Medicinal Plants Used by Traditional Healers in Jordan, the Tafila Region

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ABSTRACT

Background: The reporting of the medicinal plants and their traditional uses is important in order to prevent this knowledge from being lost. The aims of this study were to collect information concerning the traditional use of medicinal plants in the region of Tafila; identify the most important medicinal plants; determine the relative importance of the species surveyed; and calculate the informant consensus factor (F_{ic}) in relation to medicinal plant use. **Materials and Methods:** Data on the traditional medicinal uses of local plants were collected using qualitative tools. The informant consensus factor (F_{ic}) for the category of aliments and the use value (UV) of the plant species were calculated. **Results and Conclusions**: The survey revealed that 41 plant species are still in use in Tafila for the treatments of various diseases. Problems of the digestive system had the highest F_{ic} values, while *Allium cepa* L. and *Matricaria aurea* (Loefl.) Sch. Bip. scored the highest UV.

Key words: Medicinal plants, informant consensus factor, Jordan, local knowledge, Tafila

SUMMARY

- The medicinal plants used by local people of the Tafila area of Jordan their traditional uses were investigated. forty one plant species are still in use in Tafila for the traditional treatment of various diseases. The preservation of this knowledge is important not only for maintaining cultural and traditional resources but also as a resource for the future identification of leads for drug development. The use of Fic and the UV to identify plant species that are consistently used in the treatment of specific ailments assists in narrowing down the search for new effective plant-derived medicines and in validating the use of traditional medicines. Data on the traditional medicinal uses of local plants was collected using qualitative tools. The informant consensus factor (F_{ic}) for category of aliments and the use value (UV) of the plant species were calculated. in the Tafila region, the Fic values are relatively low, indicating a low level of shared knowledge and that a number of different species are used to treat similar disorders. This may be a result of the great diversity of vegetation types found across the Tafila region, with the specific plant chosen being dependent on the species most readily available in the different vegetation zones. Interestingly, however, the UVs calculated for a number of species in the Tafila region are relatively high, compared with those recorded in other areas of Jordan. These high UVs indicate that despite the diversity of vegetation types across the Tafila region, a number of plants are highly valued for medicinal use throughout the whole region. This study contributes to the body of knowledge about the use of plants in traditional medicine, helping to document and maintain the knowledge that has been traditionally passed directly from person to person. The preservation of this knowledge is important not only for maintaining cultural and traditional resources but also as a resource for the future identification of leads for drug development. Problems of the digestive system had the highest F_{ic} values, while *Allium cepa* L. and *Matricaria aurea* (Loefl.) Sch. Bip. scored the highest UV. Comparison with other ethnopharmacological studies in the region found consensus about many of the uses reported, and also identified localized uses of some species. Experimental evidence from the literature offered support for many of the reported uses.
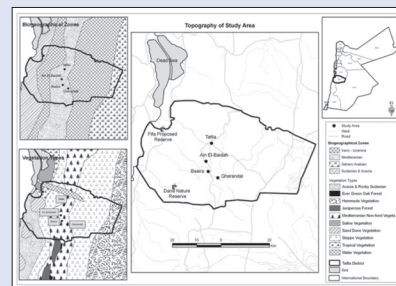
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INTRODUCTION

In the past, herbs were the only sources of most drugs, they were used to eliminate pain and treat diseases; however, this does not mean that herbal medicine is an old science as one might think. Even with the huge developments in chemistry and the pharmaceutical industry, not all of the active components of these herbs have been identified, and so the reliance on herbal medicine remains the basis for a large proportion of medications used today.[1] According to the World Health Organization (WHO), about 4000 million people in developing countries believe in the efficacy of plant remedies and use them regularly.[2] Although modern medicine may be available in these countries, herbal medicines have often maintained popularity for historical and cultural reasons.[3]

Environmental degradation, caused by the higher use rate of the herbs as a source of food, fuel, and medicine, and the disappearance of some rare

medicinal herbs due to the uncontrolled collection of medicinal plants,[4] makes this study significant. The reporting of the medicinal plants and their traditional uses is important in order to prevent this knowledge from being lost, since traditional herbal medicine is less attractive to the younger generation.

