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THESIS

Presented by

ROUANE HOUDA

ROUINA HIBAT ERRAHMANE

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TOPIC

Evaluation of the antioxidant potential of *Myrtus communis* L. aqueous extract

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JURY:

Chair: KADA SEOUSSEN **MCB. UFA Setif 1**

Supervisor: LAOUICHA SALIHA **MCB. UFA Setif 1**

Examiner: MEROUANI NAWEL **MCA. UFA Setif 1**

Laboratory Of Applied Biochemistry

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Dedication

*With a heart full of reverence and gratitude, I humbly dedicate this work to **the Almighty**, whose boundless grace and silent guidance have been my constant compass in the face of adversity. It is by His divine mercy that I have endured and prevailed.*

*To my most **honourable parents**, whose steadfast love, noble sacrifices, and unwavering devotion have shaped the very foundation of my being, may this modest accomplishment stand as a small token of the immeasurable debt I owe them.*

*To **myself**, not in vanity, but in solemn acknowledgment, for the silent battles fought, the weariness endured, and the strength summoned in solitude. You have persisted where many falter, and for that, I offer you this moment of grace.*

*To the esteemed **Rouane family**, whose name I carry with pride, may this work reflect the values, strength, and quiet honour you have instilled in me.*

And to all those who walked beside me, in word, in spirit, or in deed, your presence, however gentle, was not forgotten.

Respectfully dedicated by,
Houda Rouane

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To my ***beloved parents****, whose unwavering love, sacrifices, and quiet strength have accompanied me through every season of this journey, I am* forever *indebted. Their faith in me has been a source of strength more constant than the passing of time.*

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Penned with humble thanks,

Houda Rouane

Dedication

*First and foremost, I thank **God** Almighty for His endless blessings and guidance, without which I could not have reached this point.*

*I dedicate this work to my beloved **parents** who supported me morally before materially, and stood by me throughout my journey, always encouraging me.*

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Hibat errahmane Rouina

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Penned with humble thanks,

Hibat errahmane Rouina

الملخص

تهدف هذه الدراسة إلى تقييم الفعالية المضادة للأكسدة للمستخلص المائي لنبات الريحان من العائلة الآسية ، بالاعتماد على مجموعة من الاختبارات الكيميائية الحيوية والفيتوكيميائية التي تم اختيارها بدقة لتغطية مختلف آليات العمل المضاد للأكسدة . تم الحصول على المستخلص من الأجزاء الهوائية للنبتة باستخدام تقنية الغليان في الماء، وهي طريقة تقليدية بسيطة لكنها فعالة، وأسفرت عن مردود جيد بلغ 23.9%. تم تقدير الفعالية المضادة للأكسدة للمستخلص باستخدام ثلاث طرق :اختبار DPPH، واختبار القدرة الارجاعية، واختبار تثبيط أكسدة الدهون. في اختبارDPPH ، وهو من أكثر الاختبارات استخدامًا لتقدير قدرة المركبات على تحييد الجذور الحرة، أظهر المستخلص فعالية واضحة، حيث بلغت قيمة IC_{50} المنخفضة 7.49 0.18 ±ميكروغرام/مل، مقارنة بمضاد الأكسدة المرجعي BHT الذي سجل قيمة IC_{50} أعلى بلغت 0.098 ± 23.97 ميكروغرام/مل .هذا الفرق الكبير يُبرز فعالية المستخلص المائي في تحييد الجذور الحرة، حتى بتراكيز ضئيلة .وقد تم دعم هذه النتائج من خلال اختبار القدرة الارجاعية ، والذي أظهر قدرة المستخلص على المنح بالإلكترونات وبالتالي تثبيت الجذور الحرة، حيث بلغ EC_{50} للمستخلص 0.66 ± 17.07 ميكروغرام/مل، وهي نتيجة تعكس نشاطًا مختزلًا مهمًا .بالإضافة إلى ذلك، أظهر المستخلص قدرة معتبرة على تثبيط أكسدة حمض اللينولييك بنسبة وصلت إلى 57.49% بعد 72 ساعة من الحضن، وهي نتيجة تُقارب تلك المسجلة باستخدامBHT ، مما يعزز من فعالية المستخلص كمضاد للأكسدة في الوسط الدهني .تدل هذه النتائج تم الحصول عليها من خلال تكرار التجارب وتحليلها إحصائيًا، على أن مستخلص *Myrtus communis* يُعد مصدرًا واعدًا وطبيعيًا للمركبات المضادة للأكسدة، يمكن أن يُستثمر في تطبيقات متعددة، سواء في القطاع الغذائي كمادة حافظة طبيعية، أو في المجال الصيدلاني للوقاية من الحالات المرتبطة بالإجهاد التأكسدي .كما تفتح هذه النتائج آفاقًا للبحث في تأثيرات أخرى محتملة للمستخلص على المستوى الخلوي والنسيجي، خاصة في سياق الوقاية من الأمراض المزمنة ذات المنشأ الالتهابي أو التأكسدي .

