

Phytochemical Evaluation of Six Medicinal Plant Species Traditionally Used in Makkah to Treat Skin Diseases

AFNAN ALQETHAMI

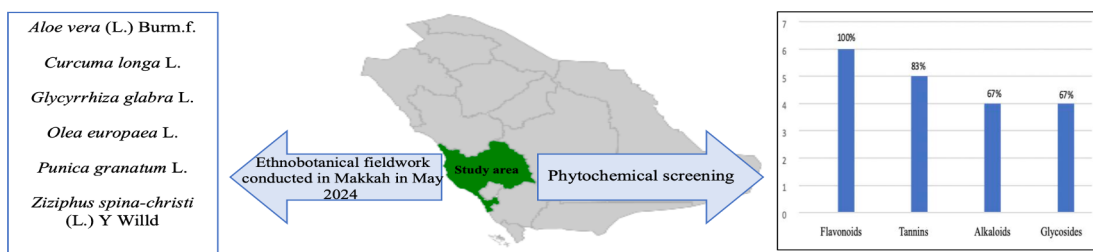
Department of Biology, Faculty of Science, Umm Al-Qura University, Makkah 21955, Saudi Arabia

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Abstract Ethnomedicinal studies indicate that herbal medicine can be used as a treatment alternative for skin disorders. Skin diseases have a significant influence on life quality. Medicinal plants are important in healthcare and have a major role in enhancing community security and health. This study investigates, for the first time, the potential therapeutic benefits and effectiveness of six medicinal plants traditionally used in Makkah to treat skin diseases, based on ethnobotanical knowledge. Thus, the main objectives of this paper are to evaluate six medicinal plants utilized in Makkah traditional medicine to treat skin diseases for the presence of alkaloids, glycosides, flavonoids and tannins, and to answer the following question: Does the ethnomedicinal importance of medicinal plants traditionally used in Makkah to treat skin diseases correspond with their secondary metabolite content? Fieldwork took place in Makkah during May 2024. Six different plant species that are members of six families were identified. Using standard methods, six medicinal plants were screened for the presence of alkaloids, flavonoids, glycosides, and tannins. As a result of this work, the components found in medicinal plants that are most frequently distributed were flavonoids (100%; 6 species), tannins (83%; 5 species), alkaloids (67%; 4 species) and glycosides (67%; 4 species). All four groups of chemical compounds were identified in the leaves of *Aloe vera*, a plant species native to Saudi Arabia. The existence of these groups appears to confirm the effectiveness of using these medicinal herbs in Makkah's ethnomedicinal practice to cure skin diseases. There is a gap between pharmaceutical innovation and traditional medicine. Interdisciplinary collaboration and conservation efforts are essential to bridge the gap between pharmaceutical innovation and traditional medicine, preserving Makkah's indigenous knowledge and biodiversity.

Graphical abstract

Phytochemical Evaluation of Six Medicinal Plant Species Traditionally Used in Makkah to Treat Skin Diseases



Keywords: Ethnomedicine; Pharmacology; Secondary metabolites; Flavonoids; Tannins

Address for correspondence:

E-mail: amqethami@uqu.edu.sa

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1 INTRODUCTION

Skin diseases are a major global health concern [1,2]. Skin problems have a significant influence on health quality, affect people of all ages and genders, and are difficult to treat due to their persistence [2,3]. Makkah, one of the world's hottest cities, is packed with people and has temperatures between 37 and 45 degrees Celsius. These conditions are thought to be among those that raise the prevalence of skin conditions [4]. Medicinal plants are important in healthcare and have a major role in enhancing community security and health. Consequently, these plants are necessary for day-to-day life [5] Ethnomedicinal studies indicate that herbal medicine can be used as a treatment alternative for skin disorders [2,6]. In the Kingdom of Saudi Arabia (KSA), medicinal plants have long been used widely in traditional medicine, and these customs are still followed today [7]. Estimates [8,9] indicate that more than 88 kinds of medicinal plants from 36 families have been reported to be used in Makkah to cure a variety of ailments for 15 major disease groups. Preferences for medicinal plants also varied based on the ailment that required therapy. For instance, it was common practice to treat skin conditions with plants. Skin diseases in Makkah have high informant consensus factor (ICF) values, according to informant consensus. Six plant species were used to treat skin diseases in Makkah such as *Aloe vera* (L.) Burm.f., *Glycyrrhiza glabra* L., *Curcuma longa* L., *Olea europaea* L., *Punica granatum* L. and *Ziziphus spina-christi* (L.) Willd [9]. Medicinal plants recognized for their positive effects on skin are highly useful, have few side effects, and have a high degree of substantial efficacy at an acceptable cost [2, 10, 11]. According to Malik et al. (2019) and Barboza et al. (2009) most herbs utilized for treating skin conditions may also have other benefit such as Analgesic, antiviral, antimicrobial, and inflammatory properties. Conventional plant species possess medicinal potential due to their phytochemical constituents, which possess distinct pharmacological effects [5]. Phytochemical components can be roughly categorized into two classes according to the functions they perform for the plant. The primary group consists of sugars, proteins, amino acids, and chlorophyll. The secondary group is comprised of alkaloids, flavonoids, saponins, tannins, and phenolic compounds. It is distinguished by its therapeutic characteristics [5, 13]. Given that ethnomedical practices are considered to be one of the potential pillars for the creation of safe and efficient pharmaceuticals [5]. Therefore, the main objectives of the present paper are to evaluate six medicinal plants utilized in Makkah traditional medicine to treat skin diseases for the presence of alkaloids, glycosides, flavonoids and tannins, and to answer the following question: Does the ethnomedicinal importance of medicinal plants traditionally used in Makkah to treat skin diseases correspond with their secondary metabolite content?

