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Exploration of the Medicinal Flora of the Aljumum Region in Saudi Arabia

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Abstract: Understanding the natural resources of native flora in a particular area is essential to be able to identify, record, and update existing records concerning the flora of that area, especially medicinal plants. Until recently, there has been very little scientific documentation on the biological diversity of Aljumum flora. The current study aimed to document medicinal plants among the flora of this region and determine the traditional usages that are documented in the literature. In the flowering season from November 2019 to May 2020, we conducted more than 80 field trips to the study area. The results reported 90 species belonging to 79 genera and 34 families in the Aljumum region, which constitute 82 species of medicinal plants from a total of 2253 known species in Saudi Arabia. The most distributed species were *Calotropis procera*, *Panicum turgidum*, and *Aerva javanica* (5.31%); within four endemic families, we found Fabaceae (32.35%), Poaceae (20.58%), and Asteraceae and Brassicaceae (17.64%). The present study reviews a collection of medicinal plants in Aljumum used in ethnomedicine. Additionally, these natural resources should be preserved, and therefore, conservation programs should be established to protect the natural diversity of the plant species in this region with sustainable environmental management.

Keywords: Aljumum region; medicinal plants; flora; folk medicine; herbarium

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1. Introduction

With the first appearance of humans on the earth, and through the centuries, humans have relied on plants and medicinal herbs as a treatment source. Medicinal plants are a part of folk medicine, which is the primary source of modern pharmaceutical discoveries [1,2]. Medicinal plants impact global health, international trade, and the economy through the pharmaceutical industries. In terms of global health, traditional medicinal plants continue to play a central role in the health care systems of a large number of the world's regions [2,3]. By the mid-1800s, at least 80% of all medicines were derived from plants. Then, after the scientific revolution that led to the pharmaceutical industry's development, synthetic drugs dominated the therapeutic arena [4].

The dependence on medicinal plants as a source of folk medicine is evident in developing countries, where traditional medicine systems have long historical origins, such as in India, China, and the Arabian Peninsula [5]. Recognition of medicinal plants' medicinal and economic benefits and their development increased in both developing and industrialized countries, despite the biological, chemical, and genetic differences between regions [6].

Herbal medicines are widely prescribed due to their remarkable effectiveness, minor side effects, and relatively low cost [7]. In Saudi Arabia, folk medicine is considered an essential aspect of people's cultural heritage, and it was widely used before the introduction of biomedicine [8,9]. The first primary health care center using traditional medicine was established in 1926. Afterwards, the biomedicine hospitals that were founded in the second half of the twentieth century positively affected folk medicine's increasing trend [10].

There are approximately 4×10^5 species of flowering plants known worldwide [11]. Only about 12% of them are used in traditional medicine, and about 10^4 species have

been studied and described scientifically in alternative medicine systems [12–14]. The chemicals derived from higher plants make up approximately 25% of pharmaceutical drugs [15]. Legalizing medicinal plants and their derivatives is necessary when used in folk remedies [16,17]. Medicinal plants represent an essential healthy and economic component of region-specific biodiversity. Therefore, it is necessary to conduct a survey of the biological diversity of medicinal plants in any country for their conservation and sustainable use and to preserve endangered medicinal species [18]. Many Saudi Arabian researchers are interested in this aspect [19,20].

Saudi Arabia has a substantial arid land area covering a significant part of the Arabian Peninsula with a geologic structure [21]. It is distinguished by several ecosystems varying in plant species diversity, comprising critical genetic resources of crop plants, medicinal plants, and xerophytic vegetation [22]. Saudi Arabia is gifted with a wide range of flora, consisting of many medicinal herbs, shrubs, and trees [23]. The flora of Saudi Arabia has about 2250 species [21]. On the other hand, the flora of Makkah district has more than 44 families, 125 genera, and 184 species. A high percentage (24.57%) of these species is used for medicinal purposes [24].

The western region of Saudi Arabia is unique in terms of its natural environment, landforms, harsh climate, and scarce water availability [21]. Previously, few floristic investigations of this region have been conducted [21,22], while numerous studies have been conducted on the floristic makeup of Saudi Arabia [25–31]. The Aljumum area is one of the largest governorates in the western region, with a life-form composition typical of arid and desert flora; the majority of species are therophytes and chamaephytes, with some Phanerophytes [27]. Furthermore, the flora in this area varies depending on the amount of rain and is threatened by a variety of anthropogenic activities such as urbanization, grazing, and logging [22].

Although this region has a unique diversity due to its geographical composition, there are few studies regarding plant diversity in this region. However, no ethnobotany surveys have been attempted, so there is a complete lack of information about their exploration. As a result, the Aljumum region's flora has received insufficient attention in terms of recording its wild medicinal plants. As consequence, the purpose of this study was to conduct field surveys within the study area to record the medicinal plants that grow in the Aljumum region.

2. Materials and Methods

2.1. Field Investigations

Aljumum province is a governorate of the Makkah region in western Saudi Arabia and is located northwest of Makkah. The population of Aljumum is about 92,000. Its geography is characterized by mountains, valleys, and arid areas invaded by many wild plants. The climate of this region is dry, and it contains mountains, valleys, and desert areas [32]. Due to its location in the tropical region to the south, its height above sea level, and its relative distance from the Red Sea, its climate is tropical desert with very hot summers. Maximum temperatures reach 44 °C and sometimes rise to the late forties [33]. In winters, the climate is warm, with the average maximum temperature being recorded in January at around 30 °C. The average annual rainfall does not exceed 50–80 mm annually in most seasons, and most of this rain falls between November and April. In autumn, the rains are affected by the so-called region of instability, which is concentrated in the Red Sea region [32].

2.2. Plants Collection

Extensive explorations of the plant diversity of the Aljumum region was conducted during the growing season from November 2019 to May 2020 (The period has not been extended due to the restrictions of the Corona Virus pandemic) where most plant species are expected to flourish (Figure 1a). The study region's total area is around 10,000 km^2, located at 39.7137181 N, 21.6474788 E, and is divided into six districts A–F (Figure 1b). The data was gathered from 90 distinct plant samples collected from the research region, and

the diversity, abundance, and different life-form spectra were determined according to Raunkiaer's classification [34–37].

