



Study based on the pharmacological toxicology of Lamiaceae plants, *Artemisia*, *Plantago major* L, and *psyllium* in Morrocco

Fatima Aslaou¹ , Aida Soulaymani² , Halima Ibrahimi^{1,3} , Milouda Chebabe³ , Hefdhallah Al-Aizari^{1,4} ,
Nour El houda Aslaou⁵ 

¹Laboratory of natural resources and sustainable development, Faculty of Sciences, Ibn Tofail University, Kenitra, Morocco,
aslaoufatima@gmail.com

²Laboratory of Economics, Management, Public Health Economics, Management, Public Health, Ibn Tofail, Morocco

³Laboratory of Health Sciences and Technologies, Higher Institute of Health Sciences, Hassan 1 University, Settat, Morocco

⁴Research Team on Health and Nutrition of Mother and Child, Mohammed V University, Faculty of Medicine and Pharmacy, Rabat, Morocco

⁵Laboratory of Chemistry, Faculty of Education, Dhamar University, Yemen.

⁶Regional Sales & Marketing manager – Middle East & Africa – Medetech Industry Expert

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PREFIX :

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IJSRIS JOURNAL



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ABSTRACT

Absinthe, or *Artemisia absinthium* L., is a plant in the Asteraceae family (formerly Compositae). It is a biennial or perennial herbaceous species of wormwood that grows between 0.4 and 1 meter tall. The plant is covered in silky white and silvery hairs that create a kind of down, giving it an ash-gray look. Its rhizome is tough. In southern Morocco, obesity is seen as essential for Sahrawi women because it reflects being raised in a wealthy household and makes them attractive to men who mainly look for a woman of noble lineage and a voluptuous figure; abdominal obesity is very common. Remember, obesity is considered important for Sahrawi women as it signifies a wealthy upbringing, making them desirable to men who primarily seek a woman of noble lineage and a plump figure. Plantaginaceae use: While Lamiaceae is often dominant, *Plantago* species from the Plantaginaceae family, such as *Plantago major* or *Plantago ovata*, are recognized.

Keywords: Obesite, *Artemisia absinthium* L., Lamiaceae, Plantaginaceae, alpha-Thujone, Brassicaceae.

1. Introduction

In southern Morocco, obesity is considered essential for Sahrawi women, as it reflects their upbringing in a wealthy household and makes them desirable in the eyes of men who seek, above all, a woman of noble lineage and voluptuous figure; the prevalence of abdominal obesity is very high (1).

The daily life of a young girl in the desert subjected to this diet is astonishing. She is forced to get up at dawn to begin her meal, which continues until sunset. First, she is given a large bowl of camel milk, sometimes as much as two liters. She is ordered to remain motionless until sunrise, at which point she is forced to drink soup, eat dates, sweets, and tea, and then drink another large bowl of whole milk. Before lunch, she is served a dish of roasted camel meat with potatoes. At noon, she is given a large plate of rice or couscous, accompanied by milk. Before dinner, she eats dates and soup, followed by another plate of rice (2).

According to the latest international obesity estimates, in 2025, 2.5 billion adults aged 18 and over were overweight. Among them, 890 million were obese. In 2022, 43% of adults aged 18 and over were overweight, and 16% were obese. In 2024, 35 million children under 5 were overweight, according to the World Health Organization (3). Moroccan beauty has its own set of criteria, particularly among some women who reject international standards that promote thinness and bohemian, glamorous hairstyles. They create their own image

of the ideal woman within their culture, where beauty is defined by excess weight and long, straight, black hair. To achieve this ideal, they resort to various life-threatening practices: traditional weight-gain recipes, the use of animal-derived medicines and pharmaceuticals, and even toxic substances that can lead to leukemia, kidney failure, infertility, or even death (4).

