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Use of medicinal plants in dermato-cosmetology: An ethnobotanical study among the population of Izarène

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ABSTRACT

An ethnobotanical study was carried out among the population riverine of the Izarène forest to enhance and safeguard ancestral knowledge of medicinal plants used in traditional pharmacopeia for the treatment of dermatological diseases. Using 480 questionnaire sheets, ethnobotanical field surveys were conducted during two campaigns (2013 to 2015). The determination of the different survey media was carried out using stratified probability sampling techniques. The ethnobotanical data were analyzed through the calculation of quantitative indices, such as Relative Frequency of Citation (RFC), Family Importance Value index (FIV), Fidelity Level (FL), Informant Consensus Factor (ICF), and the use-value of the Plant Part (PPV). The results show 62 useful plant species, belonging to 34 botanical families. The Lamiaceae family was the most represented (8 species, FIV= 0.037). The highest Relative Citation Frequency (RFC) (0.137) was recorded for Olea europaea L. Concerning the diseases treated, cosmetic use has the highest ICF (0.96), the leaf was considered to be the most used part of the plant (PPV=0.34) and the majority of the remedies were prepared under the form of a poultice. The results obtained could constitute a basis for further studies for the valorization of medicinal plants used against dermatological diseases through biological and phytochemical studies of the inventoried plants.

Keywords: Dermatological diseases, ethnobotanical surveys, Izarène forest, medicinal plants.

INTRODUCTION

The use of plants for medicinal purposes has led for several centuries to a multitude of herbal recipes to prevent, cure, relieve or improve human well-being [1]. Today, despite the development of chemical drugs to combat urinary tract diseases, there is often a return to plants as a source of active ingredients. Besides, an important part of the population, especially in rural areas, prefers medicinal plants, for economic reasons and sometimes because of difficulty in accessing medical care [2].

Thus, numerous studies in the field of ethnopharmacology, show that plants tested in traditional medicine are almost devoid of toxicities and are often effective in pharmacological models [3]. At present, natural substances present in plants are still the first reservoir of new drugs. They account for almost 60% of the drugs we have [4]. The remaining 39% of synthetic drugs are often the result of chemical modification of natural molecules or parts of natural molecules taken as heads of the series [5–7].

Since the beginning of time, the Moroccan people have used many medicinal plants as a popular medicine to cure

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many human and livestock health problems. In Morocco, given the diversity of medicinal plants with great therapeutic power, the Moroccan population adopts herbal medication for various diseases; and in this range, there is an important place occupied by dermatological affections. Dermatological diseases are numerous and widespread, they are considered as a set of pathologies whose most visible symptoms occur at the target organ level, including the skin, mucous membranes, and partners. In this context, we carried out a study based on ethnobotanical surveys and which aims to identify and inventory the medicinal plants used for the treatment of dermatological diseases with the population bordering the forest of Izarène known for its floristic, ecological diversity, which offers the local population a fairly rich knowledge of traditional herbal medicine.

Methods

Study area

According to the territorial division of 2015, the forest massif of Izarène is part of the Tangier-Tetouan-Al Hoceïma area. It is located in the North-Western part of the Kingdom, 12 Km North-East of the town of Ouezzane and covers an approximate forest surface of 14 600 ha between the parallels 34° 45' and 34° 58'N and the meridian lines 5° 25' and 5° 32'W. Limited to the southern part by marls of the Cretaceous pre-rifaine nappe, this forest massif is characterized by a rugged relief where altitudes vary approximately between 350 and 680 m [8].

The study area, the Circle of Mokrisset, is a part of the province of Ouezzane and includes 3 Caïdats (Zoumi, Mokrisset, and Brikcha), and 3 rural communes (Zoumi, Ain Baïda, and Brikcha) (Figure 1); it contains a population estimated at 25 000 inhabitants [9]. The geological formation of the forest massif is characterized by a tormented relief due to the presence of several hills forming the beginning of the Rifaine Mountains on the southern side. These hills are characterized by a deep clayey-schist or clayey-marly soil that can reach in some places more than 3 meters of depth. The climate of the area is subhumid with temperate winters, with an average annual rainfall of about 1 000 mm. These precipitations are distributed over approximately 70 days all the year (November to April). A mild winter with almost no frost and very rainy follows a dry and hot season lasting 3 to 4 months [10].

The vegetation cover is characterized by a rich and diversified forest formation, consisting mainly of vegetation that shows a degradation of the climatic formation of the cork oak [11]. The forest of Izarène has a vital economic, ecological, and social importance for the bordering population. It assures the needs of the population for the firewood and work and constitutes the principal source of fodder for the cattle [9]. Beyond its paramount functions, it plays a role in traditional medicine thanks to the use of medicinal plants as means of subsistence among the bordering population.

