Ethnobotanical survey of medicinal plants growing in the region of "Oulad Daoud Zkhanine" (Nador Province), in Northeastern Morocco

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Databases and Inventories

Abstract

Background: Medicinal plants occupy a central place in the treatment of various diseases in Morocco's rural communities. But, complete ethnobotanical studies conducted on those communities medicinal plants are few, thus the present study was carried out in the commune of Oulad Daoud Zkhanine in *Northeastern* of Morocco in order to establish a catalogue of the various medicinal plants used by the local population for therapeutic purposes.

Methods: A non sampling method was conducted to choose the population living in and around this area, herbalists, traditional practitioners and healers. This study targeted 210 people, including 33.3% men and 66.7% women, aged from 18 to 81 years. Surveys and interviews were conducted in Tharifit (local Berber language), between January 2018 to February 2019.

Results: This Ethnobotanical study reported 44 medicinal plant species belonging to 28 families, the most abundant of which are *Lamiaceae* (15.6 %). This study revealed also that leaves are the most commonly used parts of the plant (54.8 %) and that the most remedies are prepared as decoction (48.1 %). Digestive disorders rank first among the diseases treated by these plants with a rate of 51.9%.

Conclusion: The present study show that the traditional use of medicinal plants still persists in the Oulad Daoud Zkhanine commune, despite the revolution in medical technology.

Keywords: Ethno-botanical, plants, Oulad Daoud Zkhanine, Nador, Morocco

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Ethnobotany Research & Applications 19:39 (2020)

Background

Since ancient times, medicinal plants have occupied a very important place in traditional pharmacopoeia, they have been used to heal ailments, heal wounds, relieve pain and treat various diseases (Benkhnigue *et al*. 2010). The importance of these plants has continued to increase in recent years despite the progress of pharmacology. The reason is many folds, the increase in international demand for these plants, especially in rural communities in developing countries due to the absence of an effective medical system (El Hilah *et al*. 2016; Tabuti *et al*. 2003) and on the other hand their lower cost compared to

Manuscript received: 14/02/2020 - Revised manuscript received: 29/04/2020 - Published: 02/05/2020

http://dx.doi.org/10.32859/era.19.39.1-12

synthetic drugs, and the absence of their side effects on health.

In fact, among the approximately 500,000 plants on earth, about 100,000 of them have medicinal properties provided by their active compounds that act directly on the body (Belyagoubi-Benhammou *et al*. 2017). In African countries, medicinal plants constitute a very important source for the vast majority of rural populations, where more than 80% use them for therapeutic care (Tahri *et al*. 2012).

Morocco in turn, by its geographical location, climate, richness and the diversity of its flora, constitutes a very rich phyto-genetic platform, composed of approximately 5200 species and subspecies of vascular plants, including 900 endemic plants (Barkaoui *et al*. 2017). Despite this richness and diversity, the Moroccan medicinal flora is still poorly understood because of the few thousand plant species, the medicinal species recorded do not exceed 356 species and 600 species, or 8.69% and 14.28% respectively of the total Moroccan flora (Benkhnigue *et al*.2010).

The objective of the present study conducted in the Commune of "Oulad Daoud Zkhanine" in Northeastern of Morocco is to document the medicinal plants most used by the population of this region, their local names, their preparation methods and their various pharmacological and therapeutic uses.

Materials and methods

Study area

The study was carried out in the rural commune of Oulad Daoud Zkhanine situated in Northeastern of Morocco and part of the province of Nador (Figure 1). It covers an area of about 300 km², and is bounded by the rural commune of El Barkanienne; the rural commune of Kariat-Arekmane and Ras El ma in the North; the rural commune of Madaghe in the East, the rural commune of Bougriba in the South, the municipality of Zaio and the rural commune of Ouled Satoute in the West.

The climate in this area is Mediterranean type, it is humid and cool in winter and mild in summer. Precipitation is characterized by non-regularity from the year to the next. The precipitation levels vary between 300 and 400 mm/year according the location and the altitude.As for the average temperature is 26.5 °C, August is the hottest month of the year. 12.3 °C make January the coldest month of the year. (AUNDG, 2004)

