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Original Research Article

Medicinal Plants Species Most Commonly Sold by Herbalists in the Province of Marrakech, Morocco

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ABSTRACT

Morocco is home to a diverse array of plant species, and has a longstanding tradition of ethnobotanical knowledge. This cultural heritage has been preserved through the practices of traditional herbalists. This study aims to compile a comprehensive list of medicinal plants sold in the markets by the majority of herbalists in the Marrakech province. An ethnobotanical survey was conducted from June 1st to November 30th, 2021, information regarding the use of medicinal plants in Marrakech was collected from herbalists through personal interviews. A total of 86 plants were identified for the treatment of 26 diseases and various other uses. The plants were predominantly from the Asteraceae family, followed by Apiaceae and Lamiaceae. The leaves and stems were the most frequently used parts, with the majority of remedies prepared via decoction and infusion. *Ammodaucus leucotrichus* and *Carum carvi* L. exhibited the highest Relative Frequency of Citation (RFC), with RFC ratios of 40%. The category of Cold ailments had the highest Informant Consensus Factor (ICF) value of 0.77. The analysis revealed that the medicinal plants available locally primarily treat digestive system diseases (21.2%), followed by urogenital issues (17.3%), metabolic disorders (15.9%), dermo-cosmetic concerns (12.5%), respiratory ailments (11.5%), osteoarticular conditions (9.6%), neurological disorders (6.3%), and cardiovascular diseases (5.8%). The findings revealed that herbalists in Marrakech region, possesses extensive knowledge of medicinal plants. However, this expertise is confined to a dwindling number of herbalists, posing a risk of disappearance of traditional knowledge as the younger generation shows little interest in preserving these practices.

Keywords: Medicinal plants, Herbalists, Marrakech province, Morocco.

Introduction

Plants have been a foundational element in traditional medicine for millennia.[1] The World Health Organization (WHO) reports that up to 80% of the global population depends on traditional medicine for basic healthcare, and the use of native medicines and medicinal plants provides significant economic benefits.[2]

Traditional knowledge of medicinal plants by indigenous people helps preserve cultural traditions and biodiversity, while also supporting community healthcare and pharmaceutical development.[3,4] However, in many developing countries, traditional medicinal knowledge is under-researched, underused, and poorly documented.[5–7]

In Africa, traditional medicine in its various forms embodies the social and cultural practices of its practitioners, reflecting their lifestyle and worldview. In Morocco also, using plant species for healing is deeply rooted in culture and tradition. It is important to highlight that a significant number of Moroccans rely on traditional medical practices to address their primary health needs.[8–11]

With easy over-the-counter access and options for self-medication, Moroccans have a longstanding and distinguished tradition of using herbal remedies,[12–14] possibly influenced by the country's rich vascular flora, which comprises approximately 5,211 species and subspecies.[15,16]

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The Moroccan medicinal reference study shows that research on medicinal plants is important for improving the country's healthcare system.[16–20] This makes studies like ours necessary to better integrate traditional knowledge, enhance treatments, and support sustainable healthcare practices.

This paper presents a brief study of medicinal plants sold by most herbalists in Marrakech, Morocco, with the aim of cataloging these plants and the associated ethnobotanical knowledge. Future research will focus on investigating their phytochemical and pharmacological properties.

Materials and Methods

Description of the study area

Morocco, which acts as a terrestrial link between Europe and Africa, is located at a botanical crossroads due to its extensive coastlines (approximately 2800 km) along the Atlantic Ocean and the Mediterranean Sea. The country's rich plant diversity can be attributed to its geographic location, diverse topography, geology, ecoregions, and climate.[21–23]

The current study was carried out in Marrakech, a city in southern Morocco positioned at the base of the Great Atlas Mountains. Marrakech is located along a tributary of the Tensift River in the center of the Haouz plain (Figure 1).

Marrakech is bounded to the north by the provinces of El Kelaa des Sraghna and Rhamna, to the south by the province of Al Haouz, to the east by the Province of Rhamna, and to the west by the provinces of Chichaoua and Safi. According to the 2018 census, Marrakech has a total of 1,330,468 residents, divided into 980,548 urban and 349,920 rural inhabitants, across an area of 2625 km². The Medina alone has a population density of 350 inhabitants per hectare.[24] The population comprises a mix of Arab and Amazigh ethnicities.

In 1985, the old Medina of Marrakesh was designated a World Heritage Site due to its significant monuments, cultural values, and the vibrant cultural scene at Djemma el Fna square.[25] Marrakesh is home to a major traditional market that serves as a hub for the herbal trade in southern Morocco.

Data collection and study population

In this study, a documentation, and identification of a variety of plant species that herbalists sell across multiple markets in the Marrakech region, including Medina, Rahba, Mellah, and Bab Doukkala (Figure 2) were done. These are bustling marketplaces where numerous herbalists offer a wide range of Moroccan essentials, from individual herbs to complex mixtures containing various species. In addition to these, various minerals, liquids, and animal skins are also available at the stalls.[26]

These markets probably share a similar structure in terms of organization, conservation, and storage practices. Also, herbalists have uniform knowledge of medicinal plants and consistent therapeutic practices. This expertise has traditionally been transmitted orally across generations.