Jordan is a small country, but it has a great diversity of wild plants due to the varied geography and climate. It has been estimated that there are a total of 2000 plant species, belonging to 700 genera[4] and according to Atta more than 49 plant families having excess of 120 plant species used in Jordanian traditional medicine.[5] The land itself is unique in its natural diversity due to its geographical location at the meeting point of three continents (Asia, Africa, and Europe). Its special climate, which is influenced by the Mediterranean as a moderating factor and the desert as a drying factor,[6] is characterized by dry hot summers and mild wet winters with extreme variability in rainfall within and between years. In general, rainfall decreases from west to east and from north to south.

The aims of this study are to collect and use semiquantitative methods to analyze information from the local population concerning the use of medicinal plants in the region of Tafila; identify the most important medicinal plants; determine the relative importance of the species surveyed; and calculate the informant consensus factor (F_{ic}) in relation to medicinal plant use. Qualitative tools were used for data collection and to record the interviewee's personal information and topics related to the medicinal use of specific plants.

MATERIALS AND METHODS

Study area

Tafila (30.833 N 35.6 E) is located in a semidesert region on the eastern plateau of Jordan (189 km south of the capital Amman). The Tafila region spans across two biogeographical zones, Mediterranean and Irano-Turanian. The study area covers a diverse landscape, including rocky slopes, gravel plains, sand dunes, and wooded highlands. The majority of the study area consists of two distinct vegetation types, Mediterranean nonforest and steppe vegetation; however, four other vegetation types are also found in the region, providing a diverse range of plants. The rain falls only in the winter season that lasts from October to March. The mean annual rainfall is around 250 mm. The area has a Mediterranean climate with a hot, dry summer and wet winter. The average maximum temperature is 38.5°C in summer and minimum −4°C in winter.[7] The Irano-Turanian zone is characterized by lower rainfall and higher temperatures.

Interviews and plant material collection

This survey was conducted throughout the year 2007. The interviewing team was composed of six members. Interviews took place in the interviewees' homes using the native language (Arabic). The 33 interviewees were aware of their right to refuse to answer any question, to stop the interview at any time, or to simply decline the interview altogether. The survey team conducted 29 home visits during with interviews ranging in length from 30 to 120 min. During the survey, the interviewing team relied chiefly on soliciting information via conversations held during social meetings, oriented discussions, and explicit observations. Data collected through direct interviews were immediately documented in field notebooks. The informants were asked to give their knowledge about the traditional use of the plants, the plant parts to be used, the preparation method of the remedy, and the dosage. All interviews were conducted individually to ensure that the information was as unbiased as possible.

Citations by at least three independent informants were required in order for a particular plant to be reported. Plants were classified into use groups by the researchers according to information about their use in the treatment of ailments supplied by the informants. Plant specimens were collected during the mature stage and were taxonomically identified by comparing collected voucher specimen with those of known identity in the herbarium of the Department of Biological Science, Faculty of Science, University of Jordan, and with the assistance of Prof. Dr. D. El-Eisawi, Plant Taxonomist, Department of Biological Sciences, University of Jordan. A voucher specimen of each plant was deposited in the author's research laboratory at the Department of Pharmaceutical Sciences, Faculty of Pharmacy, University of Jordan.

Samples of survey herbs were collected for herbarium preparation following standard procedures[8] and given a herbarium specimen number [Table 1].

Data analysis

Informants consensus factor (F_{ic}) and plant use values (UVs)

All citations were placed into ailment categories for which the plant was claimed by the informants to be used and the informants consensus factor (F_{ic})[9] was calculated. The F_{ic} index indicates the homogeneity of the information about a specific plant use to treat a particular category of ailment and, therefore, the degree of shared knowledge for the treatment of that ailment. It most clearly defines consensus among informants by comparing the number of times a plant is mentioned for a specific ailment to the number of times that ailment is mentioned in the interview processes. The F_{ic} was calculated by the following formula[9]:

$$F_{ic} = (n_{ur} - n_t)/(n_{ur} - 1),$$

where

n_{ur}: number of use reports per each category

n_t: number of taxa used

The value of this factor ranges from 0 to 1. A high value (close to 1) indicates taxa (usually species) used by a relatively large proportion of the informants for the same category of illness, indicating a more consistent use of the medical resources. Plants that are cited as useful by only one or two informants are considered to be of low cultural importance. However, since this index is based on use categories instead of individual plant uses, there exists a certain degree of bias or subjectivity depending on how the used categories are defined by researchers and may generate different results depending on the researcher who determines and assigns the categories.