Remember that Obesity is considered essential for Sahrawi women as it signifies their upbringing in a wealthy household, making them desirable to men who primarily seek a woman of noble lineage and a plump figure. The "Tablah" program consists of rigorous steps that can have serious future health consequences, including the development of obesity-related diseases such as diabetes, high blood pressure, and damage to vital organs (5). The diet is astonishing; the girl is forced to wake up at dawn to begin a feeding spree that lasts until sunset. She is initially given a large bowl of camel milk, sometimes as much as two liters. She is instructed to remain still until sunrise, at which point she is forced to drink soup, eat dates, sweets, and tea, followed by another large bowl of whole milk, as well as large meat dishes (6). It is worth recalling that the Hassan II Institute of Agriculture and Veterinary Medicine in Rabat was able to identify some of the components of these suppositories, notably wormwood, which contains oils such as camphor. This exposes the population to the risk of infection. The genus *Artemisia*, belonging to the Asteraceae family, comprises over 300 described species, most of which live in temperate regions or the arid steppes of the Northern Hemisphere. A number of species have been cultivated since ancient times. It should be noted that wormwood is a versatile plant used in various fields, from medicine and cooking to gardening. One of its main uses by healthcare professionals is medicinal, where it is used to stimulate appetite. To prepare an infusion, steep 1.5 g of wormwood in 250 ml of hot water for 10 minutes, and drink it 30 minutes before meals. Avoid prolonged use (7).

Indeed, recent toxicological studies have shed light on the mechanism behind the strong convulsant effect of thujone, the main active ingredient in wormwood oil. However, these studies, like previous ones, do not allow us to conclude that the beverage itself is epileptogenic. Wormwood has long been recognized as a medicinal plant. It belongs to the Asteraceae family, and its floral composition classifies it among the radiate Asteraceae. It is worth recalling that the prevalence of obesity and associated cardiovascular risk factors in a population of Sahrawi women aged 15 to 70 years, who are not pregnant.



Figure 1: Wormwood

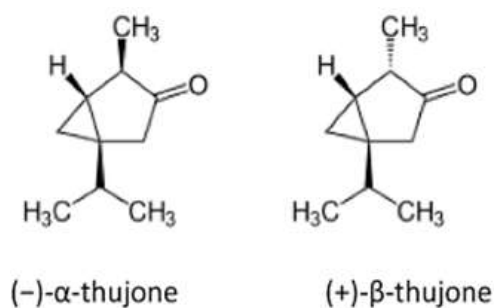


Figure 2: alpha-Thujone

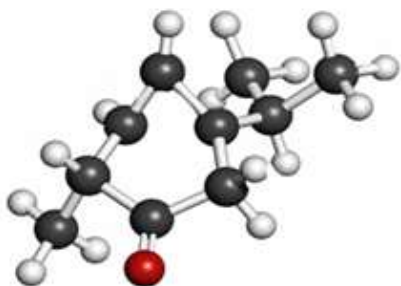


Figure 3: Estriol (oestriol) human estrogen hormone molecule

For herbal teas, use 1 tablespoon of wormwood per liter of boiling water, let it steep covered for 15-30 minutes, and then strain. It is helpful for digestive problems. Before lunch, the young girl is served a dish of roast camel meat with potatoes. At midday, she is given a large bowl of rice or couscous with milk. Before dinner, she eats dates and soup, followed by another dish of rice in southern Morocco (8).

Each group of women who are responsible for fattening girls keeps some special recipes. One of the girls from the southern regions indicates that there are those who work on allocating a sheep that is prepared for the girl to eat in one day, while preventing her from moving, so that she does not exert any

effort that may cause her to lose some grams. Therefore, a state of lethargy is imposed on her, so that she spends her time between sleeping, or taking care of her skin and hair while sitting. Creating Hormonal Imbalances to Inspire Obesity Drugs for cows: causing hormonal imbalances to further promote obesity.

The desire to gain weight isn't just a desert dream, as some might think. Many Moroccan women from across the country aspire to gain extra kilograms to achieve a more feminine, "heavy" figure. While herbal remedies remain the older method, requiring patience to achieve the desired results, resorting to medications has become the preferred solution for those seeking to gain weight, considering it a measure of beauty (9).

In particular, women in southern Morocco, due to its nature, consume more of the leaves of Plantaginaceae, which is considered a family of herbaceous plants, often recognized for their medicinal properties, with promising effects on obesity thanks to their high fiber content; however, it risks causing digestive and allergic side effects if misused or poisoned (10).

In this regard, the effect on obesity stems from the seeds (psyllium, *Plantago ovata*) and the leaves (*Plantago major/lanceolata*), which act as laxatives by promoting the swelling of mucilaginous fibers that expand upon contact with water, thereby creating a feeling of fullness, reducing caloric intake, and improving weight management. It should be noted that Sheba herb, which contains essential oils, camphor, and thujone, stimulates the appetite with the aim of attracting men in southern Morocco (11).

