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A survey of medicinal plants used by herbalists in Taza (Northern Morocco) to manage various ailments

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Abstract

The present study aims at identifying and documenting medicinal plants used traditionally by the population in Taza (Northern Morocco) to manage various diseases. Validated questionnaires were administered to herbalists from different districts of the study area. Interviews and structured conversations were used to collect relevant information. Samples of medicinal plants were requested and identified, and the use value was calculated. In total, 104 medicinal plants belonging to 47 different families are used by the population to treat various human diseases in Taza. The most cited families are *Lamiaceae* (19.4%), *Fabaceae* (9.57%), *Asteraceae* (7.05%) and *Apiaceae* (6.3%). In this region, the most frequently used plants include *Lavandulla officinalis*, *Origanum compactum*, *Rosmarinus officinalis*, *Nigella sativa*, *Rubia peregrina*, *Myrtus communis* and *Matricaria chamomilla*. Seeds/fruits (30.77%) are the most common part used, followed by leaves (19.66%) and aerial parts (17.95%). The most remedies are administered orally (72.87%) and prepared with an aqueous base, preferentially as powder (43.31%), decoction (31.50%) or infusion (19.69%). Herbal remedies are used to treat 18 pathological groups of diseases; of these, digestive disorders are the most cited by herbalists. This study showed that local knowledge of medicinal plants still exists in Taza and herbalists appear to play an important role in primary health care services in the surveyed area. These results underscores the need for more future scientific research on these medicinal plants to determine their efficacy and their safety.

1. Introduction

Traditional medicinal plants have been widely used to treat and/or to prevent diseases since ancient times. According to the World Health Organization (WHO), 80% of the world's population, especially people in developing countries is dependent on traditional medical practices for some aspect of primary health care [1-4]. The interest in the use of herbal medicines has been attributed to their good accessibility and to the believe that most of them cause fewer adverse effects as compared to conventional drugs [5, 6]. Furthermore, it has been shown that about 61% of 877 small-molecule drugs introduced worldwide between 1981 and 2002 were derived from natural products [7]. In Morocco, it is estimated that the percentage of local population relying on traditional Moroccan remedies ranges from 50 to 75 % [8-13]. Due to its geographical situation, Morocco has a rich and varied flora. Thus, more than 4200 spontaneous species and some 1500 introduced species have been catalogued [14-17]. This phyto-diversity allows Moroccan population in general and herbalists (Achâba) in particular to have a long and rich traditional knowledge on medicinal plants uses [17, 18]. In addition, the number of medicinal plants in Morocco is about 600 species [19, 20] and more than 360 species are used for the treatment of a wide variety of diseases [8, 11, 21, 22]. Some of these medicinal plants have been subjected to several recent but limited ethnobotanical surveys in different parts of the country [8, 17].

Our explorative study was carried out in Taza (Northern Morocco), a rich region in wide varieties of indigenous medicinal plants, commonly used by the local herbalists and the population to treat various ailments. However, information relative to the practice of phytotherapy in this locality is scanty in the literature. Furthermore, the information on therapeutic plants is in decline because of the lack of databases and registry [23]. Thus, this explorative survey represents the first report on the the practice of phytotherapy by the population of Taza. It was designed to identify and document medicinal plants used in the local folk pharmacopoeia in an attempt to correlate the documented uses with other pharmaco-botanical research works for the development of new phytochemical drugs, and the preservation of the local plant traditional knowledge.

2. Materials and methods

2.1. *Research area*

This ethnobotanical study was carried out in Taza, a city in Northern Morocco, which occupies the corridor between the Rif and Middle Atlas mountains (34°13′N, 4°01′W). It is bounded to the east by Guercif, to the west by the provinces of Fez and Taounate, to the south by Boulmane, and to the north by the province of Al Hoceima and Nador. The province of Taza is 550 m above sea level and cover a global surface of 15.020 km^2 with 528 281 inhabitants (2014 Census). It covers a complex ecosystem presenting diverse habitats with a rich floristic diversity. It's characterized by a hot-summer Mediterranean climate, shifting from cool in winter to hot days in the summer months. About 20 km south-west of the city of Taza is the National park of Tazekka, which covers 580 ha and includes different varieties of medicinal plants.

