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To my dearest parents,

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ملخص

كينوا البري هو محصول غذائي قديم ينتمي إلى عائلة Amaranthaceae. إنه خالٍ من الغلوتين، مما يجعله صحيًا، خاصةً للأفراد الذين يعانون من حساسية الغلوتين. سعت هذه الدراسة إلى إجراء مسح إثنوفارماكولوجي، سمية حادة، خصائص مضادة للالتهابات ومضادة للأكسدة في المختبر لنبات الكينوا البري (*C. quinoa* Wild). تشير نتائج استبيان علم الأدوية العرقي إلى أن 5.4% من الناس يستخدمونها بشكل بارز كمكون غذائي أساسي، خاصة لمرضى السيلياك. التحليل الكيميائي الكمي أن محتوى البوليفينول والفلافونويدات والتانينات الكلي يقدم قيمًا تبلغ 2.42 ± 95.3 ميكروغرام مكافئ حمض الغاليك؛ 0.18 ± 6.22 ميكروغرام مكافئ كيرسيتين و 5.89 ± 21.93 ميكروغرام مكافئ كاتيشين/ملغ من المستخلصات المجففة، على التوالي. أظهر اختبار السمية في الجسم الحي أن المستخلص الإيثانولي (EthE) من بذور الكينوا البرية لم يظهر أي آثار ضارة أو وفيات في الفئران، حيث تجاوزت الجرعة القاتلة المتوسطة (LD_{50}) عند إعطائها عن طريق الفم 2 جرام/كجم (وزن الجسم). أظهرت النشاط المضاد للأكسدة في المختبر نشاطًا في التخلص من الجذور الحرة. أظهر المستخلص الإيثانولي (EthE) للبذور أيضًا فعالية مضادة للالتهابات في المختبر وتعتمد على الجرعة. من خلال الدراسة الإثنوطينية، تثبت نتائجنا الاستخدام الطبي لـ *Chenopodium quinoa* Wild في الطب التقليدي و مصدر إضافي للعوامل المضادة للالتهابات ومضادات الأكسدة الطبيعية .

الكلمات المفتاحية: *Chenopodium quinoa* Wild ، المركبات النباتية، الإثنوفيزيولوجية، النشاط المضاد للأكسدة، النشاط المضاد للالتهابات، السمية .

Abstract

Chenopodium quinoa Wild is an ancient food crop belongs to the Amaranthaceae family. It is gluten-free this makes it a healthy, especially individuals with gluten sensitivity. This study sought to perform an ethnopharmacological survey, acute toxicity, *in vitro* anti-inflammatory and antioxidant properties of *C. quinoa* Wild. Results from an ethnopharmacological questionnaire indicate that 5.4% of people are prominently used as a primary dietary component, especially for celiac patients. The quantitative phytochemical analysis revealed that the overall polyphenol, flavonoids and tannins contents present a values of 95.3 ± 2.42 μg gallic acid equivalent; 6.22 ± 0.18 μg quercitine equivalent and 21.93 ± 5.89 μg catechin equivalent/mg dried extracts, respectively. The *in vivo* toxicity test indicated that the ethanolic extract (EthE) from *C. quinoa* Wild seeds exhibited no adverse effects or fatalities in mice, the median lethal dose (LD_{50}) when administered orally exceeded 2 g/kg (body weight). *In vitro* antioxidant activity showed a scavenging activity. The ethanolic extract (EthE) of the seeds also displayed *in vitro* anti-inflammatory potency and dose dependent. Through ethnomedicinal study, our findings prove the medicinal use of *Chenopodium quinoa* Wild in traditional medicine and as an additional source for natural anti-inflammatory and antioxidant agents.

Keywords: *Chenopodium quinoa* Wild, phytochemicals, ethnopharmacological, antioxidant activity, anti-inflammatory activity, toxicity.