2 Materials and Methods

2.1 Study area

Makkah is situated in western Saudi Arabia at coordinates 21° 26' N and 39° 46' E [14,15]. Its entire area is 33,354 hectares. There is a very rapid urbanization rate [16]. According to Alqethami et al. (2017), it is the Islamic world's most culturally diverse metropolis. The floristic components of Makkah's flora, which predominates in xerophytic species, come from the Sudano-Zambian, Irano-Turanian, and Saharo-Arabian biogeographical areas [17].

2.2 Plant collection and identification

According to ethnobotanical studies carried out by Qari et al (2024) Based on fieldwork conducted in Makkah in May 2024, samples of six distinct plant species that are customarily used to treat skin conditions in Makkah were gathered (**Table 1**). The American Anthropological Association's ethical rules [18] and the International Society of Ethnobiology's Code of Ethics [19] were adhered to. Plant specimens were identified and mounted in the herbarium of Umm Al-Qura University. utilizing herbarium specimens, the KSA Flora [20] and the KSA Flora [21]. The herbarium of Umm Al-Qura University received voucher specimens. Identification was validated by the author. Families and nomenclature used in accordance with the International Code of Nomenclature of algae, fungi and plants [22]. The list was checked with [21] and the online checklist of KSA Flora [23].

Table 1: List of plant samples including scientific names, families, common names, plant parts and Therapeutic use.

	Scientific name & Family	Common name	Plant part	Therapeutic use	References
1	<i>Aloe vera</i> (L.) Burm.f. Asphodelaceae	Aloe	Leaves	Skin	[9]
2	<i>Curcuma longa</i> L. Zingiberaceae	Turmeric	Rhizomes	Skin	[9]
3	<i>Glycyrrhiza glabra</i> L. Fabaceae	Licorice	Roots	Skin	[9]
4	<i>Olea europaea</i> L. Oleaceae	Olive	Fruits	Skin	[9]
5	<i>Punica granatum</i> L. Lythraceae	Pomegranate	Peels	Skin	[9]
6	<i>Ziziphus spina-christi</i> (L.) Y Willd Rhamnaceae	Christ's thorn	Leaves	Skin	[9]

2.3 Preparation of medicinal plant extracts

For a homogenous sample, plant materials were prewashed, dried, and ground. Ten grams of plant material were added to 100 ml of solvent (the solvent used was methanol), sealed with cotton and filtered through Whatman No. 1 filter paper after a 24-hour period **Fig 1** [24].

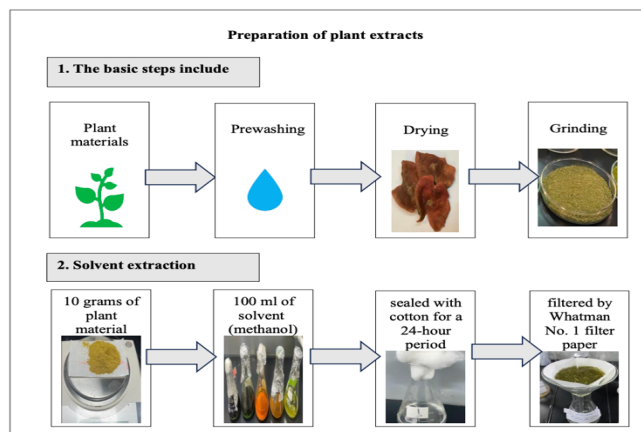


Figure 1: Diagram of the plant extraction method.

2.4 Chemicals and reagents


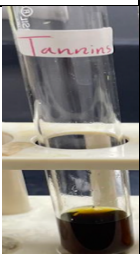
The following ingredients were used: methanol, ethanol, sodium hydroxide solution (NaOH), glacial acetic acid, ferric chloride (FeCl₃), concentrated sulfuric acid (H₂SO₄), hydrochloric acid (HCl), Hager's reagent, and distilled water.