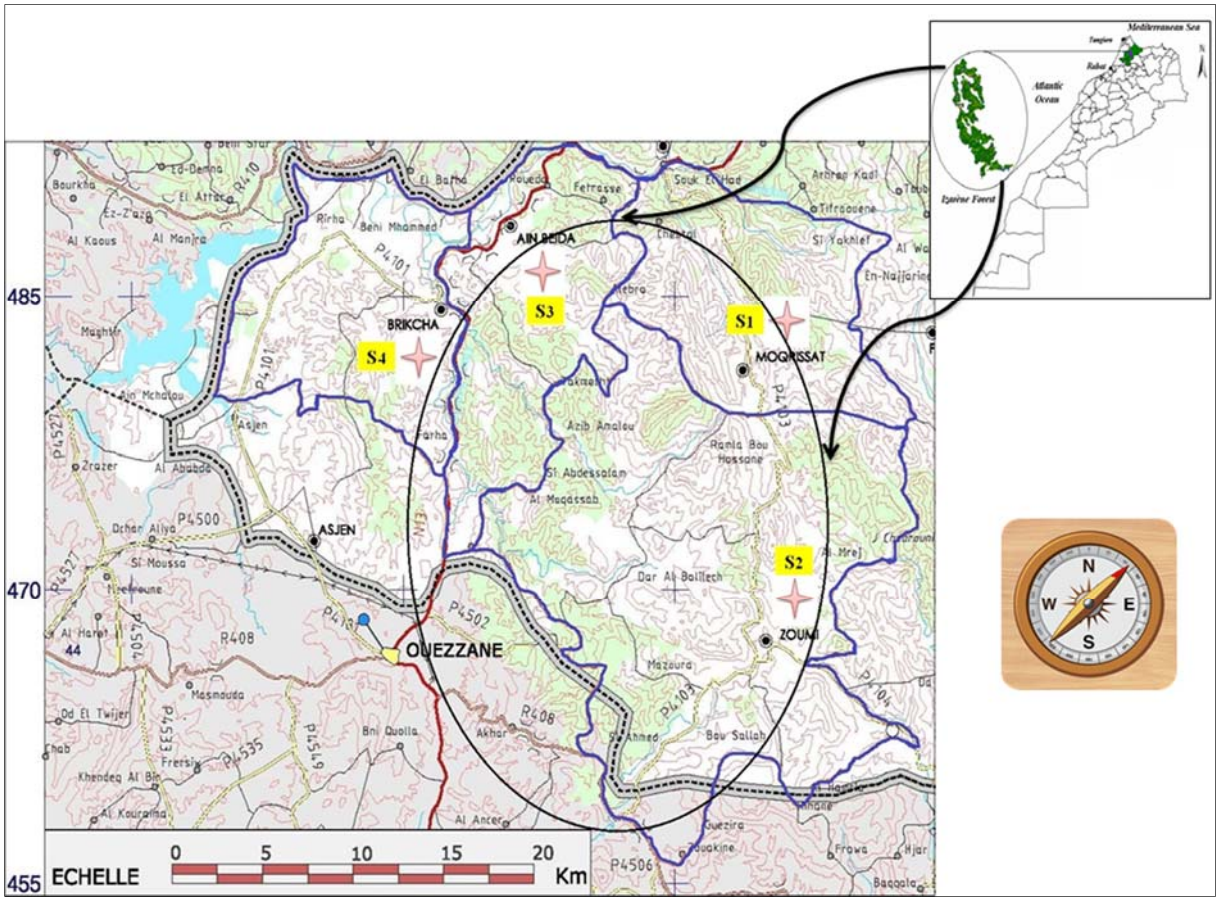

Figure 1. Location of the study area

Data collection

To gather as much information as possible about the use of medicinal plants in the treatment of dermatological diseases, ethnobotanical surveys were carried out in different localities, villages, and towns, bordering the forest of Izarène during a period from 2013 to 2015. The determination of the different survey media was carried out using stratified probability sampling techniques [12]. In this study, the sample is divided into 4 homogeneous strata (S1, S2, S3, and S4), 3 of which correspond to the numbers of rural communes in the Mokrisset Circle (Table 1). The investigation was carried out on 480 people inhabitants of villages and towns of the studied zone. By adopting a random stratified sampling, samples of 120 people are then formed for each of the 4 strata and they are put together to constitute the total sample (480 people). The field studies required us to deal with two groups: those who knew and/or used plants for medicinal purposes and those who used plants and plant products for commercial purposes (plant collectors, herbalists, traditional practitioners). The interviews with the informants were conducted in the Arabic dialect of the region. A questionnaire was prepared from the preliminary surveys in the study area and validated by a team from the Plant, Animal Productions and Agro-industry Laboratory of the Faculty of Sciences of Kenitra. The questionnaire used consists of two parts: the first part deals with the demographic characteristics of the informants and the second one focuses on the plants

used in the treatment of diseases (Appendix 1). The time devoted to each interview was approximately two hours, and the oral and written consent of the informants was collected for each interview. All persons who shared their traditional knowledge were informed about the principle of the study, its interest, and the procedure used while respecting the anonymity of the information collected.

Table 1. Distribution of the surveys by strata

Strata	Names of strata	Number of inquiries
Strata 1	Mokrisset	120
Strata 2	Zoumi	120
Strata 3	Ain Baïda	120
Strata 4	Brikcha	120
Total 480		

Identification and conservation of plant species

The plants indicated by the informants were systematically photographed and botanical samples were collected, classified, accumulated and placed in the herbarium or a plastic bag with a label indicating its vernacular name. The taxonomic validation of the species was carried out in the laboratory using herbaria and completed with the following documents: "Medicinal plants of Morocco" [13]; "Practical flora of Morocco" [14,15] and " Catalogs of vascular plants of northern Morocco, including identification keys volumes I and II" [16]. Fertile specimens for the present study were collected in the field (30 plant species), in herbal stores (20 plant species), and at the homes of traditional healers (12 plant species) in the Izarène. All voucher specimens have been preserved during documentation and deposited in the Ibn Tofail University, Morocco Herbarium for future reference.

Data Analysis

The data collected on the survey sheets were entered and transcribed into a database then processed by SPSS version 21 and the Excel spreadsheet (version 2010). Descriptive statistical methods were used to analyze the socio-demographic data of informants.

To determine the socio-demographic parameters influencing the orientation of the riverside population towards traditional medication, an analytical study using logistic regression was conducted. Analysis of ethnobotanical data was carried out using the Relative Frequency of Citation (RFC), the Family Importance Value (FIV), the Plant Part Value (PPV), Fidelity Level (FL), Informant Consensus Factor (ICF), and the Plant Part Value (PPV).