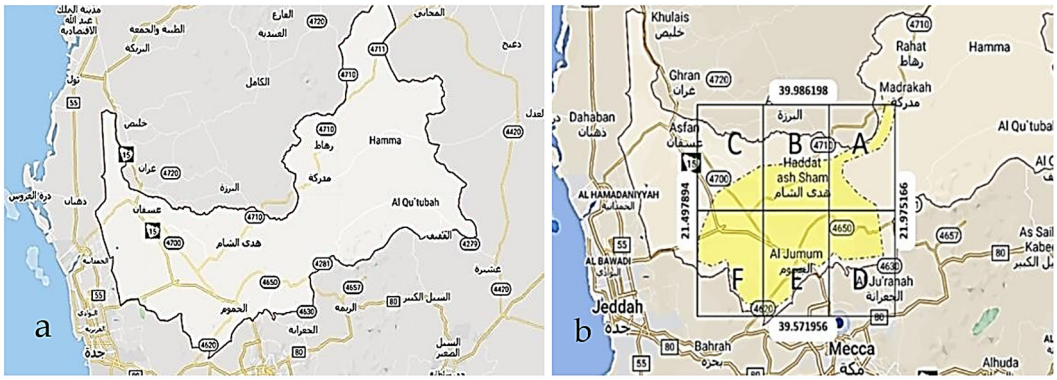

Figure 1. (**a**) Geographical boundaries of Aljumum Governorate. (**b**) Map showing the study areas divided into six zones (A, B, C, D, E, and F) and their coordinates. Google (2021), [google map for Aljumum region], https://goo.gl/maps/AKDQb3CfKQHwBoL59.

2.3. Field Trips

Six research teams were formed for field trips to collect plant samples, each team consisting of two people and a vehicle driver. Each area was visited according to the districts referred to above at a rate of two to four visits per month over a period of four months, with more than 80 field trips. The wild plant species were collected from ten territories within the study area: Aljumum city, Wadi Al-Rayan, Ayen-Shams, Al-Khaif, Rehat, Madrakah, Hada Al-Sham, Al-Fawara, Abu Urwa, and Osfan. The plant species were recorded using a quadrate of the size 10 × 10 m, distributed randomly within each site.

2.4. Plants Identification

After the field trip, the samples were initially identified according to the references of [25,26,31,38,39]. Subsequently, the plant samples were prepared and deposited at the Aljumum University College Herbarium (AUCH) in Umm Al-Qura University (UQU), Saudi Arabia, for taxonomy and confirmation of identity by taxonomy experts. Voucher specimens were preserved at the Department of Biology, Aljumum University College, UQU.

2.5. Ethnomedicinal Data

After the field trips, plant specimens were collected, serially tagged, and pressed between the blotting papers for drying [40]. Ethnomedicinal information was collected and confirmed by referring to the information sources according to [41–60].

2.6. Statistical Analyses

Descriptive statistical methods were applied to analyze and summarize plant species and families data, such as percentages, tables, chart and bar graph used Microsoft Excel 365.

3. Results

A total of 90 taxa belonging to 79 genera and 34 families were recorded and are represented in Table 1; most of the recorded species were shrubs (78%), herbs (14%), and trees (8%). The floristic diversity of the study area is shown in Figure 2. Region D was the most diverse region with frequency rates of 24.55, followed by region C, then E and B, and finally region A with percentages of 20.95%, 18.56%, 14.97%, and 10.77%, respectively. Location F was found to have little diversity, with percentages of 10.17%. Moreover, the most distributed species of flora in Aljumum are *Calotropis procera*, *Panicum turgidum*, and *Aerva javanica* with a percentage 5.31%, followed by *Rhazya stricta*, *Citrullus colocynthis*, *Acacia ehrenbergiana Trianthema portulacastrum*, and *Abutilon pannosum*, with a percentage of 4.25%. Some of the other species among the flora of Aljumum were distributed with a

variation rate of 3.19, such as *Arundo donax*, *Cassia italica*, and *Acacia tortilis*. The lowest recorded percentages were 1.06–2.12% in many species, as shown in Table 1.

Table 1. The plant taxa recorded in Aljumum, family name, collection site, and distribution rate (%) within the study zones. Zones' longitude and latitude, respectively. (A) Rehat and Madrakah: 39.721480, 21.669101; (B) Hada Al-Sham: 39.586325, 21.662486; (C) Osfan: 39.475741, 21.666860; (D) Al-Fawara: 39.700831, 21.530311; (E) Wadi Al-Rayan and Ayen-Shams: 39.614290, 21.527353; and (F) Aljumum city and Wadi Al-Rayan: 39.441392, 21.616949.