2.2. *Ethnobotanical survey and data collection*

Two questionnaires were administered to 17 herbalists from different districts of the city of Taza (Al-Quds, Bit Goulem, Gaâda, Bin-Jradi, High Taza, Trik-lwahda and Weekly market), and data were collected through face-to-face interviews over a period between April and May 2016. The informed consent was obtained orally from all herbalists prior to the interviews. Participants interviewed were informed about the objectives of the study, and that their information was purely for scientific studies and not for any commercial use; the identity of the herbalists was not to be exposed. The study was conducted in accordance with the requirements of the declarations of Helsinki and with the permission of the Polydisciplinary Faculty of Taza. The information gathered during the survey includes the profiles of the interviewed herbalists (age, gender, level of education, and experience in herbalism), ethnobotanical data such as the scientific and vernacular name of the species, the used part of the plants, the modes of preparation and administration and the medical uses. Following interviews, samples of plants used locally were requested from herbalists and preserved for later taxonomic identification. The plants were identified using botanical books and verified by Pr. Latifa El Hafid from the department of Biology, Faculty of Sciences, Oujda. The semi-structured interviews have been analyzed and the recorded plants have been entered in a separate Excel spreadsheet. The use value (UV) [24], a quantitative method that demonstrates the relative importance of species known locally, was calculated for each plant according to the following equation:

$$UV = U/N$$

where UV refers to the use value of a species; U to the number of citations per species; and N to the number of herbalists interviewed.

3. Results

3.1. Socio-demographic details of herbalists

Ethnobotanical and ethnomedicinal information was obtained and recorded from 17 herbalists (16 men and 01 women) possessing herbal shops or itinerants (weekly markets) through a questionnaire and face-to-face interviews. The majority (35.29%) were between the ages of 40 and 50 years old. The majority (41.1%) was just secondary school graduate, and only three of the herbalists had a university degree (table 1). All stated that they have acquired their knowledge and experiences in medicinal plants from their parents and elderly relatives. 41.18% of the herbalists had an experience as herbalist between 10 and 20 years

Table 1: Socio-demographic characteristics of the herbalists (n=17)

Characteristic	Frequency	Percentage (%)
Gender		
Male	16	94.12
Female	1	5.88
Education		
Primary education	5	29.41
Secondary education	7	41.18
University	3	17.65
Illiterate	2	11.76
Age		
Between 20-30 years	5	29.41
Between 31- 40 years	3	17.65
Between 41-50 years	6	35.29
Between 51-60 years	3	17.65
Years of experience as herbalist		
Between 01-10 years	4	23.53
Between 11-20 years	7	41.18
Between 21-30 years	4	23.53
Between 31-40 years	2	11.76

3.2. Traditionally used medicinal plants by the population of Taza

The results of the survey are reported in Table 2. Plant families are arranged in alphabetical order. For each plant, the following ethnobotanical informations are provided: botanical family, vernacular name, scientific name and voucher specimen codes. The number of citations of each plant, the calculated use value (UV), the part(s) of plant used and therapeutic use(s) are reported. The modes of preparation and administration are also indicated.

Table 2: List of medicinal plants cited by herbalists in Taza, including family, scientific and vernacular name, therapeutic use(s), parts used, modes of preparation and administration and voucher number.

Family	Scientific name	Voucher N°	Vernacular name	Part (s) used	Preparation	Administration	Therapeutic uses	NC	UV
Anacardiaceae	*Pistacia lentiscus* L.	HM01	Drou	Gum, leaves	Decoction, infusion	Oral	Digestive system	2	0.12
	Pistacia atlantica Desf.	HM02	Lktira, el-btem	Gum, seed	Powder	External	Obesity, hair cair	2	0.12
Apiaceae	*Petroselinum sativum* Hoffm.	HM03	Maâdnous	Seed	Powder	Oral	Prostate, kidney pain, cysts Rheumatism	2	0.12
	Carum carvi L.	HM04	Karwiya	Seed	Infusion	Oral	Digestive system, sedative	6	0.35
	Ammodaucus leucotrichus Coss. & Dur.	HM05	Kamoun sofi	Seed	Infusion	Oral	Cold, digestive system	7	0.41
	Apium graveolens L.	HM06	Krafess	Seed	Powder	Oral	Digestive system, aphrodisiac	3	0.18
	Ammi visnaga (L.) Lam.	HM07	Bachnikha	Flowers, fruit	Infusion	Oral	Dental hygiene	2	0.12
	Thapsia garganica L.	HM08	Adriass	Roots	Powder	Oral	Digestive system	1	0.06
	Ferula communis L.	HM09	Fasokh labyad	Gum	Powder	Oral, external, inhalation	Antimicrobial, hair cair	1	0.06
	Foeniculum vulgare Mill.	HM10	Nafaâ	Seed	Powder	Oral	Digestive system, sedative, Appetite stimulant	1	0.06
	Daucus crinitus Desf.	HM11	Bouzafour	Roots	Powder	Oral	Digestive system	1	0.06
	Coriandrum sativum L.	HM12	Kasbour	Seed	Decoction	Oral	Sleep disorder	1	0.06
Apocynaceae	*Ptychotis verticillata* L.	HM13	Nûnkha	Aerial part	Decoction, powder.	Oral, external	Mouth hygiene, headache	2	0.12
Aristolochiaceae	*Aristolochia longa* L.	HM14	Berztem	Roots	Powder	Oral, external	Digestive system, cancer, kidney problems, infections	5	0.29