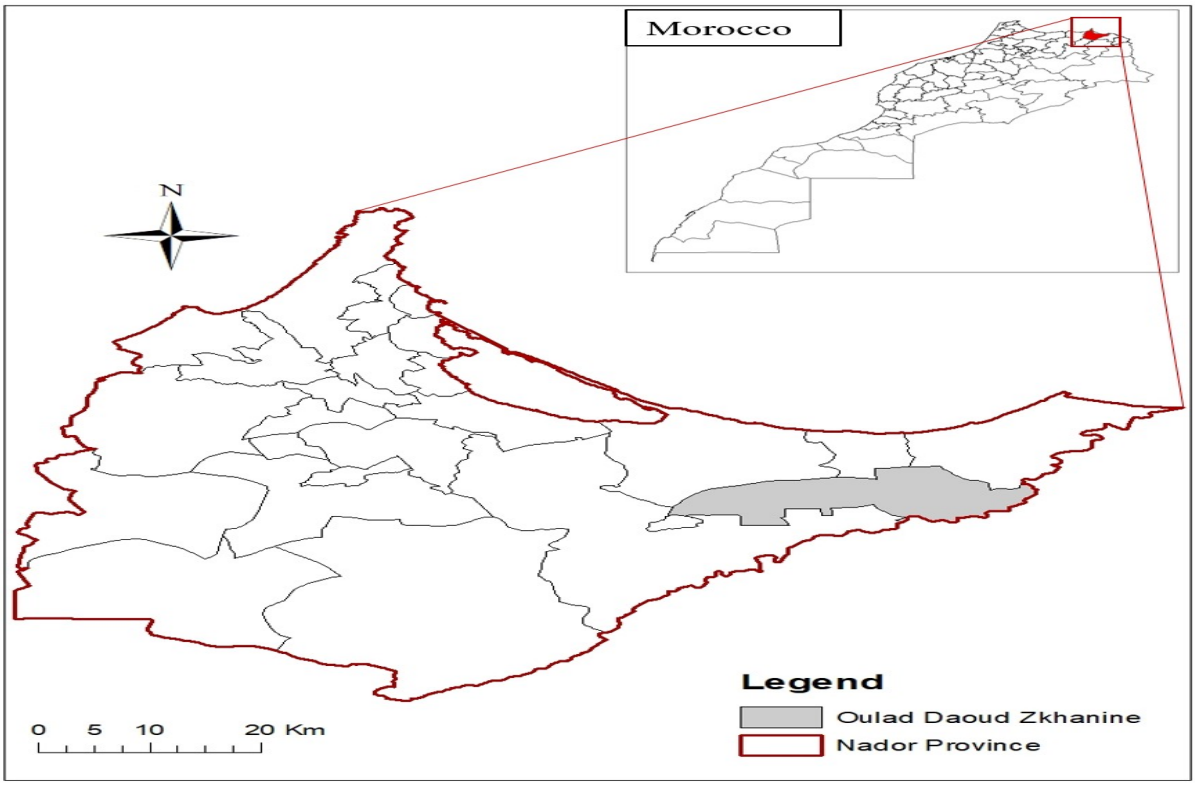

Figure 1. Geographical location of the study area prepared

As far as winds are concerned, “Oulad Daoud Zkhanine“ is exposed to East and West winds all year round. The first type, known as Chergui, is very hot and dry; blows mainly in summer and in some cases can reach speeds of more than 5 meters per second. The second, less strong, blows during autumn and winter with an average speed of 2.5 meters per second.

The commune of Oulad Daoud Zkhanine is located in the Moulouya water basin. The water table in this region is supplied by rainfall and irrigation returns. The Oued Moulouya is the main watercourse that drains the area. This river flows more than 600 km from the High Atlas at an altitude of more than 2000 m to the Mediterranean (AUNDG, 2004)

Ethnobotanical survey

The method followed during this study consisted in programming several field trips during the period from January 2018 to February 2019, to obtain general information on the commune Oulad Daoud Zkhanine and to determine the most common medicinal plants in this area. Then, using questionnaire (Annex 1) we carried out surveys and interviews with the sample of 210 people from the population of Oulad Daoud Zkhanine and its surroundings. The persons surveyed are generally herbalists, traditional practitioners and the population born and/or having lived for a long time in this commune, and who were chosen according to a non-probability sample in a random and intuitive way.

The interviews are conducted in Tharifit (local Berber language), they lasted 20 to 30 minutes during which we tried to obtain as much information as possible about the person surveyed (age, level of education, profession and family situation) and the medicinal plants used by them (local name, different uses, part used, different methods of preparation and diseases treated by these plants). The plants are identified by using the following works (Valdés, (2002); Couplan (2012); Fennane & Rejdali (2016); Bellakhdar jamal (1997).

Voucher specimens of each plant were deposited in herbarium of the laboratory of Plant Ecology Unit, Department of Plant Protection and Environment, National School of Agriculture of Meknes. Morocco. The collected information is recorded on the survey sheets and then copied onto Excel files and processed by the SPSS software.

Results and discussion

Frequency of use of plants according to the profile of the respondents

According to sex

In the region of Oulad Daoud Zkhanine, both men and women are interested in traditional pharmacopoeia. However, women use medicinal plants more than men. Among the respondents 66.7% are women and 33.3% are men (Figure 2). This is due to the fact that women have in-depth knowledge of medicinal species and their different therapeutic uses compared to men, and that women are responsible for the first aid of their grandchildren. These results are in line with the results obtained elsewhere by other ethnobotanical studies conducted in the different regions of Morocco by (Benlamdini *et al*. 2014; Eddouks *et al*. 2002; Mehdioui *et al*. 2007; Tahraoui *et al*. 2007).