Family Name	Taxa	Vouchers	Collection Site	Distribution Rate (%)
Acanthaceae	*Blepharis ciliaris* (L.) B.L.Burtt	JGD19-010	D	1.06
Aizoaceae	*Trianthema portulacastrum* L.	JGV19-090	B,C,D,E	4.25
Amaranthaceae	*Aerva javanica* (Burm.f.) Juss. ex Schult.	JGV19-011	A,B,C,D,F	5.31
	Alternanthera paronychioides A.St.-Hil.	JGV19-105	B,E	2.12
	Ouret lanata (L.) Kuntze	JGF19-012	F	1.06
	Chenopodium murale L.	JGV20-044	D,F	2.12
	Halopeplis perfoliata (Forssk.) Bunge ex Asch. & Schweinf.	JGC19-045	C	1.06
	Hammada scoparia (Pomel) Iljin	JGE20-046	E	1.06
	Suaeda vermiculata Forssk. ex J.F.Gmel.	JGV19-048	A,B,D	3.19
	Atriplex coriacea Forssk.	JGC19-041	C	1.06
Apocynaceae	*Calotropis procera* (Aiton) W.T.Aiton	JGV19-080	A,B,C,D,E	5.31
	Catharanthus roseus (L.) G. Don.	JGA19-013	A	1.06
	Nerium oleander L.	JGV20-012	D,E	2.12
	Rhazya stricta Decne.	JGV20-014	A,B,D,E	4.25
Asteraceae	*Echinops viscosus* DC.	JGE19-015	E	1.06
	Filago trinervia Cass.	JGD20-020	D	1.06
	Launaea intybacea (Jacq.) Beauverd	JGC19-016	C	1.06
	Pulicaria jaubertii E.Gamal-Eldin	JGV19-017	B,C	2.12
	Pulicaria vulgaris Gaertn.	JGD19-018	D	1.06
	Sonchus oleraceus L.	JGV19-021	A,D	2.12
Asclepiadaceae	*Cynanchum radians* (Forssk.) Lam.	JGV19-022	C,D	2.12
	Sarcostemma daltonii Decne.	JGC19-100	C	1.06
Boraginaceae	*Cordia sinensis* Lam.	JGV20-021	C,F	2.12
	Heliotropium arbainense Fres.	JGV19-024	B,D	2.12
	Heliotropium curassavicum L.	JGD20-024	D	1.06
	Heliotropium ramosissimum (Lehm.) Sieber ex DC.	JGF19-023	F	1.06
Brassicaceae	*Biscutella didyma* L.	JGA20-025	A	1.06
	Eremobium aegyptiacum (Spreng.) Asch. ex Boiss.	JGV19-030	D,F	2.12
	Farsetia stylosa R.Br.	JGV19-031	A,B	2.12
	Morettia parviflora Boiss.	JGF20-028	F	1.06
	Schouwia purpurea (Forssk.) Schweinf.	JGV19-030	A,C	2.12
	Sisymbrium irio L.	JGE19-033	E	1.06
Capparaceae	*Cadaba farinose* Forssk.	JGE19-034	E	1.06
	Maerua crassifolia Forssk.	JGF20-035	F	1.06
	Maerua oblongifolia Forssk. (A. Rich.)	JGV19-036	E,F	2.12
	Stylidocleome brachycarpa (Vahl ex DC.) Roalson & J.C.Hall	JGV19-038	D,E	2.12
Celastraceae	*Maytenus somalensis* (Loes.) Cufod.	JGV20-040	A,C	2.12

Table 1. *Cont.*

Family Name	Taxa	Vouchers	Collection Site	Distribution Rate (%)
Convolvulaceae	*Convolvulus hystrix* Vahl	JGD19-047	D	1.06
	Convolvulus pilosellifolius Desr.	JGD19-049	D	1.06
	Ipomoea batatas (L.) Lam.	JGE19-051	E	1.06
Cucurbitaceae	*Citrullus colocynthis* (L.) Schrad.	JGV19-055	A,B,D,E	4.25
	Cucumis melo L.	JGV20-052	A,D	2.12
	Cucumis melo subsp. agrestis (Naudin) Pangalo	JGD19-059	C,D	2.12
	Momordica balsamina L.	JGE19-060	E	1.06
Euphorbiaceae	*Andrachne telephioides* L.	JGV19-061	A,B,D	3.19
	Euphorbia hirsuta L.	JGB19-063	B	1.06
	Ricinus communis L.	JGV19-065	C,D	2.12
Fabaceae	*Acacia arabica* (Lam.) Willd.	JGV19-066	B,E	2.12
	Acacia ehrenbergiana Hayne	JGV19-067	B,C,D,E	4.25
	Acacia tortilis (Forssk.) Hayne	JGV19-068	A,C,D	3.19
	Alhagi maurorum Medik.	JGV19-069	B,E	2.12
	Prosopis juliflora (Sw.) DC.	JGV19-070	C,F	2.12
	Senegalia mellifera (Vahl) L.A.Silva & J.Freitas	JGV19-071	B, C	1.06
	Senna italica Mill.	JGV19-072	B, C, D, E,F	3.19
	Tephrosia desertorum Scheele	JGV20-073	C,D	2.12
	Tephrosia nubica (Boiss.) Baker	JGC19-074	C	1.06
Lamiaceae	*Ocimum basilicum* L.	JGD19-076	D	1.06
Lythraceae	*Lawsonia inermis* L.	JGV19-078	C,F	2.12
Malvaceae	*Abutilon figarianum* Webb	JGE19-080	E	1.06
	Abutilon pannosum (G.Forst.) Schltdl.	JGV19-081	A,C,D,E	4.25
	Malva parviflora L.	JGE19-082	E	1.06
Moringaceae	*Moringa peregrina* (Forssk.) Fiori	JGE19-083	E	1.06
Nyctaginaceae	*Bougainvillea spinosa* (Cav.) Heimerl	JGC19-084	C	1.06
	Commicarpus helenae (Schult.) Meikle	JGB19-085	B	1.06
	Commicarpus plumbagineus (Cav.) Standl.	JGV19-086	B,E	2.12
Oleaceae	*Jasminum grandiflorum* L.	JGE19-087	E	1.06
Poaceae	*Arundo donax* L.	JGV19-088	C,D,F	3.19
	Cenchrus purpureus (Schumach.) Morrone	JGV19-089	B,C	2.12
	Cynodon dactylon (L.) Pers.	JGV20-090	B,C	2.12
	Oryza sativa L.	JGV20-101	A,C,D	3.19
	Panicum turgidum Forssk.	JGV19-091	A,B,C,D,E	5.31
	Sorghum bicolor (L.) Moench	JGF19-092	F	1.06
Portulacaceae	*Portulaca oleracea* L.	JGV19-093	D,F	2.12
Resedaceae	*Ochradenus baccatus* Delile	JGB19-095	B	1.06
Rhamnaceae	*Ziziphus spina-christi* (L.) Desf.	JGC19-096	C	1.06
Rutaceae	*Ruta chalepensis* L.	JGE19-097	E	1.06
Salvadoraceae	*Salvadora persica* L.	JGE19-098	E	1.06
Solanaceae	*Lycium shawii* Roem. & Schult.	JGV19-099	A,D	2.12
	Solanum coagulans Forssk.	JGV19-110	D,E	2.12
	Solanum incanum L.	JGV19-111	D,F	2.12
	Solanum villosum Mill.	JGD19-112	D	1.06
	Withania somnifera (L.) Dunal	JGF19-107	F	1.06