Table 2 (Continued)

Family	Scientific name	Voucher N°	Vernacular name	Part (s) used	Preparation	Administration	Therapeutic uses	NC	UV
Asteraceae	*Cynara cardunculus* L.	HM15	Khorchef	Leaves	Powder, Infusion	Oral	Digestive system	1	0.06
	Artemisia absinthium L.	HM16	Chiba	Aerial Part	Infusion	Oral	Spine problems, cold, toothache	1	0.06
	Atractylis gummiferal L.	HM17	Addad	Roots	Powder	External	Eczema	4	0.24
	Artemisia herba-alba Asso.	HM18	Chih	Aerial part	Decoction	Oral	Diabetes, anthelmintic, anti-inflammatory, sedative, against gases, cold	7	0.41
	Matricaria chamomilla L.	HM19	Babounj	Leaves	Decoction, infusion, powder.	Oral, external	Digestive system, sedative, throat problems, eye diseases, allergy, dermocosmotology,	10	0.59
	Cnicus benedictus L.	HM20	Oud lanyab, Hûliba	Seeds	Powder	Oral	Digestive, stomachique, treatment of bone	1	0.06
	Inula viscosa (L.) Ait.	HM21	Magraman	Aerial part	Powder	External	Hemostatic	1	0.06
	Anacyclus pyrethrum L.	HM22	Tigantist	Roots	Oil, powder	Oral	Mouth hygiene, allergy, aphrodisiac, cold.	3	0.18
Berberidaceae	*Berberis hispanica* Boiss. et Reut.	HM23	Arghiss	Bark	Powder	Oral	Pathologies of the reproductive system, diabetes	2	0.12
Brassicaceae	*Brassica napus* L.	HM24	Laft	Roots	Infusion	Oral	Cold problems	2	0.12
	Lepiduim sativum L.	HM25	Hebb rechad	Seeds	Powder	Oral	Lung disorders, digestive system, influenza, cold, eye diseases, galactogenic, obesity	6	0.35
Burseraceae	*Commiphora Africana* (A. Rich.) Engl.	HM26	Oum nass	Gum	Powder	Oral	Haemostatic, diabetes	1	0.06
	Boswellia sacra Flueck.	HM27	Lkandar	Gum	Directly	Oral	Cardiac stimulant	1	0.06
Cactaceae	*Opuntia ficus-indica* (L.) Mill.	HM28	Hindiya	Flowers	Decoction, infusion	Oral	Cold, prostate, kidney pain	5	0.29

Table 2 (Continued)

Family	Scientific name	Voucher N°	Vernacular name	Part (s) used	Preparation	Administration	Therapeutic uses	NC	UV
Capparidaceae	*Capparis spinosa* L.	HM29	Kabâr	Seeds	Powder	Oral, external	Digestive system, cold, rheumatism, strengthening, sterility	6	0.35
Caryophyllaceae	*Herniaria hirsula* L.	HM30	Harasst lahjar	Aerial part	Infusion	Oral	Kidney stones	3	0.18
	Saponaria officinalis L.	HM31	Tighacht	Roots	Decoction	Oral	Antimicrobial, headache	1	0.06
	Carrigiola telephiifolia Pour.	HM32	Sarghina	Roots	Decoction	Oral, external	Headache, digestive system	1	0.06
Chenopodiaceae	*Chenopodium ambrosioides* L.	HM33	Mkhinza	Aerial part	Decoction	External	Fever	4	0.24
	Haloxylon scoparium Pomp.	HM34	Râmt	Aerial part	Decoction	Oral	Poison antidote, antimicrobial	3	0.18
Cucurbitaceae	*Lagenaria siceraria* Standl.	HM35	Guaraâ slawiya	Bark	Fumigation	Inhalation	Allergy, cold, headache	2	0.12
Cupressaceae	*Tetraclinis articulata* Benth.	HM36	Arâar	Leaves	Decoction	Oral	Digestive system, hair caire	6	0.35
Cyperaceae	*Cyperus rotundus* L.	HM37	Nabat saîd	Aerial part	Powder	Oral	Cold problems	1	0.06
Euphorbiaceae	*Euphorbia resinifera* Berg.	HM38	Takiwt	Seeds	Powder	External	Hair problems	1	0.06
	Euphorbia echinus Hook.f. & Coss.	HM39	Daghmouss	Whole plant	Powder	Oral	Toxic, diabetes, cysts, cancer, goiter	8	0.47
Fabaceae	*Trifolium spp.*	HM40	Chenan, nefla	Seeds	Powder	Oral, external	Condiment, hair problems	2	0.12
	Glycyrrhiza glabra L.	HM41	Arq souss	Stem	Decoction, powder	Oral	Pathologies of the respiratory and the digestive systems, asthma, cold, mouth affections.	5	0.29
	Ceratonia siliqua L.	HM42	Kharroub	Fruit	Powder	Oral	Digestive system, antibacterial	7	0.41
	Retama reatam (Forssk.)	HM43	Rtem	Leaves	Decoction, powder	Oral, external	Diabetes, digestive system, skin diseases	2	0.12