The use value (UV) index[10] assesses the relative importance of each plant species known locally to be used as herbal remedy. The UV is based on individual plant uses as provided by respondents and is therefore less prone to subjectivity. Because it does not require classification of primary data into subjectively assigned categories by the researcher, UV provides an objective assessment of the cultural importance of plants. In addition, with sufficient number of informants, minor uses or even mistakes will only minimally influence UVs.[10] A recent discussion of quantitative methods used in ethnobotany[11] concluded that the cultural importance (CI) index is likely to be most objective and noted that although defined differently, the UV index generates identical results to the CI index when based on individual plant uses instead of use categories, confirming the objectivity of the UV index. The UV is calculated as follows[12]:

$$UV = \Sigma U/n$$

where

UV: use value of a species

U: number of uses per species

n: number of informants

The use of the informants consensus factor in addition to the use value index allows the degree of consensus about the treatment of different

Table 1: Plants and herbs used for treatment of various human ailments in Tafila

Scientific name (voucher specimen)	Local name	Family name	Part used	Methods of use	Recommended uses	UV
Achillea fragrantissima (Forssk) Sch. Bip. (AF-T)	Kaisoom	Asteraceae	Aerial parts	Infusion	Headache, calmative, anthelmintic, carminative, cough, colic, antidiabetic	1.42
Allium cepa L. (ACP-11)	Basal	Alliaceae	Bulbs	Fresh and steam inhalation	Heart diseases, appetizer, antidiabetic, antiasthmatic, cough, anthelmintic, intestinal inflammation	2.58
Allium Sativum L. (AST-20)	Thom	Alliaceae	Bulbs	Fresh and steam inhalation	Hoarseness, alopecia, antihypertensive, arteriosclerosis, anthelmintic, intestinal inflammation	2.24
Aloe Vera (L.) (Al-VT)	Saber	Asphodelaceae	Leaves and fruit	Sap	Eczema, laxative, emollient, hair tonic, pain of nerves, stomach ulcer	1.09
Aloysia citrodora Palau (Aloy-1)	Malessa	Verbanaceae	Aerial parts	Infusion	Calmative	0.03
Anchusa strigosa Banks and Sol. (AnS-MJ)	Himhim	Boraginacea	Aerial parts	Decoction, Poultice	Stomachache, hoarseness	0.42
Artemisia herba-alba Asso (AHA-99)	Sheih	Asteraceae	Leaves and flowers	Infusion	Wound healing, anthelmintic, eczema, colic, enuresis, antidiabetic, headache	1.55
Beta vulgaris L. (BV-12)	Siliq	Chenopodiaceae	Leaves	Cooking	Edible	0.00
Citrullus colocynthis (L.) Schrad. (CC-01)	Handal	Cucurbitaceae	--	--	Highly toxic (not used medicinally)	0.00
Coriandrum sativum L. (CoS-MJ)	Kuzbara	Apiaceae	Leaves and Seeds	Decoction	Spice, anthelmintic, appetizer	0.45
Crocus pallasii Goldb. (CP-007)	Shaheem	Iridaceae	Bulbs	Fresh	Constipation	0.18
Ecballium elaterium (L.) A. Rich. (EE-MJ)	Faqos el hamir	Cucurbitaceae	Fruit juice	Nasal drops of juice	Hepatitis	0.18
Euphorbia hierosolymitana Boiss. (EH-MJ)	Halabloob	Euphorbiaceae	Latex and roots	Ointment in olive oil	Constipation	0.21
Ficus carica L. (FC-T-007)	Teen	Moraceae	Leaves and fruit	Fresh fruit and decoction of leaves	Kidney and bladder problems, acne, antidiabetic, constipation	1.27
Foeniculum Vulgare Mill. (FV-MJ)	Shomer	Umbelliferae	Leaves and seeds	Infusion	Magic trials, spices, cough, antispasmodic	0.52
Gundelia tournefortii L. (Gon-T)	A'kub	Asteraceae	The heads of the plant	Fresh or Cooked	Anemia	0.09
Juniperus communis L. (Ju-CT)	Ar'ar,	Cupressaceae	Leaves	Decoction	Calmative, antidiabetic, stomachache,	0.55
Lepidium sativum L. (LS-T)	Habb al Rashad	Brassicaceae	Seeds	Decoction	Appetizer, hair tonic, menstruation, anthelmintic, constipation, sexual weakness,	1.33
Lycium shawii Roem. & Schult. (Shaw-Tf)	Awsaj	Solanaceae	Leaves	Decoction	Mouth ulcerations, hair tonic, eye infections	0.52
Malva parviflora L. (MP-Tf)	Hobazeh	Malvaceae	Leaves	Infusion	Cough, constipation, skin burns, weakness of sight, hair tonic, urinary tract infection	1.12
Matricaria aurea (Loefl.) Sch. Bip. (MA-Tf)	Babonej	Asteraceae	Flowers	Infusion	Hemorrhoids, cosmetic, colic, skin cracks, urinary tract infection, constipation, antispasmodic, cough	2.58
Mentha longifolia L. Huds. (ML-Tf)	Habaq	Lamiaceae	Leaves	Infusion	Respiratory system, colic	0.52
Mentha piperita L. Huds. (MP-Tf)	Nana	Lamiaceae	Leaves	Infusion	Calmative, stomach Inflammation, colic, antispasmodic	1.76
Nerium oleander L. (Ner-Tf)	Duphla	Apocynaceae	Leaves	Decoction	Scabies	0.12
Nigella sativa L. (NS-Tf)	Habit el-Baraka	Ranunculaceae	Seeds	Decoction	Aching joints, memory enahancemen,, headache, eye disease, antiasthmatic, cough	1.67