Table 1. *Cont.*

Family Name	Taxa	Vouchers	Collection Site	Distribution Rate (%)
Tamaricaceae	*Tamarix aphylla* (L.) H.Karst.	JGE19-115	E	1.06
Tiliaceae	*Corchorus depressus* (L.) Stocks	JGC19-108	C	1.06
Typhaceae	*Forsskaolea tenacissima* L.	JGB20-109	B	1.06
Urticaceae	*Typha domingensis* Pers.	JGD19-094	D	1.06
Verbenaceae	*Lantana camara* L.	JGE20-117	E	1.06
Zygophyllaceae	*Fagonia orientalis* C.Presl	JGV19-116	B,D	2.12 + 1.06
	Tetraena simplex (L.) Beier & Thulin	JGV19-120	D,E	2.12
	Tribulus pentandrus Forssk.	JGV19-119	C,E,F	3.19

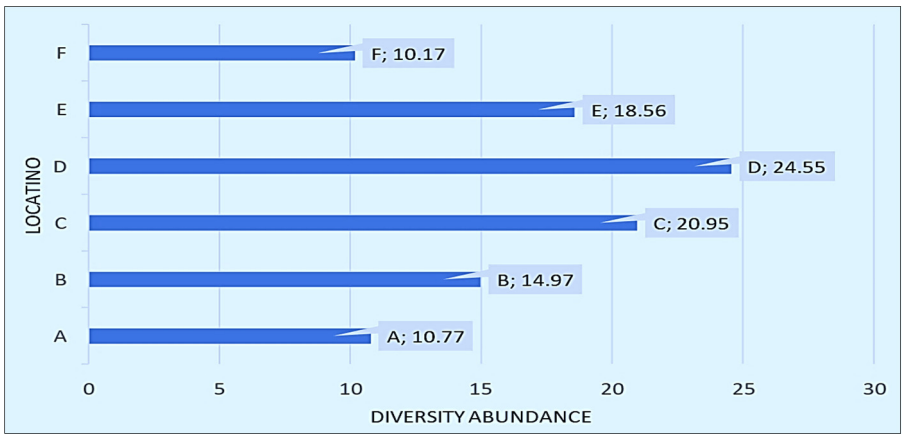

Figure 2. Flora diversity and abundance in Aljumum within the study areas.

The number and percentage of families and species of flora in Aljumum are shown in Table 2. We found 34 families, and the most prevalent was Fabaceae (32.35%) followed by Poaceae (20.58%) and Asteraceae and Brassicaceae (17.64%), while the least frequently occurring plant families were Acanthaceae, Aizoaceae, Celastraceae, Lamiaceae, Lythraceae, Moringaceae, Oleaceae, Portulacaceae, Resedaceae, Rhamnaceae, Rutaceae, Salvadoraceae, Tamaricaceae, Tiliaceae, Typhaceae, Urticaceae, and Verbenaceae with a frequency ratio of 2.94% (Figure 3). Additionally, Table 2 illustrates the abundances of the families in Aljumum compared to the flora of Saudi Arabia. Poaceae, Asteraceae and Fabaceae, Amaranthaceae, Brassicaceae, and Lamiaceae families have the highest number of species with 285, 243, 128, 93, 86, and 73, respectively, within Saudi Arabian flora, whereas Aljumum has Fabaceae, Poaceae, Brassicaceae, and Asteraceae as high-frequency species, with numbers of 11, 7, 6, and 6, respectively. However, the most frequent families in the Aljumum region, compared with their distribution in Saudi Arabia, according to their abundance or rarity were Moringaceae, Urticaceae Salvadoraceae, and Salvadoraceae, which is considered the least widespread in Saudi Arabia and was recorded among the flora of Aljumum.

Out of the 33 collected families from the flora of Aljumum, we recorded 82 plant species used as a medicinal plant using in folk remedies (Table 3). The recorded species were distributed among 32 plant families. Fabaceae was represented by nine species, followed by Brassicaceae (seven species), Poaceae and Asteraceae (six species), Solanaceae (five species), Cucurbitaceae, Amaranthaceae and Capparaceae (four species), whereas Malvaceae, Nyctaginaceae, Convolvulaceae, Apocynaceae, and Amaranthaceae had three species, and Zygophyllaceae and Euphorbiaceae had two species. All other families were represented by one species. The medicinal plants reported in Table 3 are used to treat more than 18 types of diseases, Such as congenital syphilis, rheumatic diseases, malignancies, gastrointestinal diseases, urinary disorders, certain blood disorders, as well

as some neuropathies, vascular and arterial diseases, microbiological bacterial infections, liver diseases, parasitic worm infection and so on.

Table 2. Comparison of species' percentages for each family in the flora of Aljumum and species diversity in Saudi Arabia.

No.	Families	Frequency Ratio of Families in Aljumum %	Species No.		Frequency Ratio in SA %
			Flora of Aljumum	Flora of Saudi Arabia *	
1.	Acanthaceae	2.94	1	30	3.33
2.	Aizoaceae	2.94	1	12	8.33
3.	Amaranthaceae	21.8	8	93	8.60
4.	Apocynaceae	11.76	4	68	5.88
5.	Asclepiadaceae	5.88	2	27	7.41
6.	Asteraceae	17.64	6	243	2.47
7.	Boraginaceae	11.76	4	65	6.15
8.	Brassicaceae	17.64	6	86	6.98
9.	Capparaceae	11.76	4	14	28.57
10.	Celastraceae	2.94	1	9	11.11
11.	Convolvulaceae	8.82	3	45	6.67
12.	Cucurbitaceae	11.76	4	17	23.53
13.	Euphorbiaceae	8.82	3	63	4.76
14.	Fabaceae	32.35	11	128	8.59
15.	Lamiaceae	2.94	1	73	1.37
16.	Lythraceae	2.94	1	5	20
17.	Malvaceae	8.82	3	37	8.11
18.	Moringaceae	2.94	1	1	100
19.	Nyctaginaceae	8.82	3	15	20
20.	Oleaceae	2.94	1	3	33.33
21.	Poaceae	20.58	7	285	2.46
22.	Portulacaceae	2.94	1	4	25
23.	Resedaceae	2.94	1	11	9.09
24.	Rhamnaceae	2.94	1	4	25
25.	Rutaceae	2.94	1	3	33.33
26.	Salvadoraceae	2.94	1	2	50
27.	Solanaceae	14.7	5	33	15.15
28.	Tamaricaceae	2.94	1	11	9.09
29.	Tiliaceae	2.94	1	5	20
30.	Typhaceae	2.94	1	2	50
31.	Urticaceae	2.94	1	2	50
32.	Verbenaceae	2.94	1	9	11.11
33.	Zygophyllaceae	11.76	4	28	14.29

* According to (EF-KSA, 2020; PD-SA, 2019).