Notably, most of the herbalists in Marrakesh are male.[26]

The herbalists were selected randomly as we walked through the Medina. After the objectives of the study was thoroughly explained, informed consent was obtained verbally from all participating herbalists, who collaborated voluntarily. All interviews were carried out in Moroccan Arabic language (Darija).

Twenty-one herbalists were recruited, and accepted to participate, and all the medicinal plants sold in their markets were listed. Collectively, they identified 86 different medicinal plants.

Information was collected over a period of six months through structured questionnaire interviews, which included specific questions designed to gather data on various aspects of the species, such as the vernacular name of the plant, its therapeutic use, the part of the plant used, dosage, preparation methods and the age of population treated.

The questionnaire utilized in this study was developed based on methodologies outlined in previously published literature on related topics.[12]

Plant identification

The plant species cited by the herbalist were identified the list of their scientific names were generated from the practical flora of Morocco by Fennane Volume 1, 2 and 3,[27] the medicinal plants of Morocco of Sijelmassi,[28] the traditional Moroccan pharmacopoeia of Bellakhdar,[29] and the Plant List databases (http://www.theplantlist.org/).[30]

Figure 1: Location of the study area

Figure 2: Herbalists selling their products in a market in Marrakech.

Ethnopharmacological parameter analysis

The Relative Frequency of Citation (RFC) was determined using the following formula, which takes into account the local therapeutic significance of each plant species.[31] :

$$FCR\% = \frac{FC}{N} \times 100$$

Where;

FC is the number of participants who indicated using a specific plant species, and N is the total number of participants.

Informant Consensus Factor (ICF) was calculated using the following formula [32]:

$$ICF = \frac{(Nuc - Ns)}{(Nuc - 1)}$$

Where;

Nuc = number of citations for a given use category; Ns = number of species used by informants in a given use category. The values for the Informant Consensus Factor range from 0 to 1.

Statistical analysis

The results obtained were processed and analysed using IBM SPSS Statistics Data Editor. Version 29.0.2.0 (20)

Results and Discussion

Families richest in species used as medicinal plants in the studied region

It was discovered that the majority of the medicinal plants are gathered haphazardly from bushes and mountains surrounding Marrakech. To preserve these plant parts, they are chopped into smaller pieces and either sun-dried or stored in thatched ceilings of homes or hung in fireplaces, where they are constantly heated, thereby reducing their moisture content. In terms of conservation, it was noted that the harvesting techniques in every market were hygienic. To prevent nutrient degradation, well-maintained harvesting tools are used, and the herbs are promptly transferred after harvesting.

The survey findings are outlined in Table 1, with plant families arranged alphabetically. The study encompassed 86 species of ethnomedicinal plants across 43 families. Each entry included the botanical name, local name, parts used, preparation methods, and traditional applications for each species.

These findings highlight the prevalence of certain plant families, with *Asteraceae* leading with 13 plants, followed by Apiaceae with 11 plants, and *Lamiaceae* with 9 plants. Subsequently, Fabaceae features 6 plants, and *Geraniaceae* includes 3 plants, in descending order. Conversely, other families typically contain no more than one or two medicinal plant species.

According to previous studies, the extensive use of the *Asteraceae* family can be attributed to its rich diversity within angiosperms. With approximately 128 genera and around 550 species distributed across Morocco, Asteraceae stands out as one of the most abundant plant families in the region.[33,34]

Members of the *Asteraceae* family exhibit a diverse array of properties, including anti-inflammatory, antimicrobial, antioxidant, and hepatoprotective activities.[35] Species such as Artemisia cina Berg, Arnica *montana L*., and *Matricaria chamomilla L*. are commonly utilized in pharmacy for their therapeutic benefits.[36] The Apiaceae family encompasses a substantial number of plants that are widely used to treat illnesses associated with the digestive, endocrine, reproductive, and respiratory systems.[37] Additional studies indicate that lamiaceae is notably abundant in the Mediterranean basin.[38]

The most used species were *Ammodaucus leucotrichus* and *Carum carvi* L. with the highest RFC ratio (40%), followed by Lepidium sativum and *Cinnamomum cassia blum* with an RFC ratio of 33%. The third most important species, with an RFC ratio of 28%, included *Ammi visnaga*, *Pimpinella anisum*, and *Trigonella foenum-graecum*. The Preference for their use may be related to their availability.

Numerous studies have demonstrated that, depending on the precise geographic region where the survey was carried out, the percentage of Moroccans who use medicinal plants varies greatly, ranging from 55% to 90%.[12]

Moreover, it is common for a single plant to be utilized in treating multiple diseases simultaneously.