Contd...

Table 1: Contd...

Olea europaea L. (OE-Tf)	Zaitoon	Oleaceae	Fruit	Oil	Breast Cancer, colon cancer, emollient, heart disease, constipation	2.09
Paronychia argentea Lam. (PA-Tf)	Rijel el hammame	Caryophyllaceae	Aerial parts	Decoction	Diuretic, heart disease, stones in kidney and urinary system	0.88
Peganum harmala L. (PH-Tf)	Harmal	Nitrariaceae	Whole plant	Smoking	Magic trials, sheep fertility	0.48
Petroselinum crispum (Mill.) (PS-Tf)	Bagdoones	Apiaceae	Leaves	Infusion	Appetizer, diuretic, hair tonic, cosmetic, antidiabetic, kidney and urinary system, kidney stones, urinary tract infection	1.61
Pistacia terebinthus L. subsp. *palaestina* (Boiss.) (Pis-Tf)	Butum	Anacardiaceae	Seeds	Roasted	Edible	0.00
Portulaca oleracea L. (POO-Tf)	Bakleh	Portulacaceae	Whole plant	Fresh or cooked	Edible	0.36
Punica granatum L. (PG-Tf)	Rumman	Lythraceae	Fruit coat	Decoction	Dyeing hair, stomach ulcer	0.27
Quercus coccifera L. (QC-Tf)	Baloot	Fagaceae	Fruit and roots	Decoction	Scalding, stomach ulcer, liver cirrhosis, antidiabetic	0.27
Rosmarinus officinalis L. (RO-Tf)	Hasa alban	Lamiaceae	Leaves	Infusion	Anti-inflammatory, kidney stones, rheumatism, colic, headache	0.97
Salvia fruticosa Mill. Synonym: *Salvia triloba* L. (ST-Tf)	Meriamia, Meirameieh	Lamiaceae	Leaves	Decoction, infusion	Hair tonic Antidandruff, weight loss, enhance memory, colic	0.85
Sarcopoterium spinosum (L.) Spach (SS-Tf)	Billan	Rosaceae	Roots	Poultice	Pain of nerves	0.18
Teucrium polium L. (TP-Tf)	Jeada	Lamiaceae	Aerial parts	Infusion	Diuretic, wounds healing, cholesterol reduction, calmative, cough, urinary tract infection, colic, antidiabetic	1.58
Thymus vulgaris L. (Thym-Tf)	Zaatar, Mardakoosh	Lamiaceae	Leaves	Infusion	Enhance memory, respiratory system, cough	0.97
Triticum aestivum L. (Taes-Tf)	Kamh	Poaceae	Seeds	Juice	Eye infections	0.09
Urtica pilulifera L. (UP-Tf)	Kurais	Urticaceae	Leaves and stem	Cooked, fresh, decoction	Antidandruff, anti-asthmatic, antidiabetic, depurative, anti-jaundice, urinary tract infection, rheumatism	1.30
Varthemia iphionoides Boiss and Blanche (Val-Tf)	Ktaile	Asteraceae	Flowering tops	Infusion	Kidney stones, Eye infections, renal, colic	0.58

ailments within a community to be assessed as well as the identification of the most important medicinal plant species.