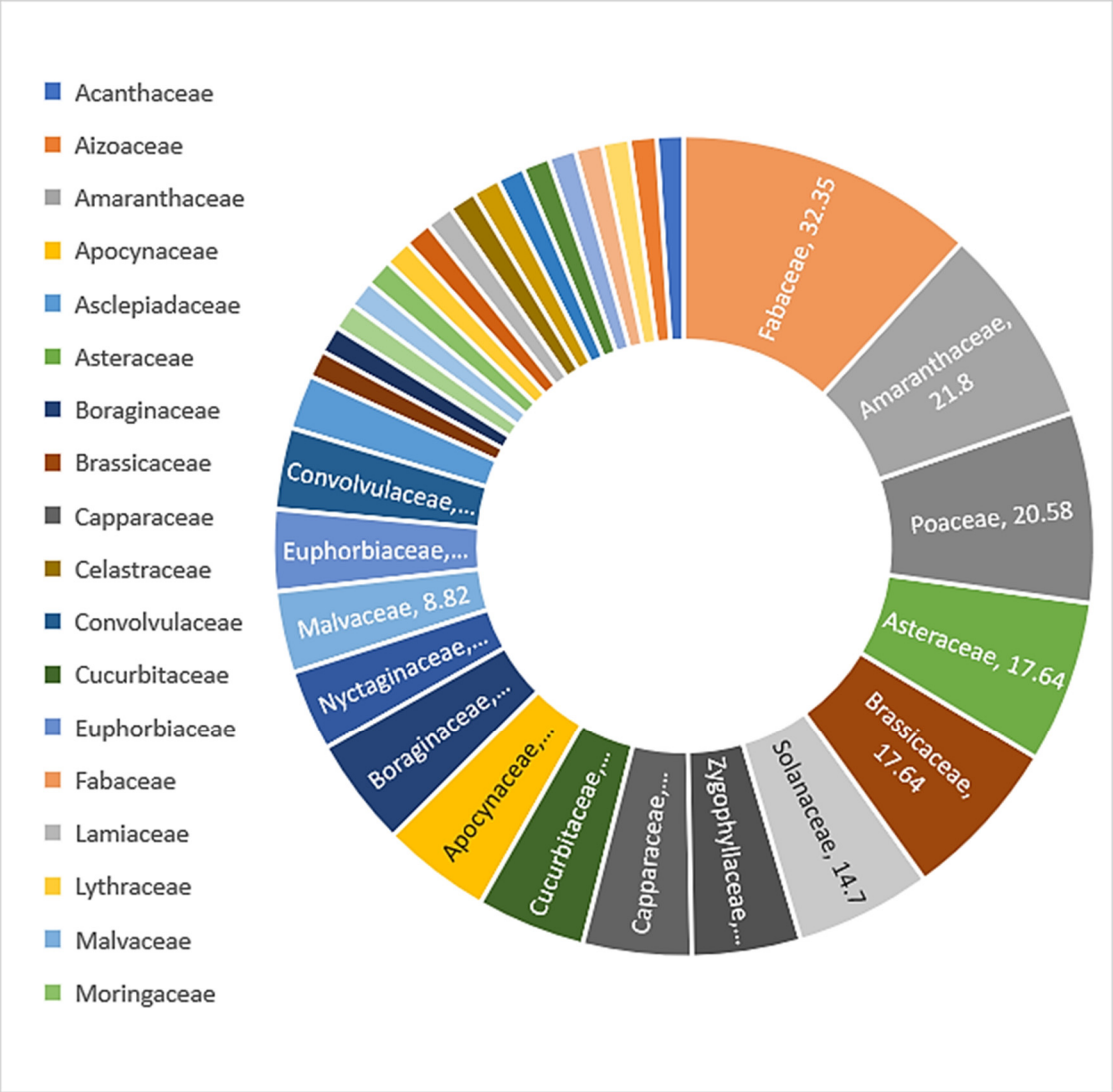

Figure 3. Family diversity abundance in Aljumum within the study areas.

Table 3. Medicinal uses of ethnobotanical confined species in Aljumum region, Saudi Arabia.

No.	Scientific Name	Family	Parts Used	Folk Medicinal Uses	Citation
1	*Abutilon figarianum* Webb	Malvaceae	Whole	Using for relieving muscle pain, depression of the central nervous system, also used for applying to wasp stings and to heal wounds.	[55]
2	*Abutilon pannosum* (G.Forst.) Schltdl.	Malvaceae	Whole	Using for treating diarrhea, dysentery and stomach troubles, antimicrobial	[56]
3	*Acacia mellifera* (M. Vahl) Seigler & Ebinger.	Fabaceae	Leaves	Antioxidant activity, antimicrobial	[57]
4	*Acacia arabica* (Lam.) Willd.	Fabaceae	Whole	Hemorrhage, colds, diarrhea, scurvy and dysentery.	[58]
5	*Acacia tortilis* (Forssk.) Hayne	Fabaceae	Whole	Skin allergy, cough, inflammatory reaction.	[59]
6	*Aerva javanica* (Burm.f.) Juss. ex Schult.	Amaranthaceae	Whole	Tooth ache	[60]