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Indeed, Plantaginaceae Use: While Lamiaceae is often dominant, *Plantago* species from the Plantaginaceae family, such as *Plantago major* or *Plantago ovata* are recognized in Moroccan, especially Taza/southern regions, for treating ailments, including diabetes (13).

Wormwood (*Artemisia absinthium*) is an aromatic perennial plant in the Asteraceae family, known for its strong camphor aroma and its historical use in making the drink of the same

name. It is also valued for its medicinal properties and its insect-repellent effects on consumers. Consuming large quantities of alcohol, including wormwood, can have adverse effects (14).

Regarding drug interactions: Due to their high fiber content, plant-based foods may decrease or slow the absorption of other medications. It is advisable to consume them separately from conventional treatments. Studies show that *Plantago* can lower cholesterol, improve insulin sensitivity, and reduce blood sugar, while also helping to combat metabolic syndrome associated with obesity (15).

Indeed, *Plantago* improves digestive issues, but ingesting it without sufficient water can cause gastrointestinal blockages, constipation, abdominal pain, flatulence, or diarrhea. Furthermore, there is a risk of choking when consuming psyllium fiber without adequate liquid, as it can obstruct the throat. Plantain pollen allergies are also a significant factor (rhinitis, sneezing). Skin or respiratory reactions may persist. (16)



Figure 4: *Artemisia* wormwood plant in Morocco

Plantago major L. Greater plantain): Broad leaves. **common in wet areas.**

Description botanique de *Artemisia absinthium* L

Absinthe, or *Artemisia absinthium* L. (Figure), is a plant in the Asteraceae family (formerly Compositae). It is a biennial, perennial, herbaceous species of wormwood that grows to between 0.4 and 1 meter in height. The plant is covered with silky white and silvery hairs that form a sort of down, giving it an ash-gray appearance. Its rhizome is hard. The silvery-

green stem is branched, downy, erect, ribbed, and leafy. The soft leaves, divided into three toothed lobes, are greenish-gray (with silvery highlights) on top and almost white and silky on the underside. They are opposite at the base and then alternate along the rest of the stem.

Description botanique de *Plantago major* L. (Grand plantain)

In Morocco, the Plantaginaceae family is primarily represented by the genus *Plantago* (plantain), with several species used in traditional medicine for their healing, anti-inflammatory, and digestive properties. The most common species are *Plantago major* (broadleaf plantain), *Plantago lanceolata* (Ribwort plantain), and *Plantago afra* /psyllium. The genus *Plantago* (75 species, commonly known as "plantains," with a cosmopolitan biogeographical distribution in temperate and tropical regions (17). Species of the genus *Plantago* are used in traditional medicine worldwide and are included in numerous pharmacopoeias, particularly for the treatment of infections and skin, respiratory, or digestive conditions, as well as in cosmetics and nutrition (18).

It should be noted that the Linaceae of southern Morocco constitute an extremely diverse and complex taxonomic group; in fact, in addition to about ten species common to the southern regions of Morocco, the study given the difficulties involved in accurately identifying some of these species and their variations aims to conduct a general revision for southern Morocco, based on morphological and anatomical criteria. The Botanical Laboratory in Morocco, along with the laboratory at the Cherifian Scientific Institute in Rabat, conducted two other studies: one on the Linaceae family and another on the model plant family Brassicaceae, known as Cruciferae as well as a local study on the Linaceae, which was conducted exclusively at the Botanical Laboratory in northern Morocco, along with an investigation of samples in collaboration with our Algerian neighbors and the laboratory of the Cherifian Scientific Institute (19).

2. Materiel and method

The survey was conducted among traditional healers, herbalists, farmers, shepherds, and users of medicinal plants — a total of 23 people. Most of the participants were elderly, and women made up a large proportion of the group because they commonly practice traditional medicine. The surveys were conducted in Arabic in Arabic-speaking regions. In Berber-speaking regions, a translator from the same ethnic group and speaking the same dialect as the tribe was used. A preliminary survey was conducted in March–April 2026 to assess the areas. According to the survey conducted in the

Rabat-Salé-Kenitra region, the objectives were to understand the local population's attitude toward the survey, obtain general information on medicinal plants, and finally collect and identify the species used, drawing on previous surveys.