Table 2 (Continued)

Family	Scientific name	Voucher N°	Vernacular name	Part (s) used	Preparation	Administration	Therapeutic uses	NC	UV
Fabaceae	*Hispida maxim.*	HM44	Soja	Seed	Powder	Oral, external	Appetite stimulant, growth stimulant, female sex hormones stimulant, cosmetology	3	0.18
	Trigonella foenum-graecum L.	HM45	Halba	Seed	Powder	Oral	Weight gain, hypertension, blood purification, digestive system, aphrodisiac, diabetes, cold	7	0.41
	Lupinus albus L.	HM46	Teramss	Seed	Powder	Oral	Diabetes	2	0.12
	Cassia senna L.	HM47	Sanamki	Leaves	Infusion	Oral	Constipation, stomachache	8	0.47
	Tamarindus indica L.	HM48	Tmar hindi	Fruit	Powder	Oral	Sedative	1	0.06
	Retama monosperma (L.) Boiss	HM49	Halalij Asfar	Seed	Powder	Oral	Stomachache	1	0.06
Fagaceae	*Quercus suber* L.	HM50	Dbagh, balût	Roots, bark	Decoction, Powder	Oral, external	Digestive system	5	0.29
Iridaceae	*Crocus sativus* L.	HM51	Zaafran lhor	Flowers	Infusion	Oral	Cardiovascular diseases, nervous system disorders	2	0.12
Juglandaceae	*Juglans regia* L.	HM52	Swak	Bark of the Roots	Decoction, directly	Oral, external	Stomachache, hair cair, dental care	3	0.18
Lamiaceae	*Origanum majorana* L.	HM53	Mardedouch	Leaves	Powder, infusion	Oral	Cancer, mouth hygiene, hypertension, female sex hormones regulator, sedative, allergy, cough	4	0.24
	Lavandula stoechas L.	HM54	Halhal	Aerial part	Decoction	Oral	Anthelmintic	1	0.06
	Mentha suaveolens Ehrh.	HM55	Mchachro	Aerial part	Decoction	Oral	Influenza, respiratory system disorders	1	0.06
	Calamintha officinalis Moench.	HM56	Mânta	Leaves	Decoction, infusion	Oral	Digestive system, cold, dizziness, poison antidote, headache, sedative, anti-inflammatory, cough, fever	9	0.53

Table 2 (Continued)

Family	Scientific name	Voucher N°	Vernacular name	Part (s) used	Preparation	Administration	Therapeutic uses	NC	UV
Lamiaceae	*Lavandulla officinalis* L.	HM57	Khzâma	Aerial part, leaves	Décoction, infusion	Oral, external	Cold problems, burns, mycoses, digestive system, respiratory system disorders, sedative, menstrual disorders, diuretic, rheumatism, hair cair	16	0.94
	Mentha pelugium L.	HM58	Fliou	Aerial part	Decoction, infusion	Oral	Influenza, against chill, poison antidote, respiratory and urinary systems problems	9	0.53
	Origanum compactum Benth.	HM59	Zaâtar	Aerial part, leaves	Decoction, infusion	Oral	Gastrointestinal antiseptic, cold problems, antimicrobial, respiratory and urinary systems problems, stomachache, headache, poison antidote, appetite stimulant	11	0.65
	Rosmarinus officinalis L.	HM60	Azir	Leaves	Decoction	Oral	Digestive system, internal bleeding, burns, poison antidote, sedative, anti-inflammatory, cold, stimulate blood circulation, hair cair	11	0.65
	Salvia officinalis L.	HM61	Salmiya boriya	Aerial part	Decoction	Oral, external	Digestive system, diabetes, hypertensive, cosmetology	6	0.35
	Ajuga iva L.	HM62	Changoura	Aerial part	Infusion	Oral	Digestive system, cardiovascular diseases, poison antidote, mouth hygiene, lung disorders	6	0.35
	Thymus vulgaris	HM63	Zdouchen, zeitra	Aerial part	Decoction	Oral	Cold, digestive system	1	0.06
	Mentha Rotundifolia Muds.	HM64	Timrsat, mchachrû	Leaves	Decoction	Oral	Digestive system	1	0.06
	Teucrium polium L.	HM65	Jaâda	Aerial part, flowers	Powder	Oral, external	Stomachache, anthelmintic, haemostatic	1	0.06
Lauraceae	*Laurus nobilis* L.	HM66	Rend, wraq sidna mûsa	Leaves	Decoction	Oral, external	Digestive system, rheumatism, mouth hygiene, condiment	4	0.24
	Cinnamomum zeylanicum Blume	HM67	Karfa	Bark, Roots	Powder, decoction	Oral	Platelet anti-aggregant, diabetes, digestive, condiment	5	0.29