Table 3. *Cont.*

No.	Scientific Name	Family	Parts Used	Folk Medicinal Uses	Citation
7	*Ouret lanata* (L.) Kuntze	Amaranthaceae	Whole	Diuretic and demulcent	[43]
8	*Alhagi maurorum* Medik.	Fabaceae	Leave	Antioxidant, Antinociceptive	[44]
9	*Alternanthera paronychioides* A.St.-Hil.	Amaranthaceae	Leaves	Treat hepatitis, tight chest, bronchitis, asthma and other lung troubles.	[45]
10	*Arundo donax* L.	Poaceae	Whole	Using for cancer, condylomata and indurations of the breast	[59]
11	*Bougainvillea spinosa* (Cav.) Heimerl	Nyctaginaceae	Whole	Anticancer, antidiabetic, antihepatotoxic, anti-inflammatory, antihyperlipidemic, antimicrobial, antioxidant, and antiulcer properties.	[57]
12	*Cadaba farinose* Forssk.	Capparaceae	Whole, leaves	purgative, anthelmintic, antisiphilitic, emmenagogue and aperient. a remedy for dysentery, fever, cough and lungs problem	[18]
13	*Calotropis procera* (Aiton) W.T.Aiton	Apocynaceae	Latex	Psoriasis, Leishmaniasis, and skin infections	[60]
14	*Cassia italica* (Mill.) Spreng	Fabaceae	Whole	Laxative and urinary tract purifier	[60]
15	*Chenopodiastrum murale* (L.) S.Fuentes, Uotila & Borsch	Amaranthaceae	Leaves, fruits	Postnatal problems	[43]
16	*Citrullus colocynthis* (L.) Schrad.	Cucurbitaceae	Leaves, fruits	Analgesic, skin infections, a laxative, diuretic, or for insect bites	[43,59]
17	*Stylidocleome brachycarpa* (Vahl ex DC.) Roalson & J.C.Hall	Capparaceae	Whole	Carminative, stomach-ache	[57]
18	*Commicarpus helenae* (Schult.) Meikle	Nyctaginaceae	Whole	Antimicrobial activity	[43]
19	*Commicarpus plumbagineus* (Cav.) Standl.	Nyctaginaceae	Leaves	Treat asthma	[57]
20	*Convolvulus hystrix* Vahl	Convolvulaceae	Whole	Antimicrobial	[55]
21	*Convolvulus pilosellifolius* Desr.	Convolvulaceae	Whole	Antimicrobial	[57]
22	*Corchorus depressus* (L.) Stocks	Tiliaceae	Seeds, Whole	ailment of aches, dysentery, enteritis, fever, and tumors.	[59]
23	*Cordia sinensis* Lam.	Boraginaceae	Whole	antioxidant, anti-glycation, anti-malarial and anti-inflammatory, malaria, intestinal disorders and conjunctivitis	[57]
24	*Cucumis melo* L.	Cucurbitaceae	Whole	Antiulcer, analgesic, anti-inflammatory, free radical scavenging, antioxidant, anthelmintic.	[59]
25	*Cucumis melo* subsp. agrestis (Naudin) Pangalo	Cucurbitaceae	fruits	Using as a cooling light cleanser or moisturizer for the skin	[57]
26	*Cynodon dactylon* (L.) Pers.	Poaceae	Whole	Stop wound bleeding, durvayugma	[46]
27	*Echinops viscosus* DC.	Asteraceae	Whole	Anti-inflammatory, depurative, diuretic, hemostatic, hypoglycemic and vasoconstrictor.	[59]

Table 3. *Cont.*

No.	Scientific Name	Family	Parts Used	Folk Medicinal Uses	Citation
28	*Eremobium aegyptiacum* (Spreng.) Asch. ex Boiss.	Brassicaceae	Leaves	Treatment of old wounds, laxative and diuretic	[57]
29	*Euphorbia hirta* L.	Euphorbiaceae	Whole	Antiasthmatic, febrifuge, narcotic and used in asthma and bronchitis	[60]
30	*Fagonia tenuifolia* Steud. & Hochst.	Zygophyllaceae	Whole	Piles, urinary disorders, dysentery, stomach ache, typhoid, cancer and as a blood purifier	[55]
31	*Farsetia ramosissima* Hochst.	Brassicaceae	leaves	Anti-diabetic	[47]
32	*Filago trinervia* Cass.	Asteraceae	Whole	Treat diarrhea, antibacterial activity	[59]
33	*Forsskaolea tenacissima* L.	Urticaceae	Roots, leaves	Relieve fevers and infections of the urethra, prevent infection, stop bleeding, anti-inflammatory, antispasmodic, antidiabetic and antipyretic	[57]
34	*Halopeplis perfoliata* (Forssk.) Bunge ex Asch. & Schweinf.	Amaranthaceae	Whole	antimicrobial activity	[59]
35	*Hammada scoparia* (Pomel) Iljin	Amaranthaceae	Whole	Against poisonous reptile bites such as scorpions, snakes and vipers as well as the treatment of digestive tract diseases, injuries, skin inflammations and diabetes.	[55]
36	*Heliotropium arbainense* Fres.	Boraginaceae	Whole	Lower blood pressure and antimicrobial	[57]
37	*Heliotropium curassavicum L.*	Boraginaceae	Whole	Antimicrobial	[57]
38	*Heliotropium ramosissimum* (Lehm.) Sieber ex DC.	Boraginaceae	Whole	Antimicrobial	[55]
39	*Ipomoea batatas* (L.) Lam.	Convolvulaceae	Whole	Diabetes, hypertension, dysentery, constipation, fatigue, arthritis, rheumatoid diseases, hydrocephaly, meningitis, kidney ailments, and inflammations.	[59]
40	*Jasminum grandiflorum* L.	Oleaceae	Whole	Wounds, skin diseases, ulcers of the oral cavity, gingivitis, headache, erectile dysfunction and eye diseases	[57]
41	*Lantana camara* L.	Verbenaceae	Whole	Antipyretic, antimicrobial and antimutagenic	[48]
42	*Launaea intybacea* (Jacq.) Beauverd	Asteraceae	Whole	Against jaundice, hepatomegaly, dyspepsia, skin disease, dry cough and galactoriya	[55]
43	*Lawsonia inermis* L.	Lythraceae	Whole	Antifungal	[57]
44	*Lycium shawii* Roem. & Schult.	Solanaceae	Whole	Antimicrobial	[59]
45	*Maerua crassifolia* Forssk.	Capparaceae	Leaves	toothache and intestinal diseases	[55]
46	*Maerua oblongifolia* Forssk. (A. Rich.)	Capparaceae	Whole	Hypocholesterolemic	[57]
47	*Malva parviflora* L.	Malvaceae	Leaves, Roots	Laxative and promotes hair growth, remove dandruff, coughs, swellings, ulcers in the bladder	[60]
48	*Maytenus somalensis* (Loes.)	Celastraceae	Whole	Anti-inflammatory and analgesic	[57]