In some rural areas, sprigs of wormwood (*Artemisia absinthium* L.) were placed in the newlyweds' bed on their wedding night, as it was believed to enhance sexual prowess and act as an aphrodisiac. Wormwood (*Artemisia absinthium* L.) was a well-known plant in the Middle Ages and is mentioned in most herbals and medical texts. It was reputed to be a general remedy for all ailments; indeed, this is why it was nicknamed "March Herb" in certain regions. The final survey took place in April–May 2026 and was based on the completion of a questionnaire (Figure 3, p. 10) during individual interviews.

The aim: Is to identify Species of the genus *Plantago* are used in traditional medicine worldwide and are included in numerous pharmacopoeias in The objective is to identify the species of the genus *Plantago*, used in traditional medicine worldwide and included in many pharmacopoeias.

In some rural areas, sprigs of wormwood (*Artemisia absinthium* L.) were placed in the newlyweds' bed on their wedding night, as it was believed to enhance sexual prowess and act as an aphrodisiac (20). Trypanocidal, trichomonacidal and cytotoxic components of cultivated *Artemisia absinthium* Linnaeus (Asteraceae) essential oil. Mem. Inst (21).

2.1. Study design and setting

A cross-sectional observational study was conducted on(plante) at the From to August 30. 2026. Brassicaceae Lamiaceae, includes *Artemisia absinthium* L, Plantaginaceae, alpha-Thujone. Plant infections come from changes in their normal state, caused by living or non-living factors, which affect their growth, yield, and overall health.

2.2. Types de maladies

Biotic diseases infectious:

These diseases are caused by fungi, bacteria, viruses, or parasites like aphids, scale insects, and mites. Symptoms include browning of leaves, deformity of shoots, the presence of fine webs (mites) or honeydew promoting sooty mold (aphids). Fungal diseases like downy mildew or damping-off are common and can lead to the rotting of young plants.

2.3. Data collection

Observations Recorded: Collar Study Area: The study was carried out in Nursery of Division of Forest products and Utilization, Faculty of Forestry, SK techniques of *Artemisia absinthium* species. The experimental site falls in a mid to high altitude characterized in the year 2025-26 for standardization of cultivation by hot summers and very cold winters. The average precipitation is 690 mm most of which was received from December to April in the form of snow and rains. The total rainfall (mm) during the experimentation period was 281.2 and 418.80 mm, respectively and means temperature was 24oc. Treatment details: The experiment was laid using 50 cuttings per treatment in three replication under four levels of spacing cm (S1 :10×10, S2 :10×20, S3 :10×30, S4:10×40) and five levels of nitrogen application kg/ha(N1 : 0, N2 : 50, N3 :75, N4 : 100) through factorial randomized complete block design (RCBD), accordingly the data was analyzed in R Studio, version 4.2.2, 2022 (R Development Core Team, 2026). diameter, Height (cm), Plant fresh weight (g), Plant Dry weight (g), seed weight/plant, No. of branches/plant.

2.4. Ethics considerations

The research ethics committee at the Faculty of Medicine and Pharmacy in Rabat and the local center's ethics committee approved the study, which did not interfere with clinical management. Written informed consent was obtained from the study participants in accordance with local requirements. The investigators adhered to the Helsinki declaration 9 and good clinical practice guidelines during the development of the study protocol, including the laboratory tests used during the investigation.

The plant was well known in the Middle Ages and was mentioned in most herbals and medical texts. It was reputed to be a universal remedy for all ailments, which earned it, in some regions, the nickname "the herb of the Faculty of Sciences of Kenitra." Ethical Considerations: Before beginning the survey of individuals exposed to risks, the ethical and professional standards that must be followed were taken into account. Official correspondence was sent to obtain authorization from various provincial departments of education, as well as consent from the survey participants. Inclusion and exclusion criteria: During the study period, herbalists practicing in the field. Statistical analysis: The various data sets were entered and coded using Excel (version 2026). Correlation analyses were performed according to variable type (quantitative, qualitative, nominal, ordinal), and the one-way ANOVA in SPSS was used. Values of $p < 0.05$ were considered statistically significant.