RESULTS AND DISCUSSION

The majority of the people in the Tafila region are of Bedouin descent living in seminomadic or settled rural communities. The informants were resident in the community and were recognized by community members as being knowledgeable about the uses of the medicinal plants and were frequently sought out by the community members for advice on the medicinal use of plants. Of the 33 informants, 11 were male and 22 were female. The plants used were either sourced from the wild or grown specifically for use. During the interviews, it was not evident that the informants were not aware of any conservation issues and there were no reported measures taken to sustain threatened species.

Women were identified as the sole source of knowledge on the use of herbs in the past, as well as, the present. Both male and female interviewees referred the team to the old Hajat, who are more knowledgeable. Women were more forthcoming in sharing their knowledge of the herbs. The community viewed healing knowledge part of the heritage of the community to be treated with utmost respect, which is to be transferred to the younger generations of women. Healers are predominately older women whose help is sought after by the community for advice on health issues particularly related to women and children.

No herbalists in its strict sense or real practitioners were encountered in this study area and the women usually practice treatment free of charge. Only four older women and one practitioner in Tafila were reported to collect plants during the spring for sale mainly to the locals. The plants used are generally "safe" and non-toxic, providing treatments for digestive problem such as nausea, vomiting, abdominal spasm, flatulence, stomachache, and kidney stones. The older women also provide female patients with all the solutions regarding pregnancy, abortion, fertility, sterility, delivery, and gynecological disorders.

A total of 41 medicinal species from 27 families were documented with their medicinal uses [Table 1]. The families of most medicinal importance in this region are Lamiaceae (six species) and Asteraceae (five species). The leaves were found to be the most frequently used parts in the preparation of herbal remedies and comprised 37% of all the reports on the use of plant parts. This was followed by flowers and aerial parts (18%), fruit (15%), seeds (12%), and other parts of the plants such as stem and sap (8%).

The most common method of administration was either as infusions or decoctions taken orally, particularly for colic, constipation, other abdominal ailments, and disorders of the urinary tract. Alternatively, the skin was bathed with decoctions or infusions for the skin disorders. Many treatments were simply administered either raw or cooked. Some

remedies were mixed with honey as the case with *Allium cepa* L. and *Nigella sativa* L. in treating asthma and cough as well as in the case of *Aloe Vera* L. in the treatment of stomach ulcers. In the case of skin diseases, inflammation, eye infection, and hair treatment, the remedies were applied topically. Remedies may also be administered by other methods such as vapor inhalation as in the case of *Peganum harmala* L. or nasal application as in the case of *Ecballium elaterium* L. juice for the treatment of jaundice especially in newborn babies.

The UV for each plant was calculated during the analysis of the data.[12] This technique emphasizes the plant's relative local importance. The species with the highest UV were *A. cepa* L. and *Matricaria aurea* (Loefl) Sch. Bip. with an UV of 2.58. *A. cepa* L. is used as appetizer, antidiabetic, anti-asthmatic, anthelmintic and for heart disease, cough, and intestinal inflammation. While *M. aurea* (Loefl.) Sch. Bip. is used for hemorrhoids, colic, skin cracks, urinary tract infection, and cough, as laxative and carminative, and in cosmetics. *Allium sativum* L. had the second highest UV (2.24). This species is frequently used for hoarseness, alopecia, hypertension, arteriosclerosis, intestinal inflammation, and as an anthelmintic. *Olea europaea* L. used for breast and colon cancer, heart diseases, constipation, and as an emollient was reported with UV of 2.09.

