utilisé pour ses propriétés thérapeutiques, en particulier son effet anti-inflammatoire. La présente étude visait à évaluer les activités antioxydante et anti-inflammatoire de l'extrait aqueux des parties aériennes d' *H. .sp* en utilisant des approches à la fois *in vitro* et *in vivo*. L'extrait a démontré une capacité antioxydante notable, présentant des valeurs d'$IC_{50}$ de 0.36 mg/ml dans le test de piégeage du peroxyde d'hydrogène et de 0.07 mg/ml dans le test de chélation des ions ferreux. En outre, l'évaluation anti-inflammatoire *in vitro* par le test de dénaturation de l'albumine d'œuf a révélé un taux élevé d'inhibition de 94.98 % à une concentration de 1 mg/ml. Dans le modèle *in vivo* d'œdème de la patte du rat induit par la carraghénane, l'extrait a significativement inhibé l'inflammation de 77.57 % à une dose de 200 mg/kg. Ces résultats soutiennent l'utilisation médicinale traditionnelle *d'H. sp* et mettent en évidence son potentiel en tant que source naturelle de composés bioactifs dotés de propriétés antioxydantes et anti-inflammatoires prometteuses pour de futures applications pharmaceutiques.

**Mots-clés :** *Haloxylon. sp*, Activité antioxydante, Activité anti-inflammatoire, chélation, Dénaturation des protéines.

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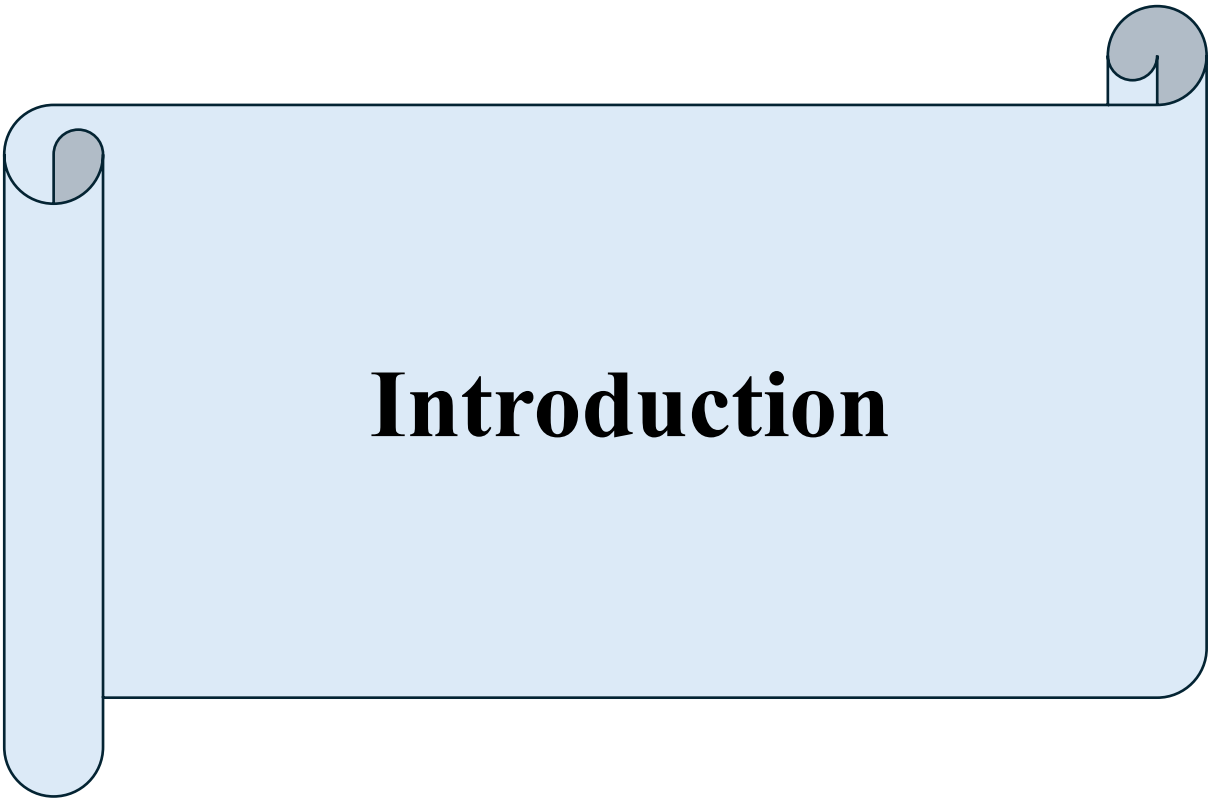
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Introduction

# Introduction

Oxidative stress is defined as a physiological imbalance between the organism's endogenous defense mechanisms and the production of reactive oxygen species (ROS). Due to the brain's high metabolic rate and significant oxygen consumption, it is uniquely vulnerable to oxidative damage. The accumulation of excessive ROS targets essential biomolecules, precipitating cellular malfunction and neurodegeneration. This process serves as a pivotal mechanism in the development of various pathologies as neurological disorders, cardiovascular and inflammatory diseases, highlighting the importance of antioxidant strategies in slowing disease progression (Dash *et al*., 2025).

Inflammation is a biological response initiated by the body in reaction to tissue injury, stress, or infection. This physiological process involves the intervention of the immune system. Under certain circumstances, this process can become harmful, leading to severe pathological conditions. The prolonged over expression of inflammatory factors can dysregulate various physiological processes by activating the inflammatory cascade. Cellular inflammation can be a driving factor for several diseases, resulting in cell death and organ damage, and chronic cellular stimulation, there by initiating tumor formation. Consequently, chronic inflammation is considered an integral part of the development of various systemic conditions, including diabetes, cardiovascular diseases, cancer, digestive disorders, autoimmune diseases, and neurodegenerative disorders (Bouyahya *et al*.,2021).

Since ancient times, medicinal plants have played a fundamental role in global healthcare systems through the modulation of biological pathways and the treatment of diverse pathologies. In contemporary pharmacology, these species are characterized as specialized biological factories endowed with a unique metabolic capacity to synthesize an extensive repertoire of bioactive secondary metabolites including phenolic compounds, alkaloids, terpenoids, and saponins endowed with potent anti-inflammatory, antioxidant, and antimicrobial activities. Rather than mere traditional remedies, these botanical species serve as an indispensable chemical reservoir for modern drug discovery. By providing precise molecular scaffolds, they act as either the direct source or the structural inspiration for a

significant proportion of the clinical agents used today to manage complex inflammatory and oxidative disorders (Yousif *et al*., 2021; Venkatasai *et al*., 2025).

Among medicinal plants adapted to arid and semi-arid environments, *Haloxylon. sp* is a halophytic shrub belonging to the Amaranthaceae family and widely distributed across desert regions of North Africa and the Middle East (Ksouri *et al*., 2012). Traditionally, this species has been used in folk medicine for the management of fever, inflammatory conditions, digestive disorders, and pain-related ailments (Amtaghri and Eddouks, 2024). Phytochemical investigations have shown that *H. sp* contains a variety of bioactive compounds, particularly phenolic compounds, flavonoids, and alkaloids, which are largely responsible for its therapeutic potential (El-Desoukey *et al*., 2022). Therefore, this species may represent a promising natural source of bioactive compounds useful in the prevention and management of diseases associated with oxidative stress and inflammation.

In this context, the present study aims to evaluate the antioxidant and the anti-inflammatory potential of the aqueous extract of *H .sp* through *in vitro* and *in vivo* approaches. Furthermore, this work contributes to the scientific valorization of local medicinal flora and supports the search for safer natural therapeutic agents with reduced adverse effects.