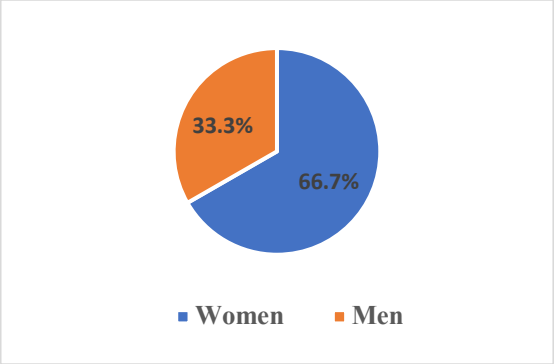

Figure 2. Distribution of medicinal plants users by sex

According to age

The use of medicinal plants in the study area is widespread among all the age groups, with a predominance of people over 60 years old (33.8%). The age categories 50 to 60 years, 40 to 50 years, and 30 to 40 years come next with 21.9%, 18.6% respectively. However, people over 20-30 years old (5.2%) and under 20 years old (1.9%) don't use a lot medicinal plants in their therapeutic treatment (Figure 3).

These results are due on the one hand to the fact that older people are familiar with traditional medicine compared to other age groups, and on the other hand to the mistrust of young people under than 20 years old who tend not to believe much in this traditional medicine (Eddouks *et al*. 2002).

According to the education level

In our study area, a large proportion of medicinal plant users are illiterate, with a percentage of 69%. This relatively high percentage is correlated with the educational level of the local population of Oulad Daoud Zkhanin. Nevertheless, people with primary school education have an average percentage of medicinal plant use (22.4%); while those with secondary and university education use medicinal plants sparingly in their therapeutic treatment (6.7% and 1.9% respectively) (Figure 4). These results are in line with other studies conducted by (Ziyyat *et al*. 1997; El hilah *et al*. 2016; Kpodar *et al*. 2015).

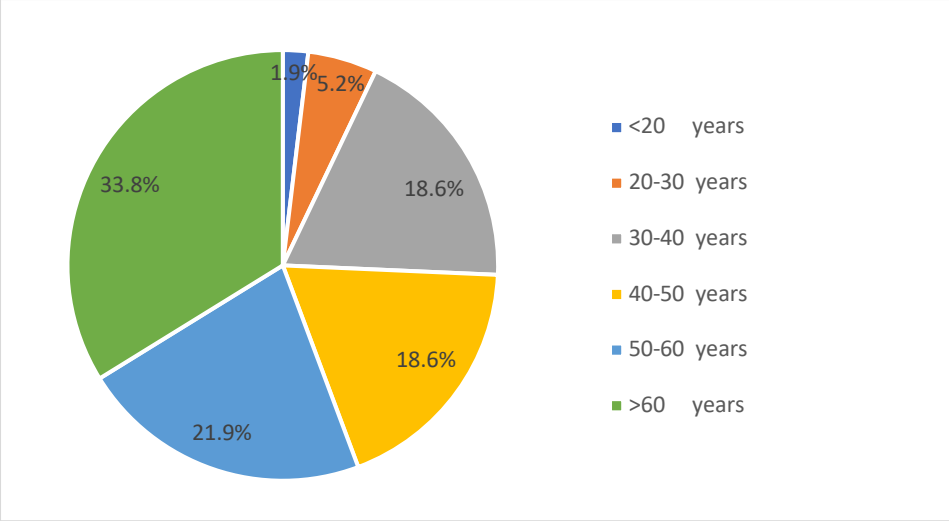

Figure 3. Distribution of medicinal plant users by age group

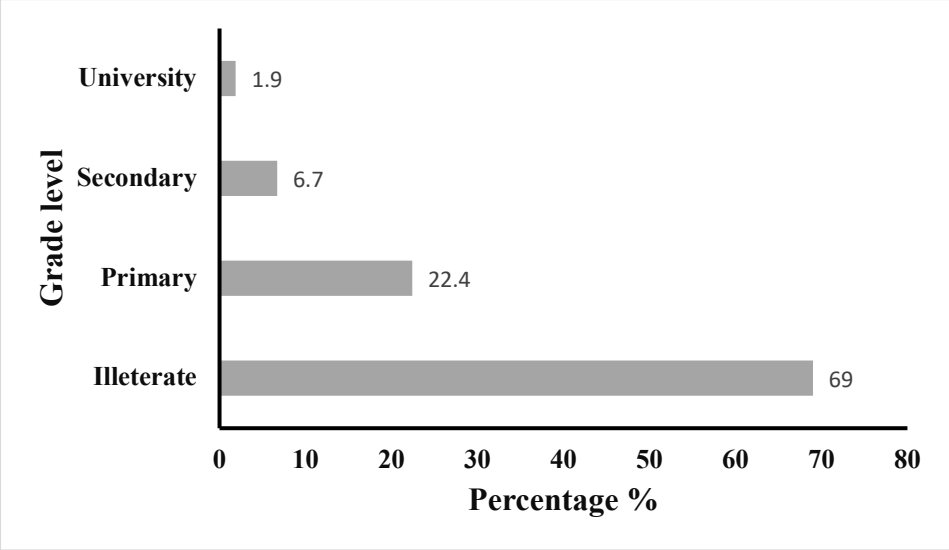

Figure 4. Distribution of medicinal plant users by grade level

According to family situation

Of all traditional medicine users in Oulad Daoud Zkhanine commune, 60.5% are married, 24.3% are widowed, 9% are divorced and a small percentage (6.2%) are single (Figure 5). These results can be explained by the fact that married people try to reduce their financial burdens and the very high costs of pharmaceutical products as much as possible (Lahsissene *et al*. 2010).