3. Results

3.1. Botanical and Toxicological Findings

Table 1: Botanical Presentation and Characteristics Artemisia absinthium L and Plantaginaceae

Side affects	Artemisia absinthium L	Plantago major L	RR (CI95%)
Weight increase	59(57.8)	12(5.8)	1.2 [1.3, 1.67]
Digestive herbal tea, Arterial pressure	23(22.5)	6(2.9)	4.3 [1.15,1.67]
Hallucinations, depression	67(65.6)	35(17.1)	1.60 [1.07,2.8]
Asthma	19(18.6)	3(1.47)	1.4 [1.16 ,1.34]
Breathing difficulties	3(1.4)	2(0.9)	2.95 [2.34 ,3.5]
Mental deterioration	8(7.8)	1(0.4)	6.30 [6.5, 7.4]
Kidney failure	30(29.4)	68(33.)	1.03 [1.7, 0.85]
Thujone neurotoxin	16(15.6)	6(2.9)	0.92 [0.87, 0.98]
Biliary, gastrointestinal, cerebral problems	47(46)	3(1.4)	3.78 [2.69, 4,1]
Benign hepatic adenoma	7(6.8%)	1(0.4)	1.7 [1.65, 7.93]
Heart failure	6(5.8)	3(1.4)	0.2 [0.73 ,0.89]

Table 2: Botanical Presentation and Characteristics Plantaginaceae

Species	Commun Name	Main Parts Used	Primary Herbal Uses
Plantago major	Greater/ Broadleaf plantain	leaves, roots, seeds	Skin issues, wounds, coughs, gut irritation
Plantago lanceolata	Ribwort/Narrowleaf Plantain	Leaves, Seeds, Roots	Respiratory infections, coughs, wound healing
Plantago ovata	Psyllium, Ispagula	Seed husks (Seeds)	Constipation, irritable bowel syndrome, cholesterol management
Picrorhiza kurroa	Kutki, Kadu	Roots, Rhizomes	Liver health, fever, asthma, allergies
Veronica officinalis	Common Speedwell	Aerial. Parts (laves/flowers)	Coughs, respiratory congestion, skin diseases

Table 3: Botanical Presentation and Characteristics Botanical Artemisia absinthium L

Vernacular Name	Scientific Name	Family	Medicinal uses
St. John's Wort	<i>Hypericum Perforatum</i>	Hypericaceae	Often studied for mood support
Echinacea	Echinacea Pureals	Asteraceae	Commonly used for immune
Valerian	Valerian officinalis	Valerianaceae	Traditionally used for sleep support

Table 4: Vegetative characteristics of the Brassicaceae plant family

Root	Stem	Leaf
Generally, a taproot system. However, in some species of this family, the taproot changes to store nutrients and can take different shapes. Two common forms of modified taproots in this family are spindle-shaped (radish) and turnip-shaped (turnip)	Stem: The stems are generally upright, most often herbaceous, although some are sometimes woody, typically solid and cylindrical, branched or not depending on the species. Most plants are hairy, with stems covered in fine hairs called trichomes.	Leaf: Radical (radish), cauline and branched; simple, alternate, with smooth, toothed, or lobed edges depending on the species; without stipules and generally lyre-shaped

Toxicology of wormwood and the Plantaginaceae and Brassicaceae		
Thujone and, wormwood <i>A. absinthium</i> L. is a native perennial shrub in Europe from Iceland and Scotland to the Mediterranean regions, found in northern India, northern Africa (Morocco, Egypt, Lebanon, Syria, Libya). A major component of the notoriously famous anisobutyric acid A	Plantago major L. Traditional herbal medicinal products (THMPs) containing leaves of <i>Plantago lanceolata</i> L. (narrow-leaved plantain) are well known and very popular among the Moroccan population. THMPs derived from <i>Plantago lanceolata</i> L. and <i>Plantago lanceolata</i> L., folium	Brassicaceae Several species of the genus <i>Brassica</i> are major agricultural crops in various regions of the world and are also known to accumulate heavy metals. Numerous studies have been conducted on the tolerance, uptake, and defense mechanisms of several of these species

3.2. Side Effects of *Artemisia absinthium*

Artemisia absinthium is a significant shrubby perennial plant that has been widely used to treat various ailments. Traditionally, absinthium has always been of pharmaceutical importance because it is used to treat hepatitis, gastritis, jaundice, wound healing, splenomegaly, dyspepsia, indigestion, flatulence, stomach pain, anemia, and anorexia (22).