2.5 Phytochemical analysis

A preliminary test called a phytochemical screening is used to find out if an extract contains secondary metabolites [25]. A number of qualitative methods mentioned below (**Table 2**) were used to detect the existence of flavonoids, alkaloids, glycosides, and tannins in samples of 6 different plant species.

Table 2: The photochemical analysis of the six plants under study.

	Test	Procedure	Observations (Indicating Positive Test)	References
Alkaloids' detection	Hager's test	A few milliliters of diluted HCl, a few drops of Hager's reagent with two milliliters of filtrate.	A yellow precipitate indicates a positive test result.	[24,26, 27, 28]
Glycoside detection	Kellar - Kiliani test	One milliliter of glacial acetic acid, one milliliter of FeCl ₃ , and one milliliter of H ₂ SO ₄ were mixed with two milliliters of filtrate (ethanol extract).	Glycosides are indicated by a green-blue color.	[29, 30]

Flavonoid detection	Alkaline reagent test	A few milliliters of diluted HCl were added after a few milliliters of the (ethanol extract) filtrate had been combined with a few drops of NaOH solution.	The presence of flavonoids is indicated by a yellow NaOH solution that becomes white upon the addition of HCl.		[27]
Tannin detection	Braymer's test	Two to three milliliters of the filtrate were mixed with a few drops of a 10% FeCl ₃ solution (extract).	If tannins are present, the solution will be dark blue or greenish-grey.		[26,29, 31]

3 Results

Six families of medicinal plants in total are utilized to treat skin conditions in traditional medicine in Makkah were examined for the existence of tannins, alkaloids, glycosides, and flavonoids, among other phytochemicals (**Table 3**). The most widely distributed substances among the medicinal plants that are employed to treat skin conditions in Makkah were flavonoids (100%; 6 species), tannins (83%; 5 species), alkaloids (67%; 4 species) and glycosides (67%; 4 species; **Fig 2**). *Aloe vera* leaves, *Curcuma longa* rhizomes, and *Glycyrrhiza glabra* roots included all four groups of chemical compounds. While, *Ziziphus spina-christi* leaves contained three different types of chemical compounds: tannins, flavonoids, and alkaloids. Additionally, two groups of chemical compounds were found in fruits of *Olea europaea*, which were glycosides and flavonoids. Furthermore, flavonoids and tannins were the two categories of chemical components identified in *Punica granatum* peels

Five different plant parts were tested including (leaves, rhizomes, roots, fruits and peels). All five of the different plant parts that were analyzed had flavonoids. Peels, rhizomes, roots, and leaves were all found to contain tannins. Fruits, rhizomes, roots, and leaves were all found to contain glycosides. Alkaloids were found in leaves, rhizomes and roots.

4 Discussions

Skin diseases have a negative effect on life quality. Consequently, it is critical to look for and identify medicinal compounds that are both effective and have few or no negative side effects. Thus, the aim of this research was to investigate the potential therapeutic benefits and confirm the effectiveness of some traditionally utilized medicinal plants to treat skin conditions in Makkah, KSA. According to the study's findings, the six medicinal plants utilized in Makkah to treat skin conditions exhibit a great deal of variation in secondary metabolite distribution. Glycosides, and tannins were found leaves of *Aloe vera*, rhizomes of *Curcuma longa*, roots of *Glycyrrhiza glabra* which agree with findings of previous studies by [28]. Flavonoids were found in all the six medicinal

plants were used to treat skin diseases in Makkah. Growing research has demonstrated the potential of flavonoids to treat a variety of skin conditions, such as ringworm, psoriasis, atopic dermatitis, acne and urticaria [32]. In Saudi Arabia, dermatitis is the most common skin condition, followed by acne and fungal infections [33, 34]. Flavonoids are naturally occurring plant extracts that are classified as potent exogenous antioxidants. They are frequently utilized in cosmetic products and are always blended with lipophilic glycosides and aglycones. They are more antioxidant and able to scavenge nearly every kind of free radical because of this chemical structure [32, 35].

The second most widely dispersed compounds among the therapeutic herbs that are utilized to treat skin diseases in Makkah were tannins. Tannins are beneficial secondary metabolites found in plants that offer several health advantages. They are employed in a variety of therapeutic domains because they may have numerous pharmacological characteristics. Nowadays, tannins are regarded as an essential ingredient having both internal and exterior effects in a range of pharmacological, medical, and nutraceutical treatments. They are used externally to treat injuries and inflammation of the skin due to their antibacterial effect [36]. They may also stop the onset of many chronic diseases [36]. They possess incredible rigorous qualities. They have a reputation for accelerating the healing of wounds and irritated mucous membranes [26].