All of the medicinal attributions cited by the interviewees were grouped into 10 ailment categories predominantly associated with different body systems: digestive system, liver, nervous system, respiratory system, skin, genitourinary system, hair, circulatory system, sensorial system, and diabetes. Table 2 shows important plant species for each illness category. The F_{ic} values indicate the degree of shared knowledge for the treatment of the ailment by medicinal herbs. The highest F_{ic} value was linked to

problems related to the digestive system (0.37) and for liver problems (0.33). The used category with the lowest F_{ic} value was circulatory system (0.14). The higher F_{ic} values indicate that the medicinal plants are effective in treating a certain disease.[13] Table 3 shows these categories with their F_{ic} values. A more detailed description of each category follows.

Digestive system problems

This group had the highest number of citations (39) with an F_{ic} of 0.37. Twenty-five species, representing 60.98% of the total plant species, were used for the treatment of digestive system ailments. This category includes treatment of all problems related directly or indirectly to digestion such as anthelmintic, carminative, colic, stomachache, constipation, appetizer, and laxative.

Quercus coccifera L., *Punica granatum* L., and *A. vera* (L.) have been screened for their possible anti-ulcer activity and their ethanolic extracts have been reported to significantly lower the severity of gastric damage in the test animals, which supports their claimed medicinal uses for stomach ulcer.[14,15]

The use of *Coriandrum sativum* L., *A. sativum* L., *A. cepa* L., and *Artemisia herba-alba* Asso as anthelmintics is also supported by experimental data. The alcoholic extract of *C. sativum* L., *A. sativum* L. and the powder of *A. herba-alba* Asso were investigated for treatment of *Haemonchus contortus* parasite,[16-19] while the oil from *A. cepa* L. demonstrated an anthelmintic effect in the rats infected with *Trichinella spiralis* and there was an increase in the production of antibodies generated during the life cycle of this parasite.[20]

Table 2: Important plant species used to treat common illnesses in Tafila

Illness category	Species
Digestive system problems	*Achillea fragrantissima, Allium cepa, Allium Sativum, Aloe Vera, Anchusa strigosa, Artemisia herba-alba, Coriandrum sativum, Crocus pallasii, Euphorbia hierosolymitana, Ficus carica, Juniperus communis, Lepidium sativum, Malva parviflora, Matricaria aurea, Mentha piperita, Olea europaea, Paronychia argentea, Petroselinum crispum, Punica granatum, Rosmarinus officinalis, Salvia fruticosa, Teucrium polium, Urtica pilulifera, Varthemia iphionoides*
Liver problems	*Urticapilulifera, Ecballium elaterium, Quercus coccifera*
Nervous system disorders	*Achillea fragrantissima, Aloysia citrodora, Artemisia herba-alba, Juniperus communis, Mentha piperita, Nigella sativa, Rosmarinus officinalis, Salvia fruticosa, Sarcopoterium spinosum, Teucrium polium, Thymus vulgaris*
Respiratory system problems	*Allium sativum, Allium cepa, Mentha piperita*
Skin problems	*Aloe Vera, Artemisia herba-alba, Malva parviflora, Matricaria auream, Nerium oleander,*
Genitourinary system problems	*Ficus carica, Malva parviflora, Matricaria aurea, Paronychia argentea, Petroselinum crispum, Rosmarinus officinalis, Teucrium polium, Urtica pilulifera, Varthemia iphionoides*
Hair and scalp problem	*Aloe Vera, Petroselinum crispum, Petroselinum crispum, Urtica pilulifera*
Circulatory system	*Allium cepa, Allium Sativum, Gundelia tournefortii, Mentha longifolia, Teucrium polium*
Sensorial system (eye)	*Lycium shawii, Malva parviflora, Nigella sativa, Triticum aestivum, Varthemia iphionoides*
Diabetes	*Achillea fragrantissima, Allium cepa, Artemisia herba-alba, Ficus carica, Juniperus communis, Petroselinum crispum, Petroselinum crispum, Teucrium polium, Teucrium polium*

Table 3: Informant consensus factor values of category of aliments

Category	Species	Percentage of all species	Use citations	All use citations (%)	F_{ic}
Digestive system problems	25	60.98	39	31.71	0.37
Liver problems	3	7.32	4	3.25	0.33
Nervous system disorders	10	24.39	14	11.38	0.31
Respiratory system problems	12	29.27	16	13.01	0.27
Skin problems	9	21.95	12	9.76	0.27
Genitourinary system problems	8	19.51	10	8.13	0.22
Hair and scalp problem	6	14.63	7	5.69	0.17
Circulatory system	7	17.07	8	6.50	0.14
Sensorial system (eye)	5	12.20	5	4.07	0.00
Diabetes	9	21.95	9	7.32	0.00