Similarly, *Plantago major* has several main therapeutic properties, particularly anti-inflammatory and antioxidant effects, which reduce inflammation of tissues and mucous membranes and protect cells from oxidative stress thanks to flavonoids, iridoids, and phenolic acids; it also promotes wound healing and supports skin care (23). With regard to Brassicaceae poisoning, certain natural toxins can form in foods as part of plants' defense mechanisms, through infestation by toxin-producing molds, or through the ingestion of toxin-producing microorganisms by animals (24).

3.3. Side Effects of Plantaginaceae

Plants in the Plantaginaceae family, such as plantain, can have significant side effects: 1. Anti-inflammatory and antiseptic properties: Plantain is used for its anti-inflammatory and antiseptic properties, but excessive consumption can cause laxative and blood-pressure-lowering effects (25). Seasonal allergies: Plantain pollen can cause allergic symptoms such as frequent sneezing, a stuffy nose, conjunctivitis, and a dry cough. People with allergies may experience itchy eyes and skin. 3. Medicinal use: Although plantain is used in herbal medicine, it is important to consult a healthcare professional before use to avoid side effects. High doses of *Plantago major* (plantain) showed negative effects on cell-mediated immunity and antioxidant enzyme activity and promoted melanization in a model organism *Galleria mellonella* (26).

3.4. Side Effects of Lamiaceae

Plants in this family are known for their medicinal properties, particularly their anti-inflammatory, antibacterial, antifungal, and antioxidant effects. Among the species most commonly used in herbal medicine are peppermint (*Mentha piperita*), rosemary (*Rosmarinus officinalis*), sage (*Salvia officinalis*), lemon balm (*Melissa officinalis*), and thyme (*Thymus vulgaris*). These plants contain active compounds such as essential oils, flavonoids, tannins, and phenolic acids, which contribute to their medicinal properties furthermore (27). The symbiotic relationship between humans and medicinal plants forms the very foundation of modern medicine, a legacy that dates back several millennia. Ancient texts from the Ebers Papyrus in Egypt to the Ayurvedic texts of India, and including the writings of Hippocrates and Dioscorides in Greece meticulously document the use of herbal remedies to treat a wide range of ailments (28).

4. Discussion General

According to scientific research, the use of non-pharmaceutical forms of *Artemisia* has attracted considerable interest, particularly in the context of malaria prevention and treatment. The World Health Organization (WHO) has issued a statement indicating that there is no justification for promoting medicinal plants of the genus *Artemisia* or their use in any form for the prevention or treatment of malaria. This statement is based on a thorough analysis of the evidence regarding the efficacy of non-pharmaceutical forms of *Artemisia*, conducted in 2019. The who believes that these herbal remedies should not be used for the prevention or treatment of malaria, and it emphasizes the importance of following established medical guidelines and practices (29). In fact, as with most medicinal herbs, "the artemisinin content

and its efficacy depend on climatic, geographic, and environmental conditions,” the organization explains in recommendations aimed at guiding the pharmaceutical industry in the production of artemisinin of sufficient quality. “Not all *Artemisia annua* plants necessarily contain artemisinin, and in some areas, depending on soil quality and rainfall, the content can be very low,” according to the World Health Organization. *Artemisia annua* is particularly sensitive to humidity and temperature, and its leaves “stored at temperatures above 20°C with high relative humidity result in a substantial loss of artemisinin content,” the organization further explains, adding that the leaves must be stored in a cool, dry place — a condition not necessarily available to people living in rural areas (30). The psyllium (*Plantago ovata*) contained in *Psylllogel fibra* is useful for: promoting regular bowel movements making, promoting regular, content soft and easy, to pass, promoting gut flora balance; slowing down nutrient absorption and promoting carbohydrate and fat metabolism. Review on psyllium husk: nutritional, functional, health benefits, food industry applications, waste treatment, and potential negative effects (31)).