Plant parts and methods used

The results showed that the vegetative parts of the plants, notably the leaves and stems were the predominant choices for use, with the leaves leading at 23.6%, followed by the stems at 13%. The reproductive organs were the second most utilized category, with seeds and flowers each at 12.5%. Bark and roots followed at 10.1%, then fruits at 8.2%, rhizomes at 5.8%, and finally peels, thallus, and bulbs each at 1.5% (Figure 3).

The preference for leaves may be due to their easy of collection, and availability. The leaf continues to be the most often used plant part in the study area, which is consistent with the results of previous studies.[39,40] The widespread use of leaves in herbal remedies can be ascribed to their role in bio-organic metabolism and storage of secondary metabolites, especially in aromatic plant species.[41]

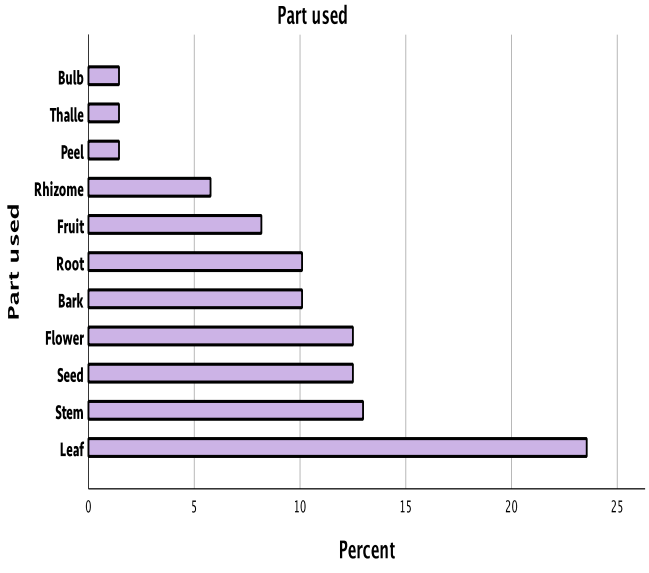

Figure 3: The plant part most commonly used in this study

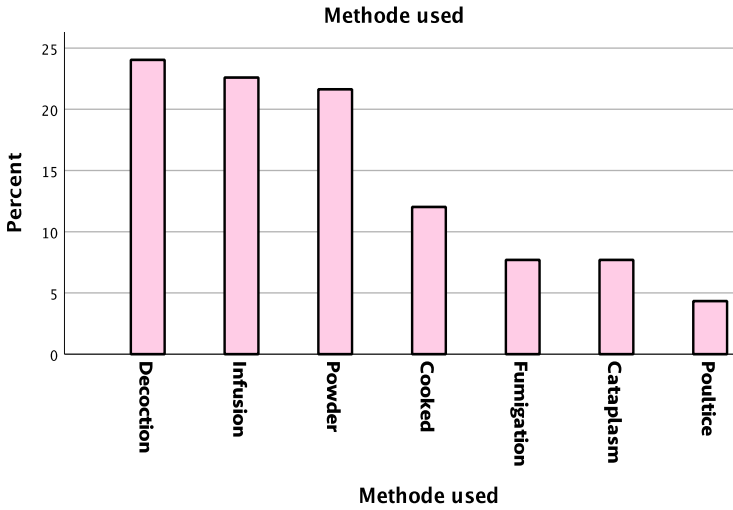

Figure 4: Preparation methods of the medicinal plants employed in this study.

Additionally, the collection of leaves generally exerts a reduced negative effect on plants compared to the harvesting of roots , stems and bark, particularly when sustainable harvesting strategies are lacking.[42]

The preparation of drugs from medicinal plants involves several methods, including decoction, infusion, powder, cooking, fumigation, and poultice. The findings indicated that most remedies were prepared using decoction 24%, and infusion 22.6% methods, followed by delivery in powder 21.6% or cooked forms 12%. Conversely, fumigation and cataplasm methods, both at 7.7%, and poultice techniques, at only 4.3%, were comparatively less employed in preparation (Figure 4).

According to other results, most of the recipes were made mostly by decoction; around 67% of herbal preparations were liquid, and water was the most popular solvent for making herbal remedies because it was readily available and simple to acquire.[43,44]A significant portion of drug preparation methods involves the use of water as a diluent.[1] The decoction's popularity can be attributed to the fact that it allows for the collection of the most active ingredients while also attenuating or preventing the poisonous effects of certain recipe.[45] The prevalence of decoction across various plant species is in complete alignment with the majority of ethnobotanical surveys.[46,47]

The most commonly treated diseases

The older phytotherapy knowledge in this area gives excellent outcomes in the treatment of various human ailments (Table 2). The informants' knowledge allowed for the classification of the reported illnesses and other daily use into 28 categories, which include; asthma, anemia, blood pressure issues, body pain, cancer, cardiologic conditions, colds, coughs, diabetes, earache, fever, hair growth problems, headache, hepatitis, hormonal balances, hyperlipidemia, neurological conditions, ophthalmological issues, oral diseases, poison bites, relaxation, skin diseases, stomach problems, thyroid disorders, traumatic injuries and urogenital infections and some plants are also used as cleaners or insecticides. To confirm the accuracy of the information supplied, the informant consensus factor was computed. Out of all the illness categories, the cold category had the highest ICF value.