Table 2 (Continued)

Family	Scientific name	Voucher N°	Vernacular name	Part (s) used	Preparation	Administration	Therapeutic uses	NC	UV
Linaceae	*Linum usitatissium* L.	HM68	Zriât lktan	Seed	Powder	Oral	Digestive system, allergy, influenza, hypocholesterolemic, asthma, appetite stimulant	7	0.41
Lythraceae	*Lawsonia inermis* L.	HM69	Henna	Leaves	Powder, infusion	Oral, cataplasm	Cancer des intestins), Digestive system, cosmtology, antifungal, hair caire, poison antidote	5	0.29
Malvaceae	*Hibiscus sabdariffa* L.	HM70	Karkadi	Leaves	Decoction	Oral, external	Cardiovascular diseases, cosmetic, stomachache	4	0.24
Myristicaceae	*Myristica fragrans* Houtt.	HM71	Lgoza lghlida	Seed	Powder	Oral	Aphrodisiac, condiment, cold	1	0.06
Myrtaceae	*Myrtus communis* L.	HM72	Raihane	Leaves	Decoction, infusion	Oral	Sedative, poison antidote, Digestive system, hair cair	10	0.59
	Eugenia caryophyllata Thumb.	HM73	Qronfel	Flowers	Powder	Oral	Cold, rheumatism, sedative, poison antidote, anti-inflammatory, urinary antiseptic, stimulant, dental problems.	5	0.29
	Eucalyptus globulus Labill.	HM74	Kalitûs	Leaves	Decoction, fumigation	Oral, inhalation	Influenza, antiseptic, diabetes	1	0.06
Oleaceae	*Phillyrea angustifolia* L.	HM75	Mlilss	Leaves, aerial part	Decoction	Oral	Anaemia	3	0.18
	Fraxinus angustifolia Vahl	HM76	Touzalt, dardar	Seed	Powder	Oral	Cold, aphrodisiac	1	0.06
Papaveraceae	*Papaver rhoeas* L.	HM77	Bellaaman	Flowers	Infusion	Oral	Cold, antimicrobial	1	0.06
Pinaceae	*Pinus pinaster* Aiton	HM78	Tayda	Bark	Powder	External	Dermocosmotology	2	0.12
Piperaceae	*Piper cubeba* L.f.	HM79	Kbaba	Seed	Powder	Oral	Mouth hygiene, condiment, cold	2	0.12
	Piper longum L.	HM80	Dar falfl	Seed	Powder	Oral	Aphrodisiac, cold, weight gain, condiment	2	0.12

Table 2 (Continued)

Family	Scientific name	Voucher N°	Vernacular name	Part (s) used	Preparation	Administration	Therapeutic uses	NC	UV
Poaceae	*Panicum miliaceum* L.	HM81	Ilane	Seed	Powder	Oral	Strengthening bones	2	0.12
	Zea mays L.	HM82	Dra	Flowers	Decoction	Oral	Prostate, allergy, cold, sedative	4	0.24
	Avena sativa L.	HM83	Khortal	Seed	Powder	Oral	Digestive system	1	0.06
Punicaceae	*Punica granatum* L.	HM84	Remân	Flowers, fruit	Powder	Oral, external	Stomachache, mouth hygiene, hai cair	9	0.53
Ranunculaceae	*Nigella sativa* L.	HM85	Sanouj, habba sawdaa	Seed	Powder	Oral	Toxic, diabetes, digestive system, allergy, antiasthmatic, cardiovascular diseases, cold, appetite stimulant	10	0.59
Ranunculaceae	*Delphinium staphysagria* L.	HM86	Habbat Ras	Seed	Powder	External	Hair cair	2	0.12
Rhamnaceae	*Zizyphus lotus* (L.) Lamk.	HM87	Sadra	Fruit, leaves	Powder, infusion	Oral, external	kidney problems, digestive system, diabetes, antimicrobial, hair cair	5	0.29
Rosaceae	*Rosa centifolia* L.	HM88	El-ward	Flowers	Decoction, infusion	Oral, external	Digestive system, cold, sedative, hair cair, cosmetic, fever	5	0.29
	Crataegus monogyna Ucr.	HM89	Zaeror, admâm	Leaves, Seed	Decoction	Oral	Cardiovascular diseases, digestive system	3	0.18
Rubiaceae	*Rubia peregrina* L.	HM90	Fouwa	Roots, stem	Decoction	Oral	Anaemia, cold, liver disorders, cosmetic, blood cleansing	10	0.59
Rutaceae	*Citrus saliaefolius* L.	HM91	Audmi	Aerial part	Decoction	Oral	Stomachache, reproductive system	1	0.06
	Ruta graveolens L.	HM92	Fîdjel	Aerial part	Fumigation, decoction	Oral, inhalation	Abortive, magic, intestinal disorders, stimulant	2	0.12
Salvadoraceae	*Salvadora persica* L.	HM93	Oud al- arak	Stem	Raw	External	Mouth hygiene	2	0.12
Sapotaceae	*Argania spinosa* (L.) Skeels	HM94	Argan	Fruit, seed	Raw	Oral	Diabetes, allergy, cardiovascular diseases	2	0.12
Schisandraceae	*Illicium verum* Hook L.	HM95	Badyana	Flowers	Decoction	Oral	Digestive system, respiratory system, allergy, sedative, against the accumulation of lactate, rheumatism, cold, condiment, aphrodisiac	7	0.41