Use of plants according to the part used, the method of preparation, the form of administration and the diseases treated

According to the part used

Each part of plant has specific therapeutic and pharmacological properties. To do this, medicinal plants can be used either whole or in part (leaf, stem, underground part, roots, flowers, and fruits). In our study area, we found that leaves are the most commonly used plant part (54.8%) followed by the whole plant (16.7%). The other parts are poorly used with a cumulative percentage of (28.5%) (Figure 6). These results can be explained by the ease of harvesting the leaves and also by the fact that the leaves are the site of photosynthesis and storage of secondary metabolites responsible for the biological properties of the plant (Slimani *et al*. 2016; Tahri *et al.* 2012; Boughrara and Belgacem, 2016).

According to the State of the plant

In our study area, the most commonly used parts of the plant are mainly dried (91%) because they are not available all year round (Figure 7). Most of the time, drying takes place in a place protected from the sun, which preserves most of the plant's active metabolites (Slimani *et al.* 2016).

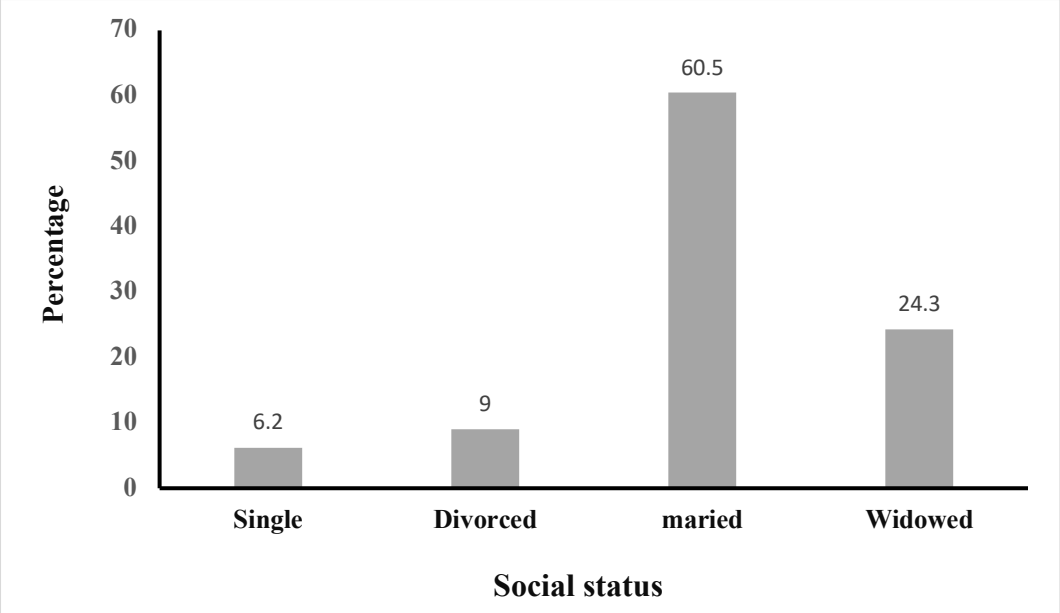

Figure 5. Distribution of medicinal plant users by social status

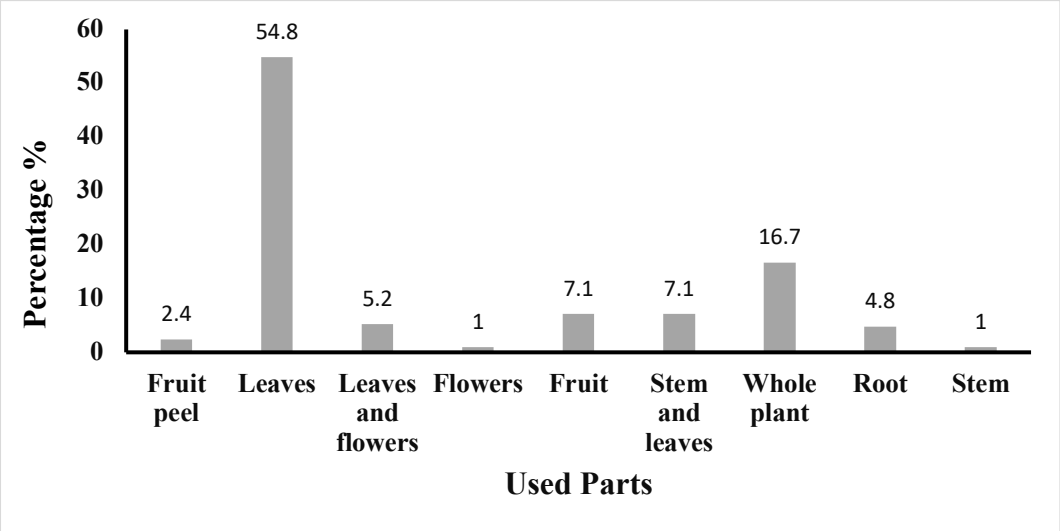

Figure 6. Distribution of the different parts used in medicinal plants

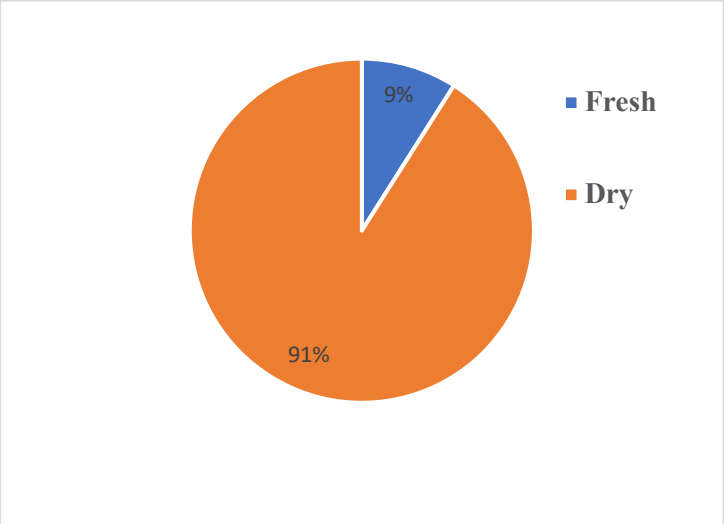