Résumé

Chenopodium quinoa Wild est une culture alimentaire ancienne appartenant à la famille des Amaranthaceae. Il est sans gluten, ce qui le rend sain, en particulier pour les personnes sensibles au gluten. Cette étude visait à réaliser une enquête ethnopharmacologique, une évaluation de la toxicité aiguë, ainsi que des propriétés anti-inflammatoires et antioxydantes *in vitro* de *C. quinoa* Wild. Les résultats d'un questionnaire ethnopharmacologique indiquent que 5.4% des personnes l'utilisent principalement comme composant alimentaire, en particulier pour les patients cœliaques. L'analyse phytochimique quantitative a révélé que les teneurs globales en polyphénols, flavonoïdes et tanins présentent des valeurs de 95.3 ± 2.42 µg équivalent acide gallique ; 6.22 ± 0.18 µg équivalent quercétine et 21.93 ± 5.89 µg équivalent catéchine/mg d'extraits secs, respectivement. Le test de toxicité *in vivo* a indiqué que l'extrait éthanolique (EthE) des graines sauvages de *C. quinoa* n'a présenté aucun effet indésirable ni aucune mortalité chez les souris, la dose létale médiane (DL₅₀) lorsqu'elle était administrée par voie orale dépassait 2 g/kg (poids corporel). L'activité antioxydante *in vitro* a montré une activité de piégeage. L'extrait éthanolique (EthE) des graines a également montré une puissance anti-inflammatoire *in vitro* et dépendante de la dose. À travers une étude ethnomédicinale, nos résultats prouvent l'utilisation médicinale de *Chenopodium quinoa* Wild dans la médecine traditionnelle et comme source supplémentaire d'agents anti-inflammatoires et antioxydants naturels.

Mots-clés : *Chenopodium quinoa* Wild, phytochemicals, ethnopharmacologique, activité antioxydante, activité anti-inflammatoire, toxicité.

List of figure

Figure 1: Phenolic compounds families: chemical structure core and classical division of some of the most common classes found in food.	4
Figure 2: Chemical structures of flavonoid compounds. (A) Flavones; (B) Flavonols; (C) Flavanones; (D) Isoflavonoids; (E) Neoflavonoids; (F) Flavanols; (G) Anthocyanins.	5
Figure 3 : Some examples of structures of the tannin main subgroups.	6
Figure 4: Functional activities and cellular metabolism leading to oxidative stress.....	8
Figure5: Schematic showing that when a cell membrane is injured the arachidonicacidPathwayis activated to initiate the local inflammatory response through the production of prostaglandins, thromboxanes, and leukotrienes.	10
Figure 6: Balance between mediators of oxidative stress/inflammation and antioxidants/anti-inflammatory mediators.	12
Figure 7: <i>Chenopodium quinoa</i> wild seeds.....	13
Figure 8: Location of the first quinoa cultivation trials in Algeria.....	14
Figure 9: Seeds structure of quinoa (a-Source of polyphenols, saponin and starch; b- Source protein and lipids).....	15
Figure 10: Secondary metabolites and bioactive molecules present in the quinoa grains.	16
Figure 11: Ground <i>Chenopodium quinoa</i> Wild	18
Figure 12: Extraction of <i>C.quinoa</i> wild	19
Figure 13: Standard curve of gallic acid for determination of total polyphenols.....	20
Figure 14: Standard curve of quercetine for determination of total flavonoids.....	20
Figure 15: standard curve of catechin for detection of condensed tannins.....	21
Figure 16: Manipulation during the oral toxicity study.....	21
Figure 17: Percentage of aware (A) and Percentage of use (B) of quinoa seeds.	23
Figure 18: Percentage of reasons why people eat quinoa seeds.....	24
Figure 19: Presente the Information people know about quinoa seeds.....	24
Figure 20: Percentage of Celiac Disease Patients	26
Figure 21: Comparison of IC ₅₀ of antioxidant activity of ethanolic extract and BHT	28
Figure 22: Comparison of IC ₅₀ of anti-inflammatory activity of ethanolic extract and Aspirin	29

List of tables

Tableau 1: Anti-inflammatory activities of some polyphenolic compounds.....	11
Tableau 2: Scientific classification of <i>Chenopodium quinoa</i> Wild	13
Tableau 3: Presents the demographic of the respondents	25
Tableau 4: Presents the various methods in which people use quinoa seeds.....	25

List of Abbreviations

ROS: Reactive oxygen species
RNS: Reactive nitrogen species
PLA₂: Phospholipase A₂
AA: Arachidonic acid
COX: Cyclooxygenase
PGs: Prostaglandins
TXA₂: Thromboxan A₂
LOX: Lipoxygenase
HpETEs: Hydroperoxyeicosatetraenoic acids
HETEs: Hydroxyeicosatetraenoic acids
LTs: Leukotrienes
LPS: Lipopolysaccharide
Casp-1: Caspase-1
IL: Interleukin
NLRP: NOD-like receptor protein
NF- κ B: Nuclear factor-kappa B
GST: Glutathione S-transferase
NQO1 (NAD(P)H): Quinone oxidoreductase 1
MCP-1: Monocyte chemotactic protein-1
ICAM-1: Intercellular adhesion molecule-1
AhR: Aryl hydrocarbon receptor
IFN- γ : Interferon-gamma
MIP-1: Macrophage inflammatory protein-1
MDA: Malondialdehyde
PCB: Polychlorinated biphenyls
SOD: Superoxide dismutase
GSR: Glutathione S-reductase
GST: Glutathione S-transferase