Relative frequency of citation (RFC)

RFC is calculated to appreciate the local importance of each species. The RFC is the result of the citation frequency (Fc), that is the number of informants who mentioned the use of the species, divided by the total number (N) of respondents[17], with ($0 < RFC < 1$). $RFC = Fc/N$

Family Importance Value (FIV)

The Family Importance Value (FIV) identifies the importance of medicinal plant families. It is calculated using the method: FIV = FC family/Ns. where $FC_{familly}$: RFC is the number of informants mentioning the family and Ns: total number of species in each family. Family use-value is a culturally significant index that can be applied to ethnobotany to calculate the biological value of the plant taxon [18].

Fidelity Level (FL)

The fidelity index is calculated to identify the species most commonly used in the treatment of a particular disease. It is calculated according to the method proposed [19]:

FL= (Fc/ Ft) x 100. Where Fc = frequency of citation of the species in the treatment of a particular disease and Ft = total number of citations of the species.

Informant Consensus Factor (ICF)

It is calculated for each category to assess the agreement between informants on the use of plants for specific use categories. It is obtained using the following formula [20]: ICF= (Nur - Nt) / (Nur – 1). Where Nur = number of use citations for a disease category and Nt = number of species used by

informants in a given use category. The value calculated from this consensus ranges from 0 to 1 and is close to 1 when the plant is used by a large number of the respondents for a particular disease and/or if the information is exchanged between informants on the use of the species for a particular disease, and close to 0 (low) when the plant is randomly selected or if there is no exchange of information about use among informants [21].

Plant Part Value (PPV)

The PPV is calculated to assess the importance of each part of the plant used by the respondents, it is obtained by the following formula [22]: PPV =$RU_{plant\ part}$/ RU. Where $RU_{plant\ part}$ = is the sum of reported uses per part of the plant and RU = the number of reported uses of all parts of the plant.

Results and Discussion

Sociodemographic profile of the respondents

The ethnobotanical surveys were carried out on a sample of 480 people, and the results obtained show that men and women are concerned with traditional medicine. However, women have slightly more knowledge about medicinal species compared to men, with a frequency of 75% compared to 25% for men (Table 2), which corresponds to a sex ratio of 3.

The predominance of women can be justified by the fact that women are always on the lookout for natural remedies based on medicinal plants, to improve their knowledge of these plants and to maintain their health and that of their families since they are closer to the plants either in their children's medication or in their use in cooking. These results confirm the results of other ethnobotanical work carried out at the national level [23–25].

The use of medicinal plants concerns all age groups at the scale of the riparian population of the forest massif of Izarène. The results obtained show a predominance of the elderly, so those with an age over 60 represent 36.5%. The age groups of [50-59], [40-49], [30-39], [18-29] have a percentage of 16.7%, 17.9%, 15% and 14%, respectively. Indeed, older persons are expected to provide more reliable information on the traditional use of medicinal plants, because they hold much of the ancestral knowledge that is transmitted orally. The transmission of this knowledge is currently in danger because it is not always ensured [26]. The relative transmission of traditional practices from one generation to the next may explain the mistrust of some people, particularly young people, who tend not to believe too much in this traditional medicine [27].

Concerning the level of education of the respondents in the study area, the results obtained show that the majority of users had been illiterate with a percentage of 48.8%. This relatively high percentage is in direct correlation with the level of education of the local population. Nevertheless, those with primary and secondary education had a significant percentage (27% and 17% respectively), while those with university education had a percentage of 8%. Other studies have shown that the knowledge of the population on the use of medicinal plants is held by illiterate people [28,29]. The majority of the residents surveyed in this region are married, with a percentage of 85% married versus 15% single. Concerning the socio-economic level, 45.2% of the people surveyed had a low socio-economic level, 42.5% are unemployed and 12.3% had a medium level.

Table 2. Socio-demographic characteristics of the participants in the study area.

	Distribution	**Number of informants**	**Percentages (%)**
Gender	Male	120	25.0
	Female	360	75.0
Age groups	[18-30[	67	14.0
	[30-40[	72	15.0
	[40-50[	86	17.9
	[50-60[	96	20.0

	Distribution	Number of informants	Percentages (%)
	> 60	159	33.1
Educational level	Illiterate	234	48.8
	Primary	128	26.7
	Secondary	81	16.9
	University	37	7.7
Family situation	Married	407	84.8
	Single	73	15.2
Monthly income	No income	204	42.5
	Low income	217	45.2
	Average income	59	12.3

According to the logistic regression model, it appears that the variables: gender, age, and least expensive use are predictors influencing the orientation of the riverside population towards traditional medication, pointing out that the least expensive use factor represents an influence of 12 times more than the other factors (Table 3). The high cost of modern medical treatments, their side effects, and the unfavorable socio-economic conditions of the local population, are the essential factors that push the local population to make extensive use of herbal medicine. These results confirm the results achieved by El Hassani in Middle Moulouya [30].

Table 3. Statistical analyses of the influence of socio-demographic parameters on confidence in-plant use the

		IC for 95%		
	Odds-Ratio	**Lower**	**Upper**	**p-value**
Gender	0.189	0.08	0.445	0.000
Age groups	0.294	0.208	0.415	0.000
Educational level	1.147	0.893	1.474	0.282
Family situation	1.203	0.340	4. 254	0.774
Monthly income	1.018	0.572	1.709	1.812
Least expensive use	12.403	5.915	26.009	0.000

Botanical families most represented in the study area

The study of medicinal plants led to the census and identification of 62 species belonging to 34 families and divided into 58 genera. These plants are presented in alphabetical order. For each plant listed, the scientific name, family, local name, the part used, and the method of preparation adopted by the local population are given, as well as the data of FL, FC, RFC, and FIV are shown in Table 5. The FIV index revealed 6 families with high importance values which are therefore preponderant in the treatment of dermatological conditions (Table 4). These are Lamiaceae (8 species with FIV = 0.037), Rosaceae (4 species with FIV = 0.033), Asteraceae (4 species with FIV = 0.032), Apiaceae (3 species with FIV = 0.032), Solanaceae (3 species with FIV = 0.03) and Fabaceae (3 species with FIV = 0.023). The remaining families had only one or two species. The dominance of Lamiaceae was also observed during similar ethnomedical surveys carried out in others regions of Morocco [2,25,31].