Table 3: A thorough list of the phytochemical screening results for the six medicinal plants that are traditionally used in Makkah to treat skin conditions, along with their scientific names, plant families, voucher specimen number, vernacular names, plant part tested, and therapeutic utilization (+) = Present and (-) = Absent.

Sample number	Scientific names	Voucher specimen number	Vernacular names	Part tested	Therapeutic Use	Alkaloids	Glycosides	Flavonoids	Tannins
1	<i>Aloe vera</i>	SDM1	Sabar	Leaves	Skin	+	+	+	+
2	<i>Curcuma longa</i>	SDM2	Korkom	Rhizomes	Skin	+	+	+	+
3	<i>Glycyrrhiza glabra</i>	SDM3	Arq asws	Roots	Skin	+	+	+	+
4	<i>Olea europaea</i>	SDM4	Zeeton	Fruits	Skin	-	+	+	-

5	<i>Punica granatum</i>	SDM5	Roman	Peels	Skin	-	-	+	+
6	<i>Ziziphus spina-christi</i>	SDM6	Seder	Leaves	Skin	+	-	+	+

Glycosides and alkaloids are also present in medicinal plants used in Makkah to treat skin diseases. Since they are present in almost all therapeutic plants, glycosides provide a multitude of medicinal uses. Glycosides have been demonstrated to have sedative effects [26,37,38]. Alkaloids have positive benefits [39]. Therefore, the existence of these groups appears to confirm the effectiveness of using these medicinal herbs in Makkah's ethnomedical practice to cure skin diseases. The leaves of *Aloe vera* included all four groups of chemical compounds. *Aloe vera* is in the aloe genus a kind of succulent plant. It is a member of the Asphodelaceae. It is common throughout Saudi Arabia [34,40]. Many skin diseases are treated topically using the gel of the leaves. Additionally, rheumatism is treated topically with it [34,41]. This plant is physiologically active with a long history of use in medicine, especially for its emollient, wound-healing, antioxidant, and anti-cancer properties [34]. According to Almoshari (2022) and Ameen et al. (2021) It has the largest concentration minerals, salicylic acid, vitamins, sugars, sterols, and anthraquinones, including anthrone, anthrone-C-glycosides, aloe-emodin-9- barbaloin, isobarbaloin, and chromones. Hence, local pharmaceutical companies may extract phytochemical components from *Aloe vera* to manufacture a new local therapeutic product for skin disorders, thereby achieving health security for skin diseases.

Different plant parts were revealed to have secondary metabolites. In comparison to other plant parts, leaves contain the highest concentration of secondary metabolites. The largest concentration of glycosides and tannins is found in leaves, which is in line with the findings of [42]. According to Almoshari (2022), leaves are rich in essential oils and secondary metabolites that have potential medical applications.

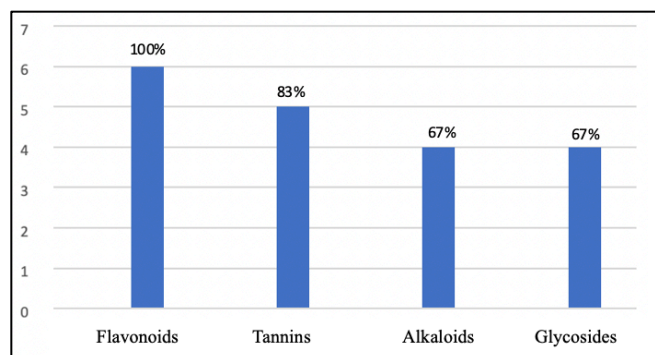


Figure 2: The percentage of phytochemical content distributed in the six medicinal plants that are traditionally used in Makkah to treat skin diseases.

5 Conclusion

This is the first study on phytochemistry to offer details about Phytochemical content of Six species from six families are used to treat skin disorders in Makkah, KSA ethnobotanical knowledge. Key findings of the research revealed flavonoids were found in all the six medicinal plants were used in Makkah to treat skin diseases. The leaves of *Aloe vera* included all four groups of chemical compounds (flavonoids, tannins, glycosides and alkaloids). Therefore, the existence of these groups appears to confirm the effectiveness of using these medicinal herbs in Makkah's ethnomedical practice to cure skin diseases. There is a gap between pharmaceutical innovation and traditional medicine. Interdisciplinary collaboration and conservation efforts are essential to bridge the gap between pharmaceutical innovation and traditional medicine, preserving Makkah's indigenous knowledge and biodiversity.

6 Acknowledgment

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Abbreviations: KSA Kingdom of Saudi Arabia; ICF informant consensus factor; NaOH sodium hydroxide solution; FeCl_3 ferric chloride, H_2SO_4 concentrated sulfuric acid, HCl hydrochloric acid

Declarations: The author declare that they have no competing interests.

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Conflicts of Interest: The authors declare no conflict of interest.

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