The category of Cold was found to have the highest ICF value (0.77) among all ailment categories. This involved the medicinal use of the following species ; calotropis procera, Berberis hispanica Boiss & Reut. , *Lepidium sativum* , *Opuntia ficus-indica* , *Cistus salviifolius* , *Trigonella foenum-graecum*, *Lavandula multifida* L , *Thymus serpyllum* , *Laurus nobilis* L. , *Ranunculus muricatus* L. , Rhamnus alaternus L. , amomum cassia blum., *Alpinia roxburgh officinarum*.

In the traditional beliefs of Moroccans, most diseases are thought to be caused by catching a cold in different parts of the body, which explains the significant number of plants cited in this category of ailments.

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Table 1: Medicinal plants species solde by herbalists in the study area

Family and scientific name	Vernacular name	Part used	Method of preparation	Traditional uses	FCR %
Amaranthacées					
Salsola vermiculat	L'ghssal/chrira/tassra	Leaf/stem	Decoction	Cleanser, Body pain, Stomach P, Cancer.	9
Anacardiaceae					
Pistachier lentisque	Drou	Leaf/ fruit	Infusion / Powder	Oral D, Stomach P, Skin D.	5
Apiaceae					
Ammadaucus leucotrichus	Kamoun soufi	Seed	Infusion	Stomach P.	40
Ammi majus	Tlilan (rjal tir)	Flower/Leaf	Poutlice/powder	Skin D, Stomach P, Asthma, Diabete .	14
Ammi visnaga	Bachnikha	Stem/Flower	Powder	Oral D, Hair growth, Skin D.	28
Anethum graveolens	Chabt	Leaf/Flower	Infusion /Cooked	Diabetes, Stomach P, Traumatological, Ophtalmological.	5
Bunium mauritanicum	Talghouda	Root	Infusion /Powder	Asthma, Hormonal B, Thyroid.	9
Carum carvi L.	El-karwiya	Seed	Infusion/ Powder	Stomach P.	40
Coriandrum sativum	Kazbour	Seed	Powder	Diabetes, Hyperlipidemia, Blood P, Stomach P.	9
Petroselinum crispum	Maadnous	Seed	Decoction/Powder	Body pain, Hyperlipidemia, Blood P.	24
Pimpinella anisum	Nafaa	Seed	Infusion	Stomach P, Cough, Relaxant.	28
Ridolfia segetum Moris.	Tebche	Leaf/flower/stem	Decoction	Anemia, Hepatitis, Relaxant.	5
Thapsia transtagana Brot.	Daryass	Root	Decoction	Body pain, Traumatological, Cancer.	5
Apocynaceae					
calotropis procera	Hayatal noufouss	Root/ Leaf	Infusion	Urogenital infection, Hormonal B, Cold.	9
Arécacées					
Saw palmetto	Lghaz	Fruit	Powder	Hormonal B, Cancer.	14
Asclepiadaceae					
Caralluma europaea	Daghmouss	Stem	Infusion/Powder	Body pain, Cough, Hormonal B, Cancer.	20
Asparagaceae					
Drimia marítima L .	Al-aanssla	Leaf, Bulb	Poultice	Cancer, Cough, Asthma, Skin D, Cardiologic.	5
Asteraceae					
Anacyclus pyrethrum	Takndicht	Bark	Powder	Anemia, Earache, Oral D, Hormonal B.	5
Artemisia huguetii	Chih	Leaf/flower/stem	Decoction	Body pain, Stomach P, Relaxant.	14
Calendula officinalis L.	Jamra	Flower/Root	Infusion	Skin D, Hair growth, Stomach P.	5
Atractylis gummifera L	Adad	Root	Fumigation	Skin diseases, Insecticide.	9
Carthamus tinctorius L	Kaff Saba	Leaf/flower/stem	Powder	Urogenital infection.	5
Chrysanthemum coronarium L	Hmissou	Flower	Decoction	Stomach P, Cardiologic , Neurological.	5
Cichorium intybus L.	Bouaaguad	Leaf	Decoction	Stomach P, hepatitis , Cancer.	5
Cynara humilis L.	Timta	Root	Décoction	Body pain, Fever, Stomach P.	5
Echinops ritro	Tasskra	Root	Decoction	Urogenital I.	14
Matricaria chamomilla	Babounj	Flower	Infusion	Relaxant, Oral D, Stomach P, Ophtalmological.	24
Rhaponticum acaule	Tafgha	Root	Decoction	Asthma, Stomach P.	5
Scolymus hispanicus L.	El Guernina	Stem	Cooked	Stomach P, Diabetes, Blood P, Fever.	14
Taraxacum officinale	Lhandba	Root/leaf/flower	Décoction	Diabetes, Blood P, Stomach P, Skin D.	9
Berberidaceae					
Berberis hispanica Boiss & Reut.	Arguiz	Bark	Décoction	Diabetes, Hyperlipidemia, Cold, Urogenital I.	5
Brassicaceae					
Lepidium sativum	Habrchad	Seed	Cooked	Anemia, Hyperlipidemia, Body pain, Stomach P, Cold.	33
Cactaceae					
Opuntia ficus-indica	Nouara karmouss	Flower	Décoction	Asthma, Cold, Stomach P, Diabetes, Hyperlipidemia.	9