Table 4. Distribution of medicinal plants according to the family importance value (FIV) in the study area.

Familly	RFCs	NS	FIV	Familly	RFCs	NS	FIV
Amaranthaceae	0.025	1	0.025	Rubiaceae	0.049	2	0.024
Amaryllidaceae	0.071	2	0.035	Gentianaceae	0.062	1	0.062
Anacardiaceae	0.023	1	0.023	Iridaceae	0.025	1	0.025
Apiaceae	0.097	3	0.032	Lamiaceae	0.3	8	0.037
Apocyanaceae	0.056	1	0.056	Lythraceae	0.16	2	0.08
Arecaceae	0.046	1	0.046	Moraceae	0.02	1	0.02
Aristolochiaceae	0.033	1	0.033	Myrtaceae	0.193	2	0.096
Asteraceae	0.13	4	0.032	Nitrariaceae	0.044	1	0.044
Boraginaceae	0.045	2	0.022	Oleaceae	0.137	1	0.137
Brachytheciaceae	0.002	1	0.002	Ranunculaceae	0.095	2	0.047
Brassicaceae	0.018	2	0.009	Rhamnaceae	0.029	1	0.029
Cannabaceae	0.11	1	0.11	Rosaceae	0.132	4	0.033
Cistaceae	0.068	1	0.068	Sapotaceae	0.077	1	0.077
Cupressaceae	0.06	1	0.06	Solanaceaea	0.091	3	0.03
Euphorbiaceae	0.091	2	0.045	Tamaricaceae	0.039	1	0.039
Fabaceae	0.07	3	0.023	Thymelaeaceae	0.116	2	0.058
Fagaceae	0.039	1	0.039	Urticaceae	0.012	1	0.012

Relative Frequency of Citation (RFC) and Fidelity Level (FL)

Some species were more recommended by the local population than others; this is reflected by a high citation frequency (FC). The value of relative frequency of citation (RFC) as numerical representatives in the quantitative ethnobotanical survey highlights the importance of traditional knowledge. Species with a very significant relative citation frequency are those with a high level of use. Among these plants, 8 species belonging to 7 botanical families were frequently used by the bordering population in the treatment of dermatological conditions. These are: *Olea europaea* L. (RFC=0.137), *Lawsonia inermis* L. (RFC=0.125), *Cannabis sativa* L. (RFC=0.11), *Eugenia caryophyllata* Thunb. (RFC=0.104), *Daphne gnidium* L. (RFC=0.089), *Myrtus communis* L. (RFC=0.089), *Rosa damascena* Mill. (RFC=0.083) and *Salvia verbenaca* L. (RFC=0.083). Some of these plants have been reported by an ethnomedical survey in the treatment of dermatological conditions [25]. Among these plants are *Lawsonia inermis* L., *Eugenia caryophyllata* Thunb., *Olea europaea* L., *Daphne gnidium* L., *Myrtus communis* L., and *Salvia verbenaca* L.. Other recent studies had experimentally proven the anti-inflammatory activity of *Lawsonia inermis* L. and the antimicrobial activity of *Allium cepa* L. and *Coriandrum sativum* L., which partly explain their use in the treatment of infectious diseases by population bordering the Izarène forest. In addition, among the listed plants, some are recognized by their toxic power such as *Ricinus communis* L., *Peganum harmala* L., *Solanum nigrum* L. [32], and *Atractylis gummifera* L. [33]. Indeed, the majority of physiotherapists are unaware of the toxicity of the plants used as well as the modalities of their use, in particular the methods of preparation and the recommended doses. The use of medicinal plants must be rationalized and the benefit/risk determined. Studies on these objectives are therefore necessary.

The fidelity index value (FL) is an important means of determining, which disease a particular species is more effective, a high FL indicates a high use of plant species for a particular disease, while a low FL demonstrates a wide range of medicinal uses but with a low frequency for each disease

[21]. In the present study, the majority of plants had a high FL, and the highest 100% FL was recorded for 53 plant species (Table 5). Only 2 species have low fidelity values (FL <70). Among the species with the highest fidelity for the treatment of a wide range of dermatological conditions are *Lawsonia inermis* L. which has the highest FL for cosmetic use (FL = 85%), *Allium cepa* L. which is used most often to treat infectious diseases (FL = 71%), *Cistus monspeliensis* L. which is used to treat skin lesions (FL = 64%) and *Solanum nigrum* L. to treat allergic conditions (FL = 87%)

Table 5. List of medicinal plants used for the treatment of dermatological diseases in the study area.