Table 2 (Continued)

Family	Scientific name	Voucher N°	Vernacular name	Part (s) used	Preparation	Administration	Therapeutic uses	NC	UV
Thymelaeaceae	*Daphne gnidium* L.	HM96	Lazzâz, mathnane	Leaves	Powder	External	Toxic, hair cair	4	0.24
Urticaceae	*Urtica dioica* L.	HM97	Harrigua	Seed, leaves	Powder, infusion	Oral	Cancer, respiratory system, diuretic, allergy, diabetes	1	0.06
Valerianaceae	*Valeriana Officinalis* L.	HM98	Sanbl	Aerial part	Powder,	Oral, external	Hair care, dental hygiene, poison antidote	4	0.24
Verbenaceae	*Lippia citriodora* (Lam.) H.B.K.	HM99	Lwiza	Leaves	Infusion	Oral	Digestive system, cold, sedative, hypertension	5	0.29
Zingiberaceae	*Amomum grana-paradisi* L.	HM100	Guoza sahrawiya	Seed	Powder	Oral	Aphrodisiac, condiment	5	0.29
	Alpinia officinarum Hance	HM101	Khdanjal	Stem	Decoction	Oral	Asthma, Aphrodisiac	3	0.18
	Zingeber officinalis Roscoe	HM102	Zanjabil ou skinjbir	Rhizome	Powder	Oral	Digestive system, aphrodisiac, hypocholesterolemic, cold	5	0.29
	Elettaria cardamomum (L.) Maton	HM103	Kaâgola	Seed	Powder	Oral	Aphrodisiac, cold	3	0.18
Zygophyllaceae	*Peganum harmala* L.	HM104	Harmal	Seed	Powder, fumigation	Oral, external	Toxic, hair cair, sedative, nervous system disorders, rheumatism, hypolipidemic	7	0.41

NC: Number of citations; UV: Use value

In total, 104 medicinal plant species corresponding to 47 families reported by herbalists to have medicinal properties have been recorded. According to the calculated UV; the most cited species are *Lavandulla officinalis* (UV=0.94), *Origanum compactum* and *Rosmarinus officinalis* (0.65), *Nigella sativa*, *Rubia peregrina*, *Myrtus communis* and *Matricaria chamomilla* (0.59), *Calamintha officinalis*, *Punica granatum* and *Mentha pelugium* (0.53), and *Cassia senna* (0.47) (Table 2). Among the 47 cited families, the most frequent are *Lamiaceae* (19.4%), *Fabaceae* (9.57%), *Asteraceae* (7.05%) and *Apiaceae* (6.3%) (Fig. 1). These four families constitute 42.32% of the cited species, while the remainder species belonged to 43 families represented 57.68% of the total families (Table 2).

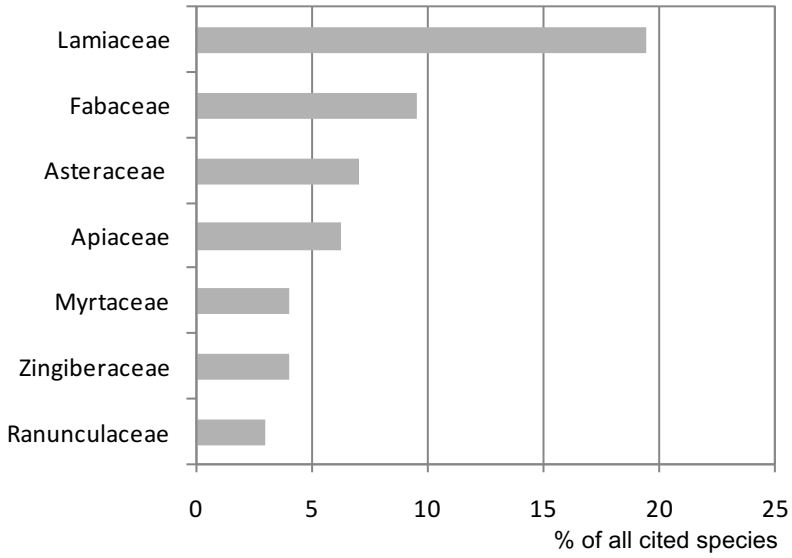

Figure 1: Most cited botanical families.