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Capparaceae					
Capparis spinosa L.	al kabar	Fruit	Cooked	Anemia, Diabetes, Asthma, Blood P.	5
Maerua crassifolia Forssk	Atil /Alssarh	Fruit	Powder	Oral D, Urogenital I.	14
Caryophyllaceae					
Corrigiola telephiifolia Pourret.	Sarghina	Root/stem	Decoction	Urogenital I, Skin D, Traumatological.	9
Herniaria hirsuta L.	Harasst lhjar	Stem/leaf/flower	Decoction	Urogenital I.	14
Chenopodiaceae					
Artiplex halimus	Al katf	Leaf	Infusion	Diabetes, Anemia, Urogenital I.	5
Cistaceae					
Cistus salviifolius	Irguel	Leaf/seed	Infusion	Cold, Stomach P, Body pain, Urogenital I.	9
Cucurbitaceae					
Citrullus colocynths	Hadja (achbardo)	Leaf/seed	Fumigation	Hyperlipidemia, Diabetes, Stomach P, Traumatological.	14
Cupressacées					
Juniperus oxycedrus	Aaraar	Leaf	Décoction	Urogenital I, Stomach P, Diabetes, Hair growth, Headache.	19
thuja orientalis	Alaafss / Takawt	Fruit	Powder	Hair growth, Urogenital I.	14
Cyperaceae					
Cyperus rotundus	Tara	Root	Poutlice/Decoction	Diabetes, Oral D, Relaxant , Blood P.	9
Fabacées					
Adenocarpus baquei bath & pit	Agoulthamt	Leaf	Décoction	Traumatological.	5
Astragalus gummifer	Lktira	Fruit	Infusion/powder	Hair growth, Urogenital I, Skin D.	14
Ceratonia Siliqua L.	Lkharoub	Fruit	Powder	Stomach P , Diabetes, Hyperlipidemia, Blood P.	19
Gum d'acacia	Aalk sahraoui	Bark	Infusion	Diabetes, Hyperlipidemia, Oral.D, Stomach P, Earache.	19
Cassia angustifolia	Sana hram	Leaf	Infusion	Stomach P, Hair growth, Skin D.	14
Trigonella foenum-graecum	Halba	Seed	Powder/cooked	Skin D, Cold, Diabetes, Hyperlipidemia, Stomach P,	28
Fagaceae					
Quercus ilex L.	Dbagh	Bark	Décoction	Hair growth, Urogenital I, Oral D, Skin D.	5
Geraniaceae					
Centaurium erythraea Rafn	Gosset lhaya	Leaf/Steam	Infusion	Hyperlipidemia, Fever, Anemia.	5
Pelargonium tetragonum	Zouwaya /zofa	Leaf	Cooked	Cough, Stomach P, Hyperlipidemia, Urogenital I.	9
Pelargonium roseum Willd	Laatercha	Leaf	Infusion	Stomach P, Body pain, Cough, Diabetes.	5
Lamiaceae					
Ajuga iva (L.) Scherb	Chendgûra	Leaf/ Flower	Décoction	Relaxant , Cardiologic, Asthma, Stomach P.	5
Lavandula multifida L.	Lkohayla	Leaf/stem	Infusion	Cough, Asthma, Cold, Urogenital I , Ophtalmological .	14
Lavandula officinalis	Khzama	Leaf/Flower	Décoction	Relaxant , Body pain, Hair growth, Urogenital I .	24
Marrubium vulgar	Mariout	Leaf/stem	Infusion	Cough, Asthma, Diabetes, Stomach P, Cancer .	5
Origanum majorana	Beraztam	Fruit	Powder	Diabetes, Stomach P, Hyperlipidemia, Poison bites.	5
Stoechas officinarum	Halhal	Leaf/stem/Fower	Décoction	Relaxant , Hair growth, Asthma, Stomach P.	5
Teucrium pruniosunum	Khayata	Leaf/stem	Infusion	Fever, Skin D, Stomach P , Urogenital I.	9
Thymus serpyllum	Zaatar	Leaf/Flower	Décoction	Stomach P, Cold, Cough, Oral D.	19
Vitex agnus-castus L.	El kherwaa	Seed	Powder	Hormonal B, Urogenital I.	9
Lauraceae					
Cinnamomum cassia blum.	Al-qarfa	Bark	Décoction	Diabetes, Hyperlipidemia, Cardiologic, Stomach P,Cold.	33
Laurus nobilis L.	Warkat-sidna moussa	Leaf	Infusion	Stomach P, Diabetes, Cardiologic, Blood P, Cold.	14
Malvacées					