Family and scientific name	Local name	Plant parts	Administration	Medicinal uses	FL %	FC	RFC
Amaranthaceae							
Chenopoium ambrosioides L.	Mkhinza	Leaves	Cataplasm	ID, SL	75	12	0.025
Amaryllidaceae							
Allium cepa L.	Lbesla	Other part	Cataplasm	ID, SL	71	14	0.029
Allium sativum L.	Toum	Other part	Friction	CU	100	20	0.042
Anacardiaceae							
Pistacia lentiscus L.	Drô	Leaves	Cataplasm	CU	100	11	0.023
Apiaceae							
Ammi majus L.	Trîlân	Seeds	Powder	AD	100	5	0.010
Coriandrum sativum L.	Qezbor	Seeds	Cataplasm	ID	100	30	0.062
Daucus carota L.	Khizzu	Roots	Cataplasm	AL	100	12	0.025
Apocyanaceae							
Nerium oleander L.	Deflaâ	Leaves	Other forms	ID	100	27	0.056
Arecaceae							
Chamaerops humilis L.	Jummar	Root	Power	CU	100	22	0.046
Aristolochiaceae							
Aristolochia baetica L.	Bereztam	Root	Powder	SL	100	16	0.033
Asteraceae							
Anacyclus pyrethrum (L.) Link.	Tigenticht	Root	Powder	AD	100	4	0.008
Atractylis gummifera L.	Addâd	Root	Powder	CU	100	10	0.021
Dittrichia viscosa (L.) Greuter	Terrahlâ	Leaves	Cataplasm	AL, ID	81	21	0.043
Matricaria chamomilla L.	Mansaniya	Flower	Cataplasm	CU	100	28	0.058
Boraginaceae							
Borago offinalis L.	Hurrîcha	Aerial parts	Cataplasm	SL	100	14	0.029
Cynoglossum officinale L.	Lossîq	Root	Cataplasm	SL	100	8	0.016
Brachytheciaceae							
Homalothecium aureum (Spruce) H.Rob.	Sunbul	Aerial parts	Cataplasm	CU	100	1	0.002
Brassicaceae							
Lepidium sativum L.	Habbrchad	Seeds	Powder,	ID	100	6	0.012
Sinapis alba L.	El khardel	Seeds	Powder, Cataplasm	CU	100	3	0.006
Cannabaceae							
Cannabis sativa L.	L'kif	Seeds	Powder, Cataplasm	CU	100	53	0.11
Cistaceae							

Family and scientific name	Local name	Plant parts	Administration	Medicinal uses	FL %	FC	RFC
Cistus monspeliensis L.	Chtâppa	Leaves	Cataplasm	ID, SL	64	33	0.068
Cupressaceae							
Tetraclinis articulata Benth.	Al'Araâr	Leaves	Cataplasm	AL, CU	69	29	0.06
Euphorbiaceae							
Mercurialis annua L.	L-hurriga L'melsâ	Roots	Cataplasm	CU	100	13	0.027
Ricinus communis L.	Lkharwa'	Seeds	Cataplasm	CU	100	31	0.064
Fabaceae							
Ononis natrix L.	Afezdade	Roots	Cataplasm	CU	100	2	0.004
Trigonella foenum-graecum L.	Al'houlba	Seeds	Macération, friction	CU	100	14	0.029
Vicia faba L.	Fûle	Seeds	Powder, Cataplasm	ID	100	18	0.037
Fagaceae							
Quercus suber L.	D'bbagh	Other parts	Powder	CU	100	19	0.039
Gentianaceae							
Centaurium Erythraea Rafn	Gossat Al'Hayya	Aerial parts	Powder	SL	100	30	0.062
Iridaceae							
Crocus sativus L.	Za'âfrane lhor	Flower	Powder	SL	100	12	0.025
Lamiaceae							
Lavandula stoechas L.	Al'Halhal	Leaves	Macération, friction	ID	100	15	0.031
Marrubium vulgare L.	Merriwta	Leaves	Cataplasm	ID	100	25	0.052
Mentha viridis L.	Naanaâ	Aerial parts	Cataplasm	SL	100	17	0.035
Ocimum basilicum L.	Lahbak	Leaves	Cataplasm	CU	100	23	0.048
Origanum compactum Bentham.	Zaâtar	Leaves	Powder, Cataplasm	SL, CU	89	9	0.018
*Rosmarinus officinalis*L.	Aazir	Leaves	Cataplasm	CU	100	4	0.008
Salvia Officinalis L.	Assalmiya	Leaves	Cataplasm	SL	100	12	0.025
Salvia verbenaca L.	Al'khiyata	Aerial part	Powder, Cataplasm	SL	100	40	0.083
Lythraceae							
Lawsonia inermis L.	L'hennâ	Leaves	Powder, Cataplasm	AL, ID, CU	85	60	0.125
Punica granatum L.	Rummân	Fruit	Powder	SL	100	17	0.035
Moraceae							
Fucus carica L.	L'kermôs	Leaves	Other forms	ID	100	10	0.02
Myrtaceae							
Eugenia caryophyllata Thunb.	Qronfel	Flower	Powder, maceration	CU	100	50	0.104
Myrtus communis L.	Arraihan	Leaves	Powder	CU	100	43	0.089
Nitrariaceae							
Peganum harmala L.	L'hermel	Seeds	Powder	CU	100	21	0.044
Oleaceae							

Family and scientific name	Local name	Plant parts	Administration	Medicinal uses	FL %	FC	RFC
Olea europaea L.	Zitoun, Zabbouj	Seeds	Other forms	CU	100	66	0.137
Ranunculaceae							
Delphinium staphisagria L.	Habbat râs	Seeds	Powder	CU	100	30	0.062
Nigella sativa L.	Assânûj	Seeds	Macération, Powder	CU	100	16	0.033
Rhamnaceae							
Ziziphus lotus L.	Nberg	Leaves	Cataplasm	ID	100	14	0.029
Rosaceae							
Prunus amygdalus stokes var. amara DC.	Lûz mûrr	Fruit	Powder	CU	100	7	0.014
Prunus amygdalus stokes var. dulcis DC.	Lûz Lahlou	Fruit	Friction	CU	100	10	0.021
Rosa damascena Mill.	L'werd L'beldi	Flower	Powder, Cataplasm	CU	100	40	0.083
Rubus ulmifolius Schott.	El-ûllîk	Leaves	Powder, Cataplasm	SL	100	7	0.014
Rubiaceae							
Coffea arabica L.	Al'qahwa	Fruit	Powder, Cataplasm	SL	100	9	0.018
Rubia tinctorum L.	Al'Fouwa	Roots	Powder, Cataplasm	ID	100	15	0.031
Sapotaceae							
Argania spinosa L. Skeels.	Argane	Fruit	Friction	CU	100	37	0.077
Solanaceae							
Hyscyamus albus L.	Gingît	Leaves	Cataplasm	AL, ID	80	10	0.021
Solanum lycopersicum L.	Maticha	Fruit	Cataplasm	CU	100	26	0.054
Solanum nigrum L.	Buqnîna	Fruit	Cataplasm	AL, SL	87	8	0.016
Tamaricaceae							
Tamarix aphylla (L.) Karst.	Takkaût	Other parts	Powder	CU	100	19	0.039
Thymelaeaceae							
Daphne gnidium L.	Lazaz	Leaves	Powder	CU	100	43	0.089
Thymelaea lythroides L.	L'metnâne	Leaves	Powder	ID	100	13	0.027
Urticaceae							
Urtica dioîca L.	Hourrîka	Aerial part	Cataplasm	CU	100	6	0.012