الكلمات المفتاحية : أكسدة الدهون، القدرة الإرجاعية، الفينولات، مضاد الأكسدة، نبات الريحان.

Abstract

The present study was conducted to investigate the antioxidant potential of the aqueous extract of *Myrtus communis* L., a plant known for its medicinal uses and bioactive phytochemical composition. The extract was obtained through a traditional decoction method using the aerial parts of the plant. Despite its simplicity, this extraction technique preserved a significant proportion of the plant's active compounds, especially polyphenols and flavonoids, which are known contributors to antioxidant activity. Quantitative phytochemical analysis revealed high concentrations of total polyphenols (98.72 ± 22.79 µg GAE/mg) and flavonoids (8.11 ± 0.46 µg QE/mg), highlighting the richness of the extract in antioxidant compounds. The *in vitro* antioxidant activity was assessed using multiple assays. The DPPH radical scavenging test, a widely accepted method for evaluating free radical neutralization, showed a remarkably low IC_{50} value of 7.49 ± 0.18 µg/ml, significantly better than that of the synthetic antioxidant BHT (23.97 ± 0.098 µg/ml). This strong scavenging effect indicates the extract's high efficiency in donating electrons or hydrogen atoms to neutralize reactive species. Furthermore, the reducing power assay confirmed the extract's ability to act as an electron donor, with an EC_{50} of 17.07 ± 0.66 µg/m L.. In addition, the extract showed a 57.49% inhibition of linoleic acid peroxidation after 72 hours, a result that closely parallels that of BHT, thereby confirming its stability and effectiveness over time in lipid-based systems. Altogether, the outcomes of this work point to a notable antioxidant capacity of *Myrtus communis*aqueous extract, attributable to its phytochemical richness. These findings suggest promising applications in the fields of functional foods, cosmetics, and pharmaceuticals, particularly as a safer, natural substitute for synthetic antioxidants. Given the rising concerns over synthetic additive toxicity, this plant extract could offer a sustainable alternative in health-focused industries.

Keywords: Antioxidant, lipid peroxidation, *Myrtus communis* L., polyphenols, reducing power.

Résumé

La présente étude a été entreprise afin d'évaluer le potentiel antioxydant de l'extrait aqueux de *Myrtus communis* L., une plante reconnue pour ses usages médicinaux traditionnels et sa richesse en composés phytochimiques actifs. L'extraction a été réalisée par décoction de la partie aérienne de la plante. Malgré son caractère artisanal, cette méthode a permis de préserver une quantité significative de substances antioxydantes hydrophiles. L'analyse quantitative a révélé une teneur élevée en polyphénols totaux (98,72 ± 22,79 µg EAG/mg) et en flavonoïdes (8,11 ± 0,46 µg EQ/mg), ce qui témoigne d'une composition riche en métabolites secondaires connus pour leurs effets antioxydants. L'évaluation de l'activité antioxydante a été menée à l'aide de plusieurs tests *in vitro*. Le test DPPH, qui mesure la capacité des composés à piéger les radicaux libres, a révélé une IC_{50} très faible (7,49 ± 0,18 µg/ml), bien inférieure à celle du BHT (23.97 ± 0.098 µg/ml) utilisé comme référence. Dans le test du pouvoir réducteur, l'extrait étudié a révélé une EC_{50} de 17,07 ± 0,66 µg/ml, indiquant une capacité à céder des électrons pour stabiliser les radicaux libres. Par ailleurs, l'inhibition de la peroxydation de l'acide linoléique exsercée par l'extrait aqueux de cette plante atteignant 57,49 % après 72 heures, une valeur proche de celle observée avec le BHT utilisé comme standard. En somme, l'ensemble des résultats obtenus met en évidence le fort potentiel antioxydant de l'extrait aqueux de *Myrtus communis*, lié à sa composition phytochimique dense. Cette efficacité justifie son usage futur dans les domaines alimentaire, cosmétique et pharmaceutique, en tant qu'alternative naturelle, sûre et durable aux antioxydants de synthèse. À l'heure où les préoccupations autour des additifs chimiques augmentent, ce type d'extrait pourrait représenter une voie prometteuse et respectueuse de la santé humaine.

Mots-clés : Antioxydant, *Myrtus communis* L. , peroxydation lipidique, polyphénols, pouvoir réducteur.