Figure 7. Distribution of the most used state of the plant

According to the preparation method

The local population of Oulad Daoud Zkhanine uses several therapeutic practices for the preparation of medicinal plants, including decoction, infusion, fumigation, poultice and powder. However, decoction is the most frequent method of preparation (48.1%) (Figure 8), followed by infusion (39.5%), while the other methods of preparation (poultice, powder, cooked, etc.) represent a cumulative percentage of 12.4%. These results shows that the population adopt the decoction method and finds it adequate to warm the body and disinfect the plant (Lahsissène *et al*. 2010).The same results are obtained by other studies done by (Salhi *et al*. 2010; Tahri *et al*. 2012; Barkaoui *et al*. 2017).

According to the treated diseases

The results of the Ethnobotanical survey (Figure 9), show that the majority of medicinal plants are used mainly in the treatment of digestive diseases with a percentage of 51.9%, followed by dermatological and respiratory diseases with 14.3% and 12.9% respectively, heart disease (9%), chronic diseases (5.7%).The same results are obtained by the studies done by (Jdaidi *et al*. 2016; Tahri *et al*. 2012; Tabuti *et al*. 2003; Slimani *et al*. 2016; Miara *et al*. 2013).

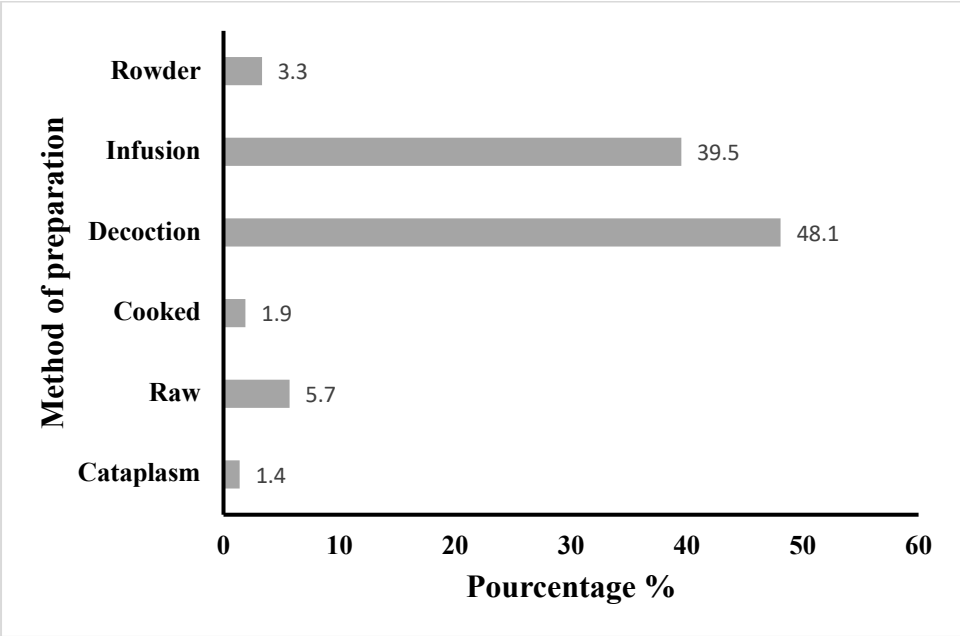

Figure 8. Distribution of the different methods of preparation of medicinal plants