CU: Cosmetic Uses; **ID:** Infectious Diseases (Abscesses and furuncles); **SL:** Skin Lesion (Burns, wounds, and injuries); **AL:** Allergy (Eczema); **AD:** Autoimmune diseases (Vitiligo).

Frequency of use of the medicinal plants according to their origin

The ethnobotanical study allowed us to identify 62 medicinal plants used in the treatment of dermatological diseases. Among them, 24 species were imported from other regions of the country, while 15 species were cultivated and 23 species had collected from the forest of Izarène. This high use of local species can be explained by the high price of imported medicinal plants by the free and proximity of local medicinal plants. It should be noted that among the spontaneous medicinal species collected in the forest of Izarène, four medicinal plants: *Salvia verbenaca*

L., *Centaurium erythraea* Rafn, *Solanum nigrum* L., and *Origanum compactum* Bentham. are scarce in the region [27] and risk disappearing from the forest if no protective measures are taken by the services concerned, due to the intensive collection of these species.

Used parts

Several parts of the listed plants were used for the treatment of dermatological diseases. The calculation of the PPV usage index showed that leaves were the most used parts with an index PPV= 0.34, followed by the seeds with an index PPV= 0.24, then flowers (PPV= 0.11). The other parts were used to a lesser degree (Figure 2). The dominance of leaf use is confirmed by similar ethnobotanical studies carried out in other regions of Morocco [23,25,34–37]. Indeed, leaves were the most used because they are at the same time central to photochemical reactions and reservoirs of organic matter derived from them, therefore rich in active principles, and they are easy to harvest.

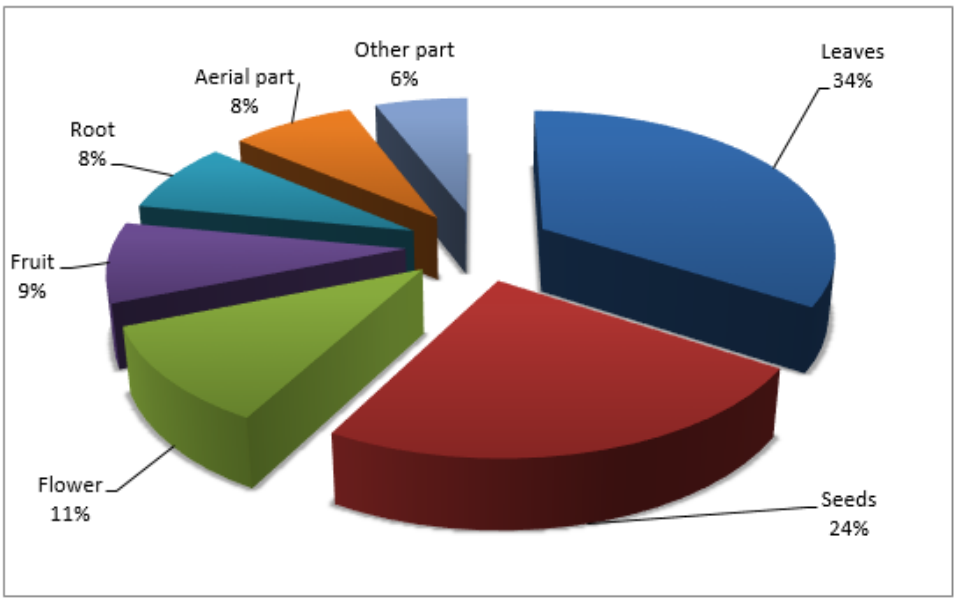

Figure 2. Different parts used for the treatment of dermatological diseases in the zone of study.

Method of preparation and administration used

Different therapeutic practices were used by the local population, for the treatment of dermatological affections (cataplasm, maceration, friction, and powder) to administer the active ingredients contained in the medicinal plants. Cataplasm was the most used mode of administration with a percentage of 46.7% (Figure 3), followed by powder preparation with a percentage of 37.7%, the other modes of preparation namely friction, maceration, and other forms had represented 15.6%. However, the majority of respondents ignore the weights, the dose, and the precise measures to be prescribed in the preparation and dosage of phytomedicines.

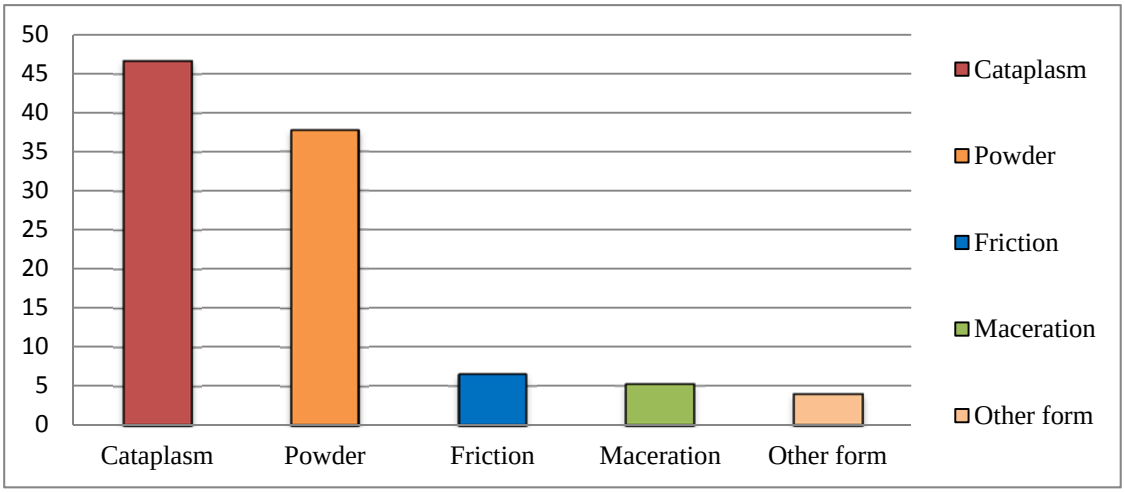

Figure 3. Percentages of different modes of remedies preparation used in the zone of study.