F_{ic}: informant consensus factor

Liver problems

This group obtained the second highest F_{ic} value (0.33). Three species are used to treat medicinal problems within this group; *Urtica pilulifera* L., *Ecballium elaterium* L., and *Q. coccifera* L. Of the three plants, only *E. elaterium* (L.) has currently been reported for the treatment of liver disorders across different regions of Jordan.[3,21] The effectiveness of *E. elaterium* (L.) is also supported by experimental data that show that extracts decrease serum bilirubin concentration in male rats.[22] Cucurbitacins, isolated from of *E. elaterium* L., have also been demonstrated to reduce direct bilirubin and total bilirubin in human plasma,[23] supporting the traditional use of *E. elaterium* L.

Nervous system problems

The F_{ic} for this category was 0.31. A total of 10 species were cited with 14 uses. The treatment of headache and as a calmative were the most frequent citations. The most important representative of this group was *Nigella sativa* L., with 86% of the informants suggesting the use of this plant for headaches. Despite the common use of *N. sativa* L. for the treatment of headaches in the Tafila region and the fact that it is frequently identified as a medicinal plant in studies of other Jordanian regions, headaches were not cited as one of the uses in these studies,[3,21,24] suggesting that this use of *N. sativa* L. is through local knowledge. *Aloysia citrodora* Palau was also reported to have a calmative effect, which may be supported by a new study, which demonstrates that the essential oil of *Aloysia citrodora* possesses antioxidative, nicotinic cholinergic, and some neuroprotective activities.[25] The use of *Salvia fruticosa* Mill and *Rosmarinus officinalis* L. for remedies targeting the nervous system problems has been investigated by two different studies. *S. fruticosa* showed sedative and cognition-enhancing properties.[26] While *R. officinalis* demonstrated antidepressant, anxiolytic, and antinociceptive effects.[27]

Respiratory system problems

This category had the second highest number of citations (16), with an F_{ic} value of 0.27. Asthma and coughs are examples of problems within this category. *A. sativum* L., *A. cepa* L., and *Mentha piperita* L. are the representative plants of this category with the three highest UVs. All three species have been reported to be used medicinally throughout Jordan. However, none of the three species have been reported to be used for respiratory illnesses in all the current studies,[3,21] suggesting variations in the local knowledge in their use.

Skin problems

This category shared the same F_{ic} value with respiratory system problems (0.27), but with a total of 12 citations (9.76% of the total). *A. herba-alba* (Asso) was claimed to treat eczema and wounds; however, this seems to be a local use of this plant. Although *A. herba-alba* (Asso) is reported as being one of the most widely used plants in Jordan,[24] its use in the treatment of skin disorders has not been previously recorded.

Genitourinary system problems

With 10 citations, this category comprises eight plant species, with F_{ic} of 0.22. This category includes ailments like diuresis, kidney and bladder problems, and urinary tract infections. *Petroselinum crispum* Mill. and *Teucrium polium* L. are representative plants of this category. *T. polium* L. is recognized as one of the most common species for the treatment of renal disorders.[24] *Paronychia argentea* Lam. was also reported as a treatment for kidney stones in the Tafila district. This knowledge also appears to be widespread across Jordan with this species being recognized as a commonly used treatment for kidney stones and urinary tract infections.[24]

Hair problems

The F_{ic} value of this category is 0.17. This category includes plant species used as hair tonic to treat dandruff. The use of the water extract of *S. fruticosa* Mill. for the treatment of dandruff in Tafila is very common and claimed to be very efficient.