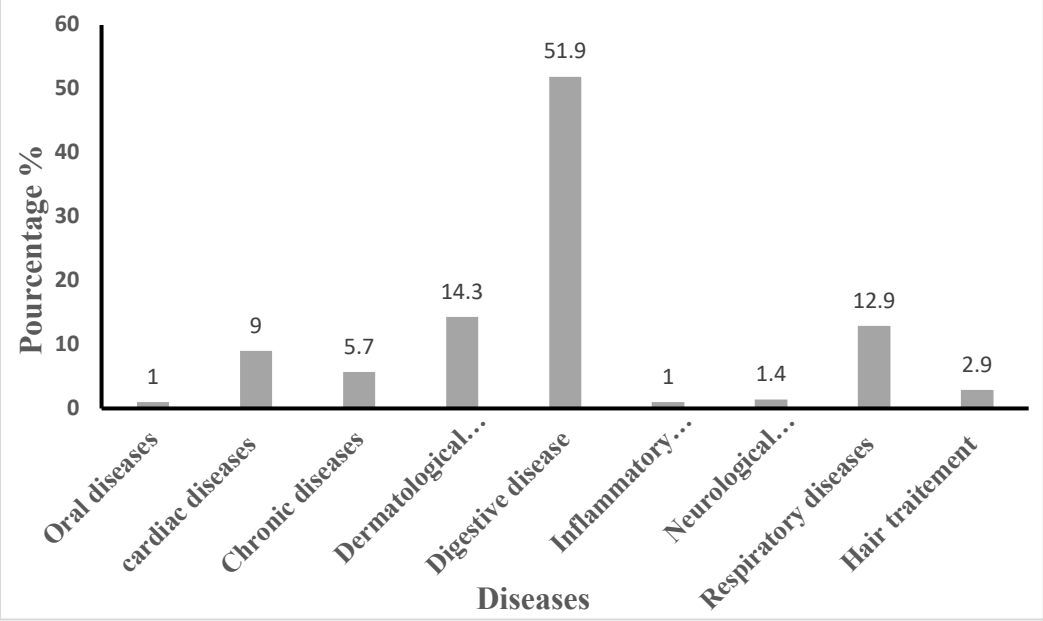

Figure 9. Distribution of the different therapeutic uses of medicinal plants

Species of the most commonly used plants in the commune of Oulad Daoud Zkhanine

The following table (Table 1) represents the medicinal plants most commonly used by the population of Oulad Daoud Zkhanine. For each given plant, we give the scientific name, local name, family, species, part used, the method of preparation adopted by the local population, as well as their different medical uses.

Table 1. Medicinal plant species and their uses

Familly	Species	Local name	Used part	Preparation method	Medical uses
Amaranthaceae	*Dysphania ambrosioides* (L.) Mosyakin & Clemants	Moulbina	Leaves; Whole plant	Cataplasm; Decoction	Headache; Fever; Oral diseases; Child's dysentery; Gastro-intestinal disorders
Anacardiaceae	*Pistacia lentiscus* L.	Fadhis	Leaves Seeds	Decoction; Infusion	Digestive infection; Anti-diarrhea
	Searsia pentaphylla (Jacq.) F.A. Barkley ex Moffett	Tizgha	Leaves	Decoction; Cataplasm	Stomach-ache; Burns
Apocynaceae	*Nerium oleander* L.	Alili	Leaves	Incense; Infusion	Angina infection; Colds; Anti-diabetic
Araceae	*Arisarum vulgare* ((O.Targ.) Tozz.	Ayarni	Tubers	Cooked; Crude	Purgative
Asparagaceae	*Asparagus acutifolius* L.	Asekoum	Stem	Decoction	Digestives diseases
	Drimia maritima (L.) Stearn	Bssal nouchen	Root	Cataplasm	Eczema; Digestive diseases
Asphodelaceae	*Asphodelus ramosus* L. subsp. *ramosus* L.	Berouag	Root	Decoction; External use	Abscess; Eczema; Dermatological diseases
Asteraceae	*Artemisia herba-alba* Asso.	Chih	Whole plant	Decoction; Infusion	Cardiac disorders (Rapid beat); Anti-diabetic; Digestives diseases
	Artemisia absinthium L.	Chiba	Leaves, Stem	Decoction infusion	Cold and Flu; Cholagogue; Diuretic
	Scolymus hispanicus L.	Yarnina	Leaves	Crude	Digestives troubles
	Calendula arvensis L.	Thazafrant	Whole plant	Decoction	Digestive disorders; Hair care
	Matricaria chamomilla L.	Ghedou mellal	Leaves	Decoction; Infusion	Digestives diseases
Boraginaceae	*Borago officinalis* L.	Bouhamdoun	Whole plant	Cataplasm; Decoction	Eczema; Dermatological diseases; Anti-diabetic; Diuretic
Cactaceae	*Opuntia ficus-indica* (L.) Mill.	Thamazoght	Flowers; Fruit	Decoction; Crude	Anti-diarrhea; Abdominal pain; Diuretic
Capparaceae	*Capparis spinosa* L.	Kebbar	Fruits Seeds	Decoction; Powder	Hypoglycemic; Anti-rheumatism
Caryophyllaceae	*Gypsophila vaccaria* (L.) Sm.	Tigheghecht	Root	Decoction; Infusion	Hypertension; Against constipation
	Herniaria hirsuta L.	Herras lehjar	Aerial parts	Decoction	Against renal lithiasis; Diuretic
Cucurbitaceae	*Citrullus colocynthis* (L.) Schrad.	Hendal	Fruits, Pulp	Powder; Decoction	Eczema; Antidiabetic; Diuretic; Purgative
Cupressaceae	*Tetraclinis articulata* (Vahl) Mast.	Laaraar	Leaves, Stem	Decoction	Vomiting; Digestive disorders; Anti-diarrhea; Hair care
Euphorbiaceae	*Ricinus communis* L.	Thazartoqzine	Leaves	Cataplasm; Infusion	Fever; Headaches; Digestif disorders; Purgative
Fabaceae	*Ceratoniasiliqua* L.	Thasliroua	Fruits	Powder; Decoction	Anti-diarrhea; Against bronchitis
Lamiaceae	*Ajuga iva* (L.) Schreb.	Chendgoura	Leaves	Decoction	Anti-diabetic; Digestives disorders; Cardiovascular diseases