The Informant Consensus Factor (ICF)

The Informant Consensus Factor (ICF) reflects the homogeneity of information provided by different informants regarding the medicinal plants used to treat a category of diseases. Table 6 shows that the ICF values range from 0.87 to 0.96 per use category. A total of 62 species was identified to treat dermatological diseases. The categories with the highest ICF values were cosmetic use (0.96), followed by infectious diseases (0.93) and skin lesions (0.93). These high ICF values reflect the reasonable reliability of informants on the use of herbal species [38] and indicate that natural remedies are considered to be extremely effective. Consequently, species with a high ICF should be prioritized for further pharmacological and phytochemical studies to discover new active molecules.

The lowest agreement among informants was observed for medicinal plants used to treat allergies (Eczema) (0.91) and autoimmune diseases (Vitiligo) (0.87). These values highlight a marked non-homogeneity in the consensus for these categories and may indicate a lack of specific use for a set of species. In agreement with [39], a low ICF could also be due to the availability of readily available synthetic drugs that represent a better alternative to traditional drugs.

Table 6. ICF values by categories for the treatment of dermatological diseases.

Categories	**List of plant species used (number of citations)**	**Total number of**		**ICF**
		Species	**Use citations**	
Cosmetic Uses (CU)	*Allium sativum* L. (20), *Pistacia lentiscus* L. (11), *Chamaerops humilis* L. (22), *Atractylis gummifera* L. (10), *Matricaria chamomilla* L. (28), *Homalothecium aureum* (Spruce) H.Rob. (1), *Lepidium sativum* L. *Sinapis alba* L. (3), *Cannabis sativa* L. (53), *Tetraclinis articulata* Benth. (9), *Mercurialis annua* L. (13), *Ricinus communis* L. (31), *Ononis natrix* L. (2), *Trigonella foenum-graecum* L. (14), *Quercus*	33	753	0.96

Categories	List of plant species used (number of citations)	Total number of		ICF
		Species	Use citations	
	suber L. (19), *Ocimum basilicum* L. (23), *Origanum compactum* Bentham. (8), *Rosmarinus officinalis* L. (4), *Lawsonia inermis* L. (51), *Punica granatum* L. (17), *Eugenia caryophyllata* Thunb. (50), *Myrtuscommunis* L. (43), *Peganum harmala* L. (21), *Olea europaea* L. (66), *Delphinium staphisagria* L. (30), *Nigella sativa* L. (16), *Prunus amygdalus* stokes var. amara DC. (7), *Prunus amygdalus* stokes var. dulcis DC. (10), *Rosa damascena* Mill. (40), *Argania spinosa* L. Skeels. (37), *Solanum lycopersicum* L. (26), *Tamarix aphylla* (L.) Karst. (19), *Daphne gnidium* L. (43), *Urtica dioîca* L. (6).			
Infectious Diseases (ID): Abscesses and furuncles	*Allium cepa* L. (10), *Coriandrum sativum* L. (30), *Nerium oleander* L. (27), *Dittrichia viscosa* (L.) Greuter (17), *Lepidium sativum* L. (6), *Chenopoium ambrosioides* L. (9), *Cistus monspeliensis* L. (12), *Vicia faba* L. (18), *Lavandula stoechas* L. (15), *Marrubium vulgare* L. (25), *Lawsonia inermis* L. (6), *Fucus carica* L. (10), *Ziziphus lotus* L. (14), *Rubia tinctorum* L. (15), *Hyscyamus albus* L. (2), *Thymelaea lythroides* L. (13).	16	229	0.93
Skin Lesion (SL): Burns, wounds and injuries	*Allium cepa* L. (4), *Aristolochia baetica* L. (16), *Borago offinalis* L. (14), *Cynoglossum Officinale* L. (8), *Chenopoium ambrosioides* L. (3), *Cistus monspeliensis* L. (21), *Centaurium Erythraea* Rafn (30), *Crocus sativus*L. (12), *Mentha viridis* L. (17), *Origanum compactum* Bentham. (1), *Salvia Officinalis* L. (12), *Salvia verbenaca* L. (40), *Rubus ulmifolius* Schott. (7), *Coffea arabica* L. (9), *Solanum nigrum* L. (1).	15	195	0.93
Allergy (AL): Eczema	*Daucus carota* L. (12), *Dittrichia viscosa* (L.) Greuter (4), *Tetraclinis articulata* Benth. (20), *Lawsonia inermis* L. (3), *Hyscyamus albus* L. (8), *Solanum nigrum* L. (7).	6	54	0.91
Autoimmune diseases (AD): Vitiligo	*Ammi majus* L. (5), *Anacyclus pyrethrum* (L.) Link. (4),	2	9	0.87

Origin of information on medicinal plants

Regarding the therapeutic use of medicinal plants, the majority of respondents gathered information through the experience of people around them (62.8%), which reflects the image of the relative transmission of traditional practices from one generation to the next. Herbalists are ranked as the second source of information (20.6%) and a small minority (16.6%) through their own experience via television programs (Figure 4).