3.3. Plant part used and modes of preparation and administration

Our results showed that seeds/fruits (30,77%), leaves (19.66%) and aerial parts (17.95%) are the most often parts used in the preparation of herbal remedies, followed by rhizome, Roots, stems and flowers (13.68%), bark (5.13%), gum (4.27%) and the entire plant (0.85%) (Fig. 2). The plant remedies are prepared mostly in the form of powder (43.31%), decoction (31.50%), or infusion (19.69%). The other modes of preparation (fumigation, raw and oil) represent only 7%. The administration of the remedies are done orally (72.87%), by external application as cataplasm (24.03%) or through inhalation of the burned plant (3.10%). The results showed also that people usually use a mixture of plants to treat their diseases.

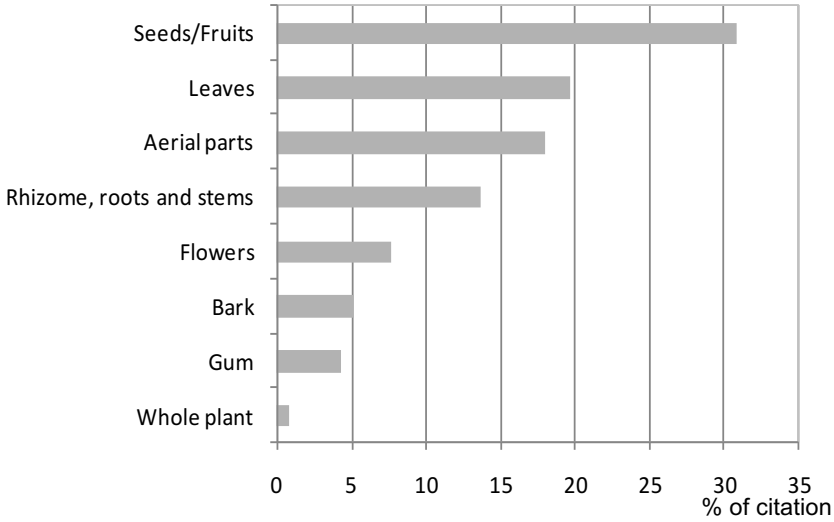

Figure 2: Percentage of citations of the different plant parts used

3.4. Human medicinal plant uses

As reported by herbalists, the identified medicinal plants are used for curing and/or preventing 18 pathological groups of diseases (Table 3). The major illnesses treated by plants products include digestive disorders (16.4%),

followed by cold problems (11.67%), liver and metabolic disorders (11.36%), and infections/infestations (11.04%) problems. 8.83% of the therapeutic uses concerns external applications, especially to treat dermatological problems (table 3).

Table 3: Pathological groups of common diseases cited by herbalists

Pathological groups	Citations	Percentatge
Digestive system disorders	52	16.40
Liver and metabolic disorders	36	11.36
Infections/infestations	35	11.04
Cold problems	37	11.67
Nervous system and psychology	20	6.31
Dermocosmology	28	8.83
Genito-urinary system disorders	28	8.83
Respiratory system disorders	14	4.42
Blood and cardiovascular diseases	19	5.99
Poisoning	10	3.15
Allergy	10	3.15
Anti-inflammatory	9	2.84
Apetite stimulant	5	1.58
Head problems	6	1.89
Prostate problems	3	0.95
Ophthalmic disorders	2	0.63
Cancer	2	0.63
Goiter	1	0.32
Total : 18	317	

4. Discussion

The present study aimed to identify medicinal plants used by herbalists in Taza and documenting traditional medical practices. This work is part of a project to promote the natural resources of the region of Taza. According to literature data, similar ethnobotanical surveys have been carried out in various other regions of Morocco and in the Mediterranean countries [9, 10, 26, 27]. However, to our knowledge, this is the first study to address the traditional use of medicinal plants in this part of Morocco". This study will allow us subsequently to select some plants for further scientific studies to validate their traditional uses. The ethnobotanical and ethnomedicinal data were gathered through structured interviews among the local herbalists through different parts of the study area. The choice of traditional herbalists is due to their significant role in primary health care system, their experiences and rich knowledge in the medicinal uses of plant species acquired through generations. The majority of the professional herbalists interviewed were men and aged 40-50 years old, which is supported by recent other ethno-pharmacological study [25]. The practices as herbalist do not require a high level of education (table 1). In fact, only 17.64% of the herbalists had a university degree, while the majority (41.1%) has just secondary education, which is in agreement with the findings of Omwenga et al. [5]. The results indicated also that a significant number of participants interviewed (23.53%) have been practicing as herbalists for a long period (20-30 years). This is a positive indicator, as the profession requires longer experience, especially in plant identification, diagnosis and therapy of the patients. We noted also that some herbalists were more reluctant to be interviewed and only after communication and explanation of the objectives of the study did they give us the information about the plants.