Table 3. *Cont.*

No.	Scientific Name	Family	Parts Used	Folk Medicinal Uses	Citation
49	*Mimosa mellifera* M. Vahl.	Fabaceae	leaves	Anticancer	[60]
50	*Momordica balsamina* L.	Cucurbitaceae	Whole	Antimicrobial, eye wash to treat eye pains, Promote fetal growth, Baby fever	[55]
51	*Morettia parviflora* Boiss.	Brassicaceae	Whole	Antimicrobial	[59]
52	*Moringa peregrina* (Forssk.) Fiori	Moringaceae	Seeds	Antinflamtory Analgesic, Abdominal pain, Burns, Constipation, Febrifuge, Laxative and Headache	[57]
53	*Nerium oleander* L.	Apocynaceae	Leaves, Roots	Used in skin diseases	[49]
54	*Ochradenus baccatus* Delile	Resedaceae	Whole	Back pain, fistula, general tonic	[43]
55	*Ocimum basilicum* L.	Lamiaceae	Leaves	Treatment of cough, fever, ringworms, internal piles, diarrhea and kidney disorders	[50]
56	*Cynanchum radians* (Forssk.) Lam.	Asclepiadaceae	Stems	Diuretic	[57]
57	*Oryza sativa* L.	Poaceae	Whole	Eye infection, treatment of burns	[55]
58	*Panicum turgidum* Forssk.	Poaceae	Whole	Eye infection	[60]
59	*Portulaca oleracea* L.	Poaceae	Leaves	Epilepsy	[43]
60	*Portulaca oleracea* L.	Portulacaceae	Whole	Anti-inflammation	[57]
61	*Prosopis juliflora* (Sw.) DC.	Fabaceae	Whole	Antiprotozoal	[57]
62	*Pulicaria jaubertii* E.Gamal-Eldin	Asteraceae	Whole	Antimicrobial activity	[59]
63	*Pulicaria vulgaris* Gaertn.	Asteraceae	Whole	Antimicrobial activity	[57]
64	*Rhazya stricta* Decne.	Apocynaceae	Leaves	To treat diseases such as tumors, intestinal pain, and Alzheimer's, in addition to using it as an anti-insomnia, pain reliever, aphrodisiac, and other health problems, rheumatism and Allergy	[51]
65	*Ricinus communis* L.	Euphorbiaceae	Whole	Treatment of scrofulous sores, boils and rheumatic swellings	[55]
66	*Ruta chalepensis* L.	Rutaceae	Stem, Leaves	Scarlet fever, headaches, heart conditions and measles	[43]
67	*Salvadora persica* L.	Salvadoraceae	Stem, Leaves	Mouth disinfectant and toothpick, The leaves of the arak tree are good laxatives for the intestine and treat constipation, reduce joint pain and rheumatism.	[57]
68	*Senna italica* Mill.	Fabaceae	Leaves, pods, seeds	For elephantiasis and eye diseases and as purgative	[59]
69	*Sisymbrium irio* L.	Brassicaceae	Seeds, leaves, flowers	Relieve cold, treat coughs and chest congestion and fever.	[57]
70	*Solanum coagulans* Forssk.	Solanaceae	Roots, Seeds.	For stomachache, treat coughs.	[43]

Table 3. *Cont.*

No.	Scientific Name	Family	Parts Used	Folk Medicinal Uses	Citation
71	*Solanum incanum* L.	Solanaceae	Leaves, Roots, Fruits.	Antimicrobial, treated include a sore throat, angina, stomach-ache, colic, headache, painful menstruation, liver pain and pain caused by onchocerciasis, pleurisy, pneumonia and rheumatism.	[57]
72	*Solanum villosum* Mill.	Solanaceae	Unripe fruits., Leaves.	Squeezed on babies' gums to ease pain during teething. The leaves are used in the treatment of stomachache.	[43]
73	*Sonchus oleraceus* L.	Asteraceae	Leaves, flowers, Roots	Promotes menstruation and to treat diarrhea. The latex in the sap is used in the treatment of opium addiction, warts and cancer. The gum has been used as a cure for the opium habit.	[57]
74	*Sorghum bicolor* (L.) Moench	Poaceae	Roots	Primary care of anemia, cancer, and a variety of infectious diseases, including viral diseases.	[59]
75	*Suaeda vermiculata* Forssk. ex J.F.Gmel.	Amaranthaceae	Whole	Cardiac stimulation	[57]
76	*Tamarix aphylla (L.) H.Karst.*	Tamaricaceae	Leaves, Roots	Wound infection and Stomachache, bark is used for treating eczema and other skin diseases.	[60]
77	*Tephrosia nubica* (Boiss.) Baker	Fabaceae	Whole	lower blood pressure and cardiac stimulation	[59]
78	*Trianthema portulacastrum* L.	Aizoaceae	Roots, Leaves	Using to relieve obstructions of the liver, and to relieve asthma and amenorrhea. They are used in the treatment of oedema, jaundice, strangury and dropsy.	[57]
79	*Typha domingensis* Pers.	Typhaceae	Roots, Leaves, Seeds	The leaves are analgesic, antioxidant, diuretic. The leaves have shown significant nootropic activity and have potential for use in the treatment of Alzheimer's Disease.	[56]
80	*Withania somnifera* (L.) Dunal	Solanaceae	Whole	Used in rheumatic complaints, dyspepsia, loss of appetite, cough and dropsy. Used in ulcers, used for toning up the uterus of women for habitual miscarriage	[57]
81	*Ziziphus spina-christi* (L.) Desf.	Rhamnaceae	Whole	A powder made from the charred thorns is used as an antidote to snake bites. The roots are used to treat headaches. The boiled leaves are applied to various surface wounds.	[52]
82	*Tetraena simplex* (L.) Beier & Thulin	Zygophyllaceae	Leaves, Fruits	An infusion of the leaves acts as a skin cleanser. It is used as an anti-inflammatory.	[59]