Circulatory system

Heart disease, hypertension, and arteriosclerosis are examples of problems belonging to this category. The widely used *A. sativum* L. and *A. cepa* L. are the representative plants of this category. The chloroform extract of *Gundelia tournefortii* L. has been reported to have a mild inhibitory effect on platelet aggregation, which offers some support for the traditional use of *G. tournefortii* L. for anemia.[28]

Sensorial system problems and diabetes

These two categories shared the same F_{ic} value of 0.00. There was only one use citation for each plant in each category. Five plant species were used for eye diseases and nine for diabetes. The categories recorded a lower F_{ic}, which could be due to the informants' diverse backgrounds or their different sources of information. Alternatively, according to Aburjai, this may be attributed to the civilization trend of the society and the tendency of the people to follow orthodox medicine in modern society for recognized diseases.[3]

This survey reported nine medicinal plants that were used as antidiabetics in Tafila; however, only five of these plants have been tested for their hypoglycemic effect. *A. herba-alba* (Asso) was found to produce a significant reduction in blood glucose level.[29] *Ficus carica* L., *Juniperus communis* L., and *Urtica pilulifera* L. induced a significant hypoglycemic effect in streptozotocin-diabetic rats.[30–32] On the other hand, *T. polium* L. has been reported to exhibit no hypoglycemic effect.[33]

There are some criteria one should take into account when using medicinal plants and investigating their biological activities. First, it is important to select the correct part or parts of the plant. According to Aburjai, the different part of the plants may contain different concentrations of the active constituents and in some cases may contain totally different phytochemical substances.[3] Second, the harvest time of the herb, the soil, the climatic conditions, and the method of drying, processing, and extraction should also be recorded as all these factors may influence the amount of active constituents present.

Most of the informants are aware of the toxic plants found in Tafila, the main ones being *Citrullus colocynthis* L., *Euphorbia hierosolymitana* Boiss., *Ecballium elaterium* L., *Nerium oleander* L., and *Peganum harmala* L. Despite the toxicity of these plants, patients rarely suffer any adverse consequences because the practitioners of these plants are skilled in dealing with such plants and they take the appropriate precautions such as using lower doses. This is why these plants were noted to be used by traditional medicine practitioners and not by the locals, and according to Al-Qura'n, toxic plants of Jordan are well identified and fully known by local rural inhabitants.[34] Interestingly, *Citrullus colocynthis* L. was reported as highly toxic by the informants and not used medicinally in the region of Tafila. However, in the Mujib Reserve, it is used for the treatment of jaundice, diabetes, and arthritis.[21] This may represent regional variations in knowledge of handling this species or regional variations in the toxic constituents of the plant.

CONCLUSION

This study investigated the medicinal plants used by local people of the Tafila area of Jordan, a semi-desert region on the eastern plateau of Jordan. The calculated F_{ic} and UV indicate that the people of the

Tafila region have a sound knowledge of traditional medicine, with 72 indications and a total of 41 medicinal plants of importance recorded. Interestingly, the study also reports the use of traditional medicine for the treatment of "modern diseases" such as hypercholesterolemia and diabetes. Comparable medicinal uses have been documented for many of the plants from surveys conducted in Jordan and neighboring countries. However, variations in the use of plants for different medical conditions suggest that there are local differences in knowledge about plants and their uses, which may also reflect the diversity of plant species in the Middle East.

Consistent with ethopharmacologic studies of other regions in Jordan, digestive disorders scored the highest F_{ic} with a similar percentage of use citations across the different regions. However, in the Tafila region, the F_{ic} values are relatively low, indicating a low level of shared knowledge and that a number of different species are used to treat similar disorders. This may be a result of the great diversity of vegetation types found across the Tafila region, with the specific plant chosen being dependent on the species most readily available in the different vegetation zones. Interestingly, however, the UVs calculated for a number of species in the Tafila region are relatively high, compared with those recorded in other areas of Jordan. These high UVs indicate that despite the diversity of vegetation types across the Tafila region, a number of plants are highly valued for medicinal use throughout the whole region.

This study contributes to the body of knowledge about the use of plants in traditional medicine, helping to document and maintain the knowledge that has been traditionally passed directly from person to person. The preservation of this knowledge is important not only for maintaining cultural and traditional resources but also as a resource for the future identification of leads for drug development. The use of F_{ic} and the UV to identify plant species that are consistently used in the treatment of specific ailments assists in narrowing down the search for new effective plant-derived medicines and in validating the use of traditional medicines. A literature survey provided support for the efficacy of some but not all of these plants in the treatment of various illnesses.

Financial support and sponsorship

Conflicts of interest

There are no conflicts of interest

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