As for the distribution of *Plantago ovata*, it is divided into four categories: Native Range: *Plantago ovata* is native to the Indian subcontinent, primarily in regions of India and Pakistan (32). The main producers of psyllium include India, Pakistan, and several European countries, such as Spain and France. Regarding North America: Psyllium is widely recognized in North America, where it is cultivated for its dietary fiber properties, The United States and Canada are among the countries that grow and process psyllium (33). It is traditionally known and used in these areas for its medicinal and culinary properties. Cultivation in Other Countries: Due to the demand for psyllium seed husks and their health benefits, *Plantago ovata* is now cultivated in various countries around the world (34). finally, *Plantago ovata* and its products, such as psyllium seed husks, are traded globally and are popular dietary supplements due to their high fiber content. They are available in many countries, including the United Kingdom, Australia, and other parts of Europe, (35).

4.1. Role Digestive de la thuyone

The role of thujone in absinthe Presence:

Thujone occurs naturally in the essential oils of wormwood (*Artemisia absinthium*), a key plant in the production of this iconic drink. Although wormwood oil can contain up to 50% thujone, current regulations limit its concentration in beverages to 35 mg/L in Europe. This restriction aims to ensure consumer safety while preserving the distinctive aromas of absinthe. The accumulation of these compounds

appears to be more abundant in certain plant families (the Asteraceae or Cupressaceae) than in others. Four species (*Artemisia absinthium*, *Salvia officinalis*, *Tanacetum vulgare*, *Thuja occidentalis*), characterized by high intraspecific chemical variability, were evaluated in detail from a chemotaxonomic perspective (36). By its very nature, absinthe is an aromatic plant with numerous health benefits, used since ancient times for medicinal and ritual purposes. Thujone is a terpenoid compound found in A notorious and widely used plant, *Artemisia absinthium*, or absinthe, has been a source of remedies, intoxication, and psychedelic experiences for centuries (37). Absinthe has been used worldwide to treat parasites, cancer, digestive disorders, and many other ailments. In addition, thousands of people claim to have experienced hallucinations after consuming absinthe in a distilled alcoholic beverage (38). Despite this, absinthe owes its effects to a complex composition. Its main active ingredients are sesquiterpene lactones (including absinthin, responsible for the extreme bitterness, thuyone which affects the nervous system at high doses, antioxidant flavonoids, astringent tannins, and a notable amount of vitamin C (39).

1. this tradition of consumption, absinthe contains a toxic monoterpene, thujone, which can be fatal in large quantities. Presence in absinthe, Thujone naturally appears in the essential oils of wormwood (*Artemisia absinthium*), which is a main plant used to make this famous drink. Even though wormwood oil can have up to 50% thujone, current rules cap its levels in drinks at 35 mg/L in Europe. This is meant to keep people safe while still keeping the unique flavors of absinthe. Biological activities of thujone have now been justified by modern instruments, pharmacological and clinical investigations. The mechanism of neurotoxicity of thujones has been widely investigated in animals, cultured neuronal cells and expressed receptors. Thujones are modulators of the GABA-gated chloride channel where α -thujone is about twofold to threefold more potent than β -thujone. The neuronal effect was declared to be completely reversible Shaikh, N. 2013 Phytochemical and ethnopharmacological perspective of *Afsantin Artemisia absinthium* Linn. (40). It should be noted that the accumulation of these compounds seems to be more abundant in certain plant families (for example, the Asteraceae or Cupressaceae) than in others. Four species (*Artemisia absinthium*, *Salvia officinalis*, *Tanacetum vulgare*, *Thuja occidentalis*), characterized by high intraspecific chemical variability, have been studied in detail from a chemotaxonomic point of view (41).

Presence in absinthe, it is strongly not recommended for postpartum women. It contains thujone, a neurotoxic compound, which passes into breast milk and can pose serious risks to the baby. Here are the key points regarding its effects

and risks: Neurotoxicity: In high doses, absinthe can cause seizures, hallucinations, and mental disorders. Breastfeeding contraindication: Its active ingredients are dangerous for the breastfed baby. Digestive issues: If consumed to stimulate appetite, it can cause cramps and stomach irritation if taken in excess. Risk of interactions: It is not compatible with other treatments (anti-inflammatories, medications for blood sugar). Data from the NIH (2023) indicates that Wormwood is a frequent cause of cross-reactivity in patients allergic to ragweed (42).