	Lavandula multifida L.	Lakila	Leaves	Decction	Bronchitis; Colds; Asthma; Digestives diseases
	Marrubium vulgare L.	Thamariouth Marriwa	Leaves	Decoction; Cataplasm	Bronchitis; Anti-diarrhea; Cardiovascular diseases; Digestive diseases; Dermatological diseases; Colds
	Thymus saturejoides Coss.	Jyouchen	Whole plant	Decoction	Digestives diseases; Bronchitis; Colds; Asthma
	Salvia rosmarinus Spenn.	Azir	Whole plant	Decoction; Powder; Fumigation	Stomach pain; Diabetes; Natural baby talcum powder; Dermatological diseases; Headache
	Lavandula dentata L.	Azir noghyol	Whole plant	Decoction ; Powder	Digestive diseases; Respiratory diseases; Diuretic; Dermatological diseases
	Teucrium polium L.	Thayrart	Leaves	Decoction	Diuretic; Depurative; Anti-diarrhea
Lythraceae	*Lythrum salicaria* L.	Asghar Amalal	Flowers	Cataplasm	Dermatological diseases
	Punica granatum L.	Reman	Fruit peel	Powder; Decoction	Digestive diseases; Anti-diarrhea ; Hair loss treatments
Malvaceae	*Malva sylvestris* L.	Thibi	Leaves	Cooked; Decoction	Constipation; Digestive diseases
Moraceae	*Ficus carica* L.	Thazarth	Leaves	Decoction	Genitourinary diseases; Digestive disorders
Nitrariaceae	*Peganum harmala* L.	Harmal	Fruits	Raw; Incense	Hair care; Diabetes
Oleaceae	*Olea europaea* L. subsp. *europaea*	Azamour	Leaves	Decoction; Infusion	Anti-diabetes; Hypertension
Papaveraceae	*Papaver rhoeas* L.	Belâaman	Leaves	Decoction; Infusion	Hair treatments stomach pains
Plantaginaceae	*Globularia alypum* L.	Thasalgha	Leaves	Decoction; Cataplasm	Vomiting; Constipation; Anti-diabetic; Eczema; Wounds and injuries
Rhamnaceae	*Rhamnus alaternus* L.	Amlillas	Stem and leaves	Decoction; Infusion	Anemia and jaundice; Liver infection
	Ziziphus lotus (L.) Lam.	Thazagorth (sidr)	Leaves, Fruits	Decoction; Powder	Digestive diseases; Diabetes
Scrophulariaceae	*Verbascum sinuatum* L.	Slah ndar	Leaves	Infusion	Eyes treatments
Solanaceae	*Withania frutescens* (L.) Pauquy	Thirant	Root, Fruits	Decoction; Raw (fruit)	Vomiting; Digestive disorders
	Lycium intricatum Boiss.	Azou	Whole plant	Decoction	Hair treatments
Thymelaeaceae	*Daphne laureola* L.	Alazaz	Leaves	Powder	Anti-hair loss
Urticaceae	*Urtica dioica* L.	Herriga (thayzint)	Leaves	Decoction; Infusion	Anti-diarrhea; Abdominal pain; Diabetes

The frequency of use of different species

The results (Figure 10) show that the Lamiaceae family predominates with a percentage of 15.9 %, followed by the Asteraceae with 11.4 %, Asparagaceae, Anacardiaceae, Caryophyllaceae, Rhamnaceae, Solanaceae, Lythraceae families with a percentage of 4.5 % each. The remaining other botanical families represent only a small percentage (2.3 %). Those results are explained by the nature of the ecosystem studied (forest, steppe) which makes some families dominate over the others in this type of study (Miara *et al*. 2013) and are in line with the results of other studies done by (Mikou *et al*. 2015; Tahri *et al*. 2012; Elhilah et al. 2016).

Conclusions

This study is the first to focus on ethno-pharmacological knowledge of plants used in the

commune of Oulad Daoud Zkhanine in Northeastern of Morocco. It allowed us to develop the catalogue of medicinal plants used in this commune. The frequency of use of medicinal plants in this commune is closely linked to the profile of the people surveyed. Thus, young people, compared to the elderly, generally do not know the names and usefulness of the majority of plant species. Women and men have a shared medicinal knowledge, with a slight difference in the percentage of medicinal plant use between the two sexes, with a slight advantage going to women.