This survey clearly showed that phytotherapy is widely practiced by the population in Taza to treat various human diseases. The comparison between our documented data with other areas [10-11] showed the presence of some differences concerning the plants used, their vernacular names, the diseases treated and the methods of use. Among the plant families recorded, the most numerous were the *Lamiaceae* (13 plants), followed by *Fabaceae* (10 plants) and *Apiaceae* (10 plants). The prevalence of these families was also mentioned by previous ethnobotanical studies achieved both throughout Morocco and in Mediterranean countries [8-12, 23, 26-31]. The others inventoried families are represented by one to four species which demonstrates the

biodiversity of medicinal plants in this region. The most frequently cited species are: *Lavandulla officinalis*, *Origanum compactum*, *Rosmarinus officinalis, Nigella sativa, Rubia peregrina, Myrtus communis, Matricaria chamomilla, Calamintha officinalis, Punica granatum* and *Mentha pelugium*. Some of these species were also cited by other ethnobotanical surveys carried out in different regions of Morocco [10, 11, 31]. In fact, these species are well known both by herbalists and the population, and every informant listed at least three ailments treated by each species. Very often, older people possess in the household a store of dried plants and prepared plant remedies for themselves and their families [32]. Furthermore, according to the herbalists, for most of the species, one or more common names were reported, and some species reported in the survey come from other regions of Morocco or are imported from outside the country.

The principal diseases treated by the identified plants include digestive system (52 plants), cold problems (37 plants), liver and metabolic disorders (36 plants), infections/infestations (35 plants), dermatological problems (28 plants), and genito-urinary system disorders (28 plants). These results are partially in accordance with other studies achieved in other areas of Morocco [29, 30] and Mediterranean countries [26, 27]. This may indicate that these diseases are relatively high in the study area. These herbal remedies have also other various properties, e.g., as sedatives, antipyretics, antirheumatics, antiallergics, antidotes and emmenagogues. Several toxic species are widely known and, therefore, their internal use is severely forbidden. Furthermore, it is worthy of note that some of the cited plants have already been subjected to pharmacological research to validate their traditional uses: for example, some anti-diabetic plants such as *Artemisia herba-alba* [33, 34], *Nigella sativa* [35, 36], and *Trigonella foenum-graecum* [37, 38] have proven this property experimentally. *Crocus sativus* [39-41] and *Hibiscus sabdariffa* [42, 43], which are cited in the present study to be useful against cardiovascular disease, have proved this property in experimental investigations. However, a large number of the cited plants uses have not been subjected to any scientific studies. In addition, new utilizations have been reported for some of the identified plants. Moreover, it was also found that one plant might be used for curing several ailments, for exemple *Lavandulla officinalis* L. is used to treat digestive and respiratory systems, menstrual disorders, rheumatism and cold problems.

A large part of remedies are taken orally mainly as decoction, infusion or in the form of powder. Such modes of preparation were also reported in other regions of Morocco [29], and Mediterranean countries [26, 44, 45]. In fact, the decoction allows collecting most active ingredients, reduces the toxic effect of certain recipes, and allows to warm the body and to disinfect the plant [46]. In the part used, seeds and/or fruits are prevalent followed by leaves and aerial parts. In fact, leaves and aerial parts are responsible of the photosynthesis reactions, are easy to collect [47], and supply the majority of active principles such as alkaloids, flavonoids and essential oils [30, 31]. Nevertheless, the excessive harvest of these species can lead to their disappearance. So, it is necessary to exploit them in a reasonable way to protect them and assure their durability.

Conclusion

The present study showed that local knowledge of medicinal plants still exists in Taza and herbalists appear to play an important role in the healthcare of the local population. So, it is necessary to preserve this traditional knowledge and to evaluate scientifically the claimed therapeutic effects of the locally used medicinal plants. However, we have noticed the existence of some problems relative to the medical diagnosis, the posology, the identification of the plants, the time required for the preparation of the remedies and the duration of treatment, which are assumed by herbalists that are not specialists. In addition, the packing and conservation of the plants in the herbalist's shops or in the open market don't respect regularly the hygienic conditions and plants are often exposed to dust, humidity…, resulting in loss of their efficacy. Furthermore, special attention should be given to the promising species in the region that are used widely and traded outside the country.

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