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Hibiscus sabdariffa	Karkadih	Flower	Décoction	Diabetes, Hyperlipidemia, Blood P, Hair growth, Relaxant, Hepatitis.	9
Lythracées					
Punica granatum	Kchour roman	Peel	Décoction/Powder	Stomach P, Oral D, Cardiologic, Hair growth.	5
Oléacées					
Olea europaea	Ourak zitoun	Leaf	Décoction	Diabetes, Blood P, Hyperlipidemia, Cancer.	5
Papaveraceae					
Fumaria parviflora lam	Narelbarda / Sibana	Leaf / stem	Infusion	Relaxant, Body pain, Asthma, Cough.	5
Parmeliaceae					
Evernia prunastri ach.	Lhyat-chikh	Thalle	Décoction	Fever, Hepatitis, Relaxant, Body pain, Cough.	5
Pinaceae					
Pinus taeda	Tayda	Bark / leaf	Powder / Infusion	Body pain, Cancer, Relaxant, Headache.	9
Plantaginaceae					
Globulaire alypum	Tasselgha	Flower/leaf	Powder/Infusion	Stomach P, Urogenital I, Blood P.	5
Plantago ovata	Rabla	leaf	Decoction/cooked	Asthma, Cough, Stomach P, Hyperlipidemia.	5
Plumbaginaceae					
Armeria Mauritania vallar.	Aarqlahmer	Root	Decoction	Urogenital I, Stomach P, Cardiologic.	5
Poaceae					
Poa bulbosa L.	Adkher	Rhizome	Décoction	Stomach P, Body pain, Diabetes, Cancer.	5
Urticacées					
Urtica dioica L.	Horigua	Leaf	Infusion	Anemia, Cough, Urogenital I, Stomach P.	5
Ranunculaceae					
Ranunculus muricatus L.	Wden-Lhalouf	Root	Powder	Cold, Traumatological, Oral D, Urogenital I.	5
Renonculacées					
nigella sativa	Sanouj	Seed	Powder	Cough, Diabetes, Blood P, Hyperlipidemia, Urogenital I, Hair growth, Asthma.	14
Rhamnaceae					
Ziziphus	Nbagu	Fruit	Powder	Stomach P, Cardiologic, Skin D.	9
Rhamnus alaternus L.	Amliliss	Leaf/Bark/Fruit	Décoction	Relaxant, Cold, Anemia, Hepatitis, Stomach P.	5
Rubiacées					
Rubia peregrina L.	Fouaa	Root	Powder	Urogenital I, Traumatological, Hepatitis, Stomach P.	9
Terfeziaceae					
Terfezia arenaria	Terfass	Root	Cooked	Urogenital I, Traumatological, Hyperlipidemia.	5
Thymelaeaceae					
Daphne gnidium L.	Alezaz	Leaf	Infusion	Hair growth, Urogenital I, Stomach P.	14
Valérianacées					
Nardostachys jatamansi	Sanbel	Leaf /stem	Powder	Stomach P, Hepatitis, Hormonal B, Hair growth, Ophtalmological.	5
Xanthorrhoeaceae					
Asphodelus ramosus L.	Blalouz	Rhisome	Powder	Earache, Skin D .	5
Zingiberaceae					
Alpinia roxburgh officinarum	Khoudnjal	Root	Décoction	Cardiologic, Blood P, Urogenital I, Fever ,Cold.	24
Zygophyllaceae					
Tetraena fontanesii	Aaguaya	Stem/leaf	Powder	Stomach P, Headache.	19

Hormonal B: Hormonal Balance; Stomach P : Stomach problems ; Blood P: Blood Pressure; Skin D : Skin diseases; Orale D :Oral diseases; Urogenital I : Urogenital infection.

Table 2: Categories of ailment and associated informant consensus factor (ICF) values

Ailments	Total number of species	Use citation	ICF
Anemia	8	13	0.46
Asthma	13	20	0.36
Blood pressure	13	34	0.63
Body pain	14	36	0.62
Cancer	10	17	0.43
Cardiologic	9	24	0.65
Cold	13	42	0.77
Coughs	13	29	0.57
Diabetes	24	59	0.60
Earache	3	6	0.6
Fever	6	13	0.58
Hair growth	14	37	0.63
Headache	3	10	0.7
Hepatitis	7	9	0.25
Hormonal balance	7	14	0.53
Hyperlipidemia	18	53	0.6
Neurological	1	1	0.00
Ophthalmological	4	10	0.6
Oral diseases	11	29	0.64
Poison bites	1	1	0.00
Relaxation	13	31	0.6
Skin diseases	15	36	0.6
Stomach problems	48	126	0.62
Thyroid disorders	1	1	0.00
Traumatological	8	12	0.4
Urogenital infections	27	61	0.56
Cleaner and Insecticides	2	4	0.66