The information acquired, based on the questionnaire sheets and floristic surveys conducted in the field, helped us to draw up a catalogue of 44 plant species, whose medicinal plant monographs are represented in this article. These taxa are divided into 28 families with a clear dominance of the Lamiaceae, Asteraceae family. The results of ethnobotanical surveys show that most medicinal species in the study area are widely used in the treatment of digestive, dermatological and respiratory diseases. These devices are mainly treated with foliage, which is the most commonly used plant organ, and with decoction, which is the most dominant method of preparation in traditional herbal medicine. Finally, it appears from this ethnobotanical research that the traditional use of medicinal plants still persists in the said region, despite the revolution in medical technology.

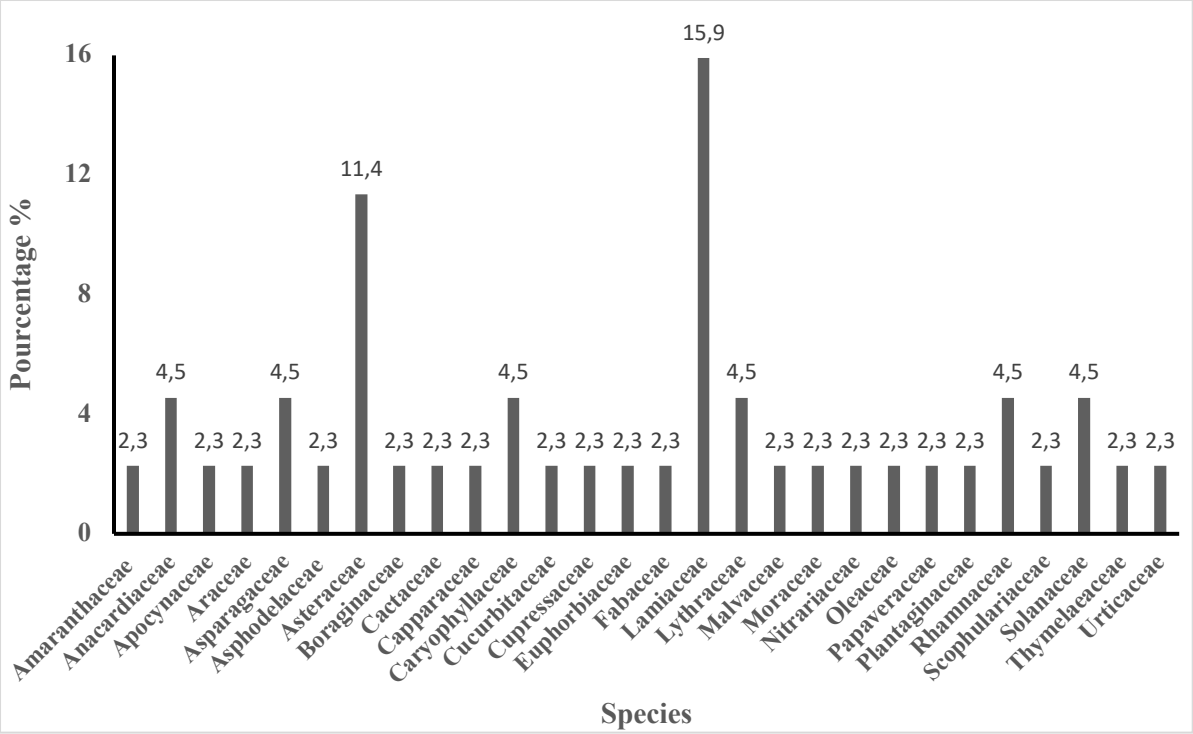

Figure 10. Distribution of the frequency of use of the most commonly used medicinal species

Declarations

List of abbreviations*:* SPSS: System Package for Social Sciences

Ethical Approval and Consent for Participation and publication: An oral agreement has been established between respondents and researchers, which explains, on the one hand, the framework in which the work is carried out, the objectives and importance of the research and the commitment not to use the information provided for commercial purposes. The interviewee undertakes to participate explicitly in the conduct of the interview and to choose to have his or her personal information and knowledge disseminated. Absence of all ethical conflicts

Availability of data and materials: *As detailed in the manuscript, a voucher specimen was deposited* in the laboratory of Plant Ecology Unit, Department of Plant Protection and Environment, National School of Agriculture of Meknes. Morocco

Competing interests: The authors declare that they have no conflict of interests.

Funding: This research work was carried out with the financial support of National Centre for Scientific and Technical Research in Morocco (CNRST) as part of a scholarship for excellence granted to JAADAN Hayat. It did not receive any specific contribution from commercial agencies or not-for-profit sectors.

Author contributions: JAADAN, Akodad, Moumen participated in designing of the study; JAADAN,

Baghour, Skalli and Belmalha participated in the collection of field data and identification of plant samples. JAADAN and Ezrari analyzed the data and JAADAN wrote the initial draft of the manuscript. All the authors participated in writing and giving feedback on the manuscript and approved the final version of the manuscript.

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Annex 1. Ethnobotanical and socio-cultural questionnaire sheet adopted for this study

Location surveyed …….

Geographic location (GPS) : …….

Person under investigation

Age : < 20 ☐ [20