At a molecular level, the primary active constituent of the Wormwood plant is thujone (specifically alpha-thujone). Thujone acts as a potent antagonist of the Gamma-Aminobutyric Acid (GABA) type A receptor. GABA is the primary inhibitory neurotransmitter in the central nervous system (CNS). By blocking these receptors, thujone prevents the normal 'braking' action of the brain, leading to neuronal hyperexcitability (43). This explains both the traditional use of Wormwood as a stimulant and its high-dose toxicity, which can manifest as convulsions. Furthermore, Wormwood contains bitter sesquiterpene lactones, such as absinthin, which stimulate the gustatory (taste) receptors, leading to increased secretion of digestive enzymes and bile, which is why it has been historically used for gastrointestinal disorders (44) Research has shown that the concentrations of thujone present in absinthe were not sufficient to exceed these thresholds, and the marketing of wormwood - flavoured alcoholic beverages has ultimately been reinstated. The declining fears of absinthism may have led to a revival of the medical uses of wormwood, evidenced by several experimental reports, e.g. on the treatment of Crohn's disease (45). Medicinal plants constitute a substantial reservoir of bioactive compounds with considerable therapeutic potential, and their varied chemical compositions and numerous biological activities render them invaluable for drug development, food preservation, cosmetic applications, and traditional medicinal practices. Ongoing research into phytochemicals is expected to produce novel therapeutic agents and substantiate the traditional applications of medicinal plants within contemporary healthcare systems. (46).

Thujone is a volatile monoterpene ketone of plant origin which is produced by several plants that are frequently used for flavoring foods and beverages. The use of thujone and thujone-containing plant parts for human consumption is currently regulated by the European Parliament and Council and the European Medicines Agency. The best-known neurotoxic effects are connected to the GABA-gated chloride channel, where α -thujone is a modulator roughly two to three times as potent as the β isomer. Based primarily on in vitro

experiments, genotoxicity and carcinogenic properties of thujones have also been detected in parallel with antimutagenic and immune-modulatory effects

Acknowledgements

Support from the Faculty of Science was instrumental in the success of this research, and open access was provided by Ibn Tofail University in Kenitra, along with support from the faculty members. This research was supported by the Ministry of Innovation and Technology as part of the Higher Education Institutional Excellence Program for research in plant breeding and plant protection at Ibn Tofail University, in full compliance with ethical standards.

Table 5: List of medicinal plants cited by herbalists in Laayoune, scientific and vernacular name used and toxicological

Family name	Scientific name	Vernacular name	Used part	Administration	Medicinal used	Toxicological signs
Plantaginaceae	<i>Plantago ssp</i>	Lssn ejjedi	Roots, seed	Oral	Laxative, diuretic, antibacterial	Digestive disorders
Asteraceae	<i>Artemissa herb-alba</i>	Chih	Aerial part	Oral, inhalation	Prevention of colon cancer	Thujone, major component of mugwort in neurotoxic
	<i>Artemisia</i> <i>Absinthium</i> <i>Pulicaria arabica</i>	Oueden halouf	Barks, Roots	Oral	Antioxydant, antimicrobial, cytotoxic, Antimicrobial cytotoxic, antifungal	High sodium, concentration resulting in hypertension
Myristicaceae	<i>Myristia fragns houtt</i>	Chiba	Leaves	Asteraceae	<i>Artemisia Absithium L</i>	Intense excitation of the nervous system
	Myrtaceae <i>Eugen caryophyllata</i> Thunb	Qronfel	Flowers	Oral	Rich in antioxidants and vitamins, anti-inflammatory action	Respiratory with pulmonary oedem

Linaceae	Linum usitatissimum L. Origanum Officinalis	Zriat	Seed	Oral, external	Digestive, urinary	Abdominal pain, spam
Rubiaceae	Rubia peregrina. L	Fouwa	Roots, stem	Oral	Prevention of anemia	Hepatotoxici ty
Solanaceae	Mandragora Automnalis	Taryla	Roots Leaves	Oral, External	To treat hptention (high blood pressure)	Death
Lamiaceae	Lavandula officinalis. L	Khzama	Flower s	Oral	Rheumatis m and cramps	Uterotptic signs
Brassicaceae	Anastatica Hierochuntica .L	Kaff maryam	Seed	Oral	Stomach cancer and infections	Hepatotoxici ty

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