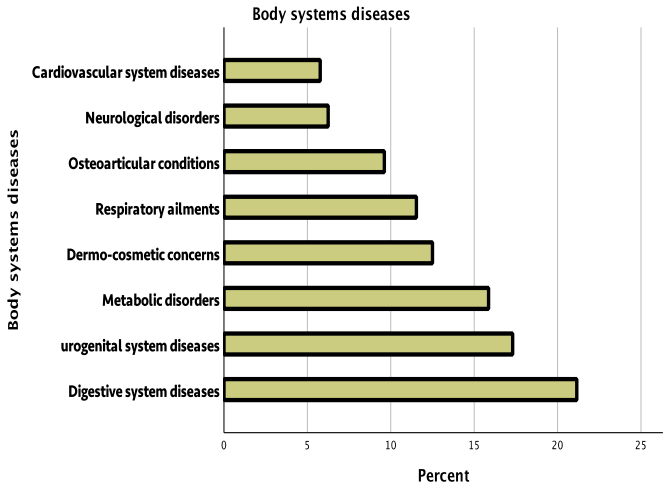

Figure 5: Diseases most commonly treated in this study

Moreover, other research findings suggest that the presence of cold agglutinins, defined by 'cold' autoantibodies that are active at temperatures below 30°C, can contribute to the development of painful osteoarticular crises,[48] a dry cold that tends to intensify the pain, by causing a loss of fluidity in the liquid that lubricates the joints (synovial fluid). As a result, the joints tend to "rub" more and become more painful.

Ethnopharmacological studies have shown that osteoarticular diseases, which can be caused by cold, are a first-use category.[49,50]

Headache (0.7) was the condition category with the next-highest ICF scores. This included the therapeutic application of *Pinus taeda*, *Tetraena fontanesii* , and *Juniperus oxycedrus* as herbal treatments.

The category of cleaners with insecticidal activity was found to be in the third position with ICF value of 0.66. This involved the use of the following species ; *Salsola vermiculat* used as a cleaner - the older generation is familiar with this plant because it is a good vegetale washing solution for cleaning clothes because of its saponifying qualities, and *Atractylis gummifera L.* used as insecticides - this plant is very well known by families in rural areas in Morroco to combat insects. The diseases were categorized by body systems to facilitate analysis. The results revealed the diverse range of pathologies addressed by locally available medicinal plants in the studied region. Leading in popularity is the treatment of digestive system diseases with 21.2% , followed by those of the urogenital system with 17.3%, metabolic disorders 15.9%, dermo-cosmetic concerns 12.5%, respiratory ailments 11.5% , osteoarticular conditions 9.6% , and neurological disorders with 6.3% in descending order. Finally, cardiovascular diseases ended the list with 5.8% (Figure 5).

In Morocco, acute digestive system disorders emerge as a prevalent daily ailment commonly addressed with medicinal plants by a significant portion of the population, a finding supported by the work of Es-Safi et al. (2020),[51] which correlates closely with the findings from the present study.

Diabetes stands out as a primary health concern managed using herbal remedies in Morocco, with researchers advocating for the expanded use of medicinal plants in the treatment of metabolic disorders.[52,53]

In several nations, medicinal plants have been used to treat a variety of urinary and urogenital conditions. In Ethiopia, scientific databases have recorded numerous plant species from 64 families traditionally used to treat various urological and urogenital disorders, among the families with the highest number of medicinal species were Cucurbitaceae and Asteraceae, followed by Euphorbiaceae and Apiaceae.[54]

Skin disease is the fourth most common illness in humans. However, this might not be accurate because many people with skin problems do not visit dermatologists.

Moreover, other studies highlight the long-standing use of medicinal plants in treating several ailments, such as skin conditions, which are frequently self-treated and not always declared.[55] Among the reported taxa from various families, plants from the Fabaceae family were highly preferred for treating skin problems in West Africa.[56] Based on the results from this study, the Fabaceae family is represented by 6 species, which significantly contribute to the importance of dermo-cosmetic uses.

The frequent use of medicinal plants to cure respiratory ailments in Morocco is widely reported in literature. People from many parts of the world, including Africa, Asia, and Latin America, employ traditional medicine to treat respiratory diseases, which helps them satisfy some of their demands for basic healthcare. For example, in agreement with the findings, up to 80% of people in Africa rely on traditional medicine for this purpose.[57]

Also, the findings from the current study demonstrated the existence of traditional Moroccan ethnomedical knowledge on the use of aromatic and medicinal herbs to treat osteoarticular disorders. On the other hand, studies conducted on a number of species showed that Poaceae was the largest botanical family of medicinal plant species used to treat osteoarticular conditions, followed by Asteraceae.[45]

Many medicinal plants are employed for their beneficial effects on the neurological system as well as for their analgesic and mental health therapeutic properties. In a study of the ethnomedical knowledge about

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medicinal plants used in the treatment of neurologic disorders in the Moroccan Rif, found that most often used families of medicinal plants were Asteraceae and Lamiaceae, with respect to the treatment of neurological disorders, including epilepsy.[58]
Lastly, the disease list highlighted the importance of secondary metabolites such as flavonoids, polyphenols, as antioxidants present in plants which help combat oxidative stress, and help prevent cardiovascular illnesses, the leading cause of mortality worldwide.[59–62]