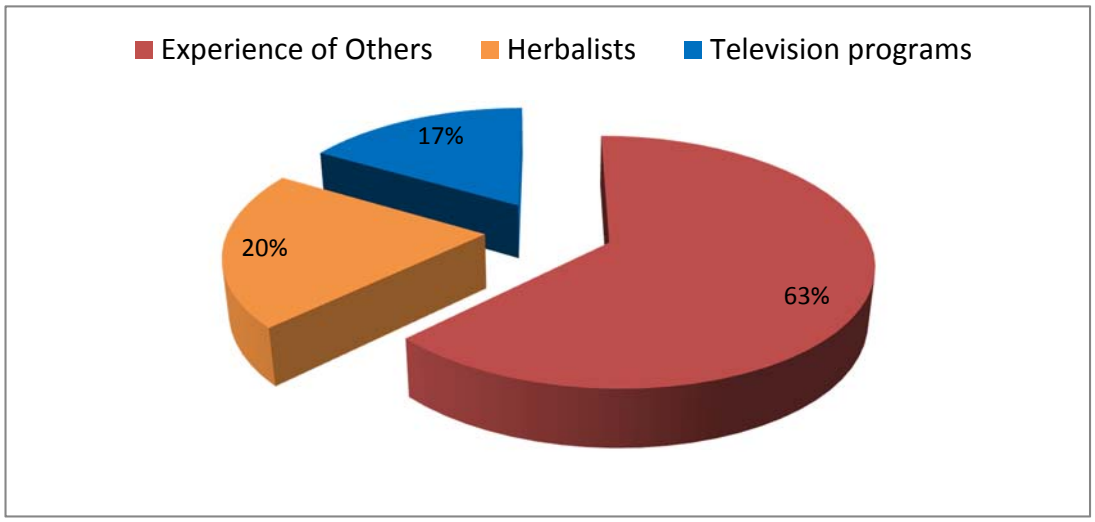

Figure 4. Modes of acquisition of traditional knowledge

Conclusion

The ethnobotanical surveys conducted as part of this study have highlighted the medicinal plant potential and the traditional knowledge related to the use of plants among the population of the Izarène forest. A total of 62 plants of therapeutic value were identified and used in the treatment of respiratory ailments. The qualitative analysis showed a strong association between the orientation of the local population towards traditional medication and certain socio-demographic characteristics low cost, gender, and age are the essential factors that push the local population towards this medication. Similarly, the list of species collected contains toxic plants. In the light of this study, we would like to make the local population aware of the risks of the anarchic use of plants for therapeutic purposes. This work constitutes a source of information which contributes to knowledge of the medicinal flora and the safeguarding of local popular know-how. It can also constitute a database for phytochemists and pharmacologists for the valorization of medicinal plants used in dermatological affections to discover new active ingredients that can be used in pharmacology.

Declarations

List of Abbreviations

SPSS: statistical package for social science
Fc: frequency of citation.
RFC: relative frequency of citation
FIV: family importance value
PPV: plant part value
ICF: informant consensus factor
CU: Cosmetic Uses
ID: infectious diseases (Abscesses and furuncles)
SL: skin lesion (Burns, wounds and injuries)
AL: allergy (Eczema)
AD: autoimmune diseases (Vitiligo).

Ethics approval and consent to participate

Before conducting interviews, all participants gave their prior consent knowing the reason for the study.

Author's contributions

HO: Compiled the literature sources, data analysis, and interpretation, NC: wrote the manuscript. EM and NF: Helped in data, LZ and AD: supervised the work and improved the manuscript. All authors read, reviewed, and approved the final version of the manuscript.

Consent for publication

Not applicable

Availability of data and materials

The data was not deposited in public repositories.

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Conflicts of interest

The authors declare that there is no conflict of interest regarding the publication of this paper.

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استخدام النباتات الطبية في مستحضرات التجميل الجلدية: دراسة استقصائية عرقية–عقاقيرية في منطقة إزارين

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ملخص

تم إجراء دراسة استقصائية عرقية–عقاقيرية بين سكان إزارين لتعزيز وحماية المعرفة السلفية للنباتات الطبية المستخدمة في الأدوية التقليدية لعلاج الأمراض الجلدية. باستخدام 480 ورقة استبيان ، تم إجراء مسوحات ميدانية عرقية نباتية خلال حملتين (من 2013 إلى 2015م). تم تحديد أوساط المسح المختلفة باستخدام تقنيات أخذ العينات الاحتمالية الطبقية. تم تحليل البيانات العرقية النباتية من خلال حساب المؤشرات الكمية، مثل التردد النسبي للاقتباس (RFC)، ومؤشر قيمة أهمية الأسرة (FIV) ، ومستوى الإخلاص (FL) ، وعامل توافق المخبر (ICF) ، وقيمة استخدام جزء النبات (PPV). أظهرت النتائج 62 نوعا نباتيا مفيدا تنتمي إلى 34 عائلة نباتية. كانت عائلة الشفهيات هي الأكثر تمثيلاً (8 أنواع0.037 = FIV). تم تسجيل أعلى تردد اقتباس نسبي (0.137) (RFC) لـ *Olea europaea* L.. فيما يتعلق بالأمراض المعالجة ، فإن استخدام مستحضرات التجميل يحتوي على أعلى معدل (ICF 0.96) ، واعتبرت الورقة هي الجزء الأكثر استخدامًا من النبات (PPV = 0.34) وتم تحضير غالبية العلاجات على شكل كمادة. يمكن أن تشكل النتائج التي تم الحصول عليها أساسًا لمزيد من الدراسات لتثمين النباتات الطبية المستخدمة ضد الأمراض الجلدية من خلال الدراسات البيولوجية والكيميائية النباتية للنباتات التي تم جردها في المنطقة.

الكلمات الدالة: الأمراض الجلدية، المسوح الإثنية النباتية، غابة إزارين، النباتات الطبية.

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