4. Discussion

Saudi Arabia represents a large portion of the Arabian Peninsula, as mentioned earlier, and it is considered a large country with dynamic geographies and variable habitats. Generally, it is very rich in its biodiversity of wild plants (flora) at the level of genera, such as Acacia, Aerva, and Caralluma, or at the family level, such as Fabaceae, Poaceae, and Brassicaceae [30]. Recently, many species have been recorded among the flora of Saudi Arabia, and the number of species is increasing day by day based on new field trips and biodiversity surveys [21,29]. Initially, the number of documented species was around 1500 species, as recorded by Mujahid between 1974–1988 [39]. After 25 years, the number was increased to approximately 2300 based on many scientific publications concerning the flora of Saudi Arabia [38,61,62]. This indicates the importance of conducting more surveys in different and broad habitats in Saudi Arabia to discover the biological diversity and new species, especially medicinal plants [63,64]. This study focused on a specific region of Saudi Arabia, namely, the Aljumum Governorate, which is located northwest of Makkah. It has a wide area of land that was once known for agriculture due to the soil's fertility and its numerous valleys [65].

The results showed 90 species from this limited area, which contains 6.44% of the species from the total flora of Saudi Arabia. This study can be considered the first study concerning the flora of Aljumum, although some studies have recorded many plant species in the Aljumum area for various research purposes [22,66,67]. The most prevalent families recorded in this study were Fabaceae and Poaceae, which are families with a typical distribution in most ecosystems in the Makkah region according to some studies that were interested in the flora of the western region of Saudi Arabia [68–71]. The findings of the current study have shown that the locations of C (Osfan), D (Al-Fawara), and E (Wadi Al-Rayan and Ayen-Shams) were the most diverse in general terms of biodiversity assessments. This result is consistent with the studies of [21,72], which suggests that this diversity is a result of variable topography among these locations and the abundance of valleys and their influence on the soils.

The current study also provides a preliminary survey of the medicinal plants in the region as it is known that traditional herbal medicine currently plays an important role as a subject of scientific research, especially when the literature and field work data are properly evaluated. These evaluation results could introduce several plants that could be prioritized in the study of specific biological activity in folk medicine [73]. Additionally, many chemical compounds can be extracted from these plants and used in the pharmaceutical industries [74,75]. These families included the most-used species in traditional medicine, such as Verbenaceae, Urticaceae, and Zygophyllaceae [76].

Recent years have seen an increase in scientific study on traditional plant medicine, particularly when the literature and fieldwork data are carefully analyzed. These evaluation findings can assist in prioritizing various plants for future research for their unique biological activity based on their traditional herbal applications and geographic distribution [73]. In this study, ethnomedicinal information was collected from 82 medicinal plants belonging to 34 families in the Aljumum region. The dominant plant families with a higher number of plant species were Fabaceae (32.35%), Poaceae (20.58%), and Asteraceae and Brassicaceae (17.64%). The use of these species may be preferred because of their ready availability. These are the most widely used medicinal plants in these families according to [77]. Some medicinal plants species (*Acacia arabica*, *Cassia italica, Senna italica, Sorghum bicolor, Echinops viscosus, Sonchus oleraceus, and Sisymbrium irio*) among these families are widespread species in local folk medicine. Herbal remedies are prepared using a variety of plant parts. However, the majority of herbal preparations are obtained from the leaves (45%), and a similar observation has been made for other forested communities with abundant leaves and green vegetation [78]. Furthermore, it is possible that the preference for leaves is due to the fact that leaves are the primary photosynthetic organ in plants and are responsible for the majority of the biosynthesis of secondary metabolites, which act on the body as bioactive molecules for remediation [79]. Therefore, the leaves are responsible for

photosynthesis and the release of toxins that protect the plant from environmental dangers, which adds further therapeutic value [80].

Many of the plant species recorded in the current study are preferred by herbalists for the treatment of gastrointestinal and dermatological diseases. The majority of herbalists provide oral treatments for gastrointestinal disorders in the form of decoctions and sometimes as raw ingestion. Skin diseases were the most treated ailments by herbal preparations, mainly in paste forms [81]. In Saudi Arabia, rheumatic illnesses affects 2/50,000 inhabitants [82]. However, most Saudi patients, particularly in rural regions and among the elderly, prefer to manage their condition using traditional medicines Six plant species were shown to be beneficial in the management of rheumatic illnesses in our study: *Ipomoea batatas*, *Rhazya stricta*, *Ricinus communis*, *Salvadora persica*, *Solanum incanum*, and *Withania somnifera*. This has been proven in many studies for these plant species [42,83]. Additionally, many plants have been used in traditional medicine as anti-inflammatory agents, which was shown by the results of the current study for many plant species such as *Moringa peregrina*, *Acacia tortilis*, *Bougainvillea spinosa*, *Cordia sinensis*, *Cucumis melo*, *Echinops viscosus*, *Forsskaolea tenacissima*, *Maytenus somalensis*, and *Tetraena simplex*, as described in some reports [84]. Among the various medicinal properties of the plant species collected from this location, anti-inflammatory and antiaromatic actions were found to be particularly useful in treating illness. Otherwise, several curative actions of various species were reported, as shown in the results. Our findings did not discover any previously unknown ethnic uses of therapeutic herbs.

5. Conclusions

The current study identified 82 species that are utilized in folk medicine among the 90 species that were surveyed from various environments throughout the Aljumum region. This study also provides a database that allows researchers to locate medicinal plants in this region for future studies to broaden the use of plant extracts in folk medicine or pharmaceutical manufacturing. The study also discussed the medical significance of these families and plant species in the treatment of various disorders. However, these natural resources must be conserved, which necessitates the establishment of conservation programs to protect the natural diversity of plant species in this region through sustainable environmental management. Researchers will have a better understanding of how varied environmental variables impact a single plant species, allowing them to analyze the impact of different environments on medicinal benefits and take advantage of the biological diversity of the vegetation in the Aljumum region.

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