Dose of the herbal formulations
The use of specific doses in treatment with medicinal plants ensures consistency and efficacy while minimizing adverse effects. However, strict adherence may overlook individual responses and traditional wisdom. Conversely, unregulated traditional medicine offers flexibility but increases risks.
From the findings of the present study, 28.8% of informants indicated adhering to a specific dosage when using medicinal plants for treating illnesses, while 71.2% opted for traditional medicine practices without adhering to a specific dosage (Figure 6).
Studies have shown that a majority of medicinal plant users overlook dosage considerations, this poses a health hazard that may result in poisoning due to excessive or prolonged use.[63] It is important to note that the majority of serious side effects stem from the overuse or misuse of these medicines. The risk of side effects escalates in scenarios where the production and sale of such products remain largely uncontrolled or unregulated, coupled with inadequate consumer information regarding their proper usage.[64] in summary, achieving a balance between standardized dosing and traditional methods maximizes therapeutic benefits while minimizing potential risks.

The age of the population
The majority of the medicinal plants were used to treat the population aged between 20 to 50 years (Adult), which accounted for 45.2% of the population, followed by people over the age of 50 years (seniors), which accounted for 39.9% of the population. People under 20 years represented 14% of the population (Figure 7).
The larger proportion of medicinal plants users within the age bracket 20-50 years could be attributed to the fact that this age group consists of the most socially active individuals who shoulder family responsibilities, while the age group 50 years and above represents individuals who may require chronic medication due to their age-related health needs. Similar findings were reported by Pala et al. (2010), who indicating that older individuals, particularly women, extensively use traditional medicinal plants for health purposes.[65] They perceive these remedies as easily accessible, cost-effective, and free from side effects.

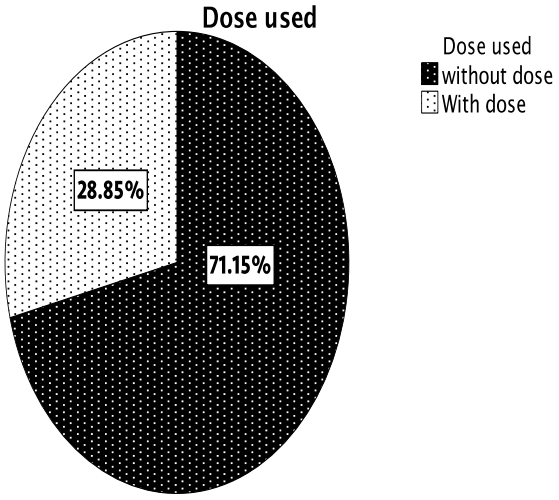

Figure 6: Dosage adherence to medicinal plant use

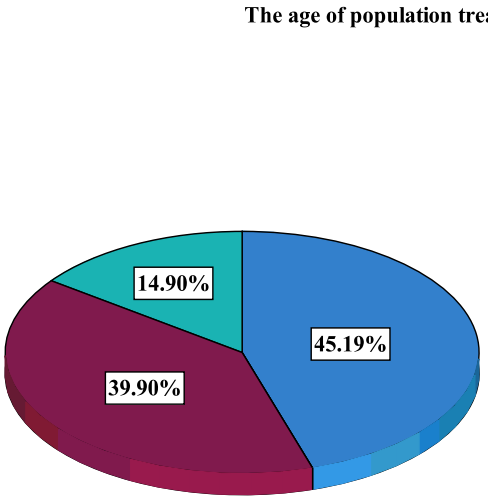

Figure 7: Age of the population using medicinal plants for therapeutic purposes

Conclusion

In the province of Marrakech, despite access to modern healthcare facility, many residents still rely on traditional medicine, using medicinal plants to treat simple ailments such as colds, fevers, headaches, stomach disorders, and skin diseases. The results indicated that the province of Marrakech, with its geographical and cultural diversity, possesses a rich knowledge of medicinal plants. This expertise is predominantly found among elderly herbalists.
This study reported a list of medicinal plant species that can serve as a database of medicinal plants commonly found in most herbalists' shops. Eighty-six (86) plant species belonging to 43 families that have been reported by 21 herbalists to be able to treat 26 human ailments and addressing other daily needs such as serving as cleansers or insecticides. In the light of the above, it is important to document and identify the plants with the highest Relative Frequency of Citation, validate their effectiveness through scientific testing, and explore new bioactive compounds for potential therapeutic use. The declining number of elderly herbalists, along with the younger generation's lack of interest and search for better job opportunities, poses a serious risk to the preservation of traditional medicinal knowledge. This highlights the urgent need to document and safeguard this knowledge before it disappears.

Conflict of Interest

The authors declare no conflict of interest.

Authors' Declaration

The authors hereby declare that the work presented in this article is original and that any liability for claims relating to the content of this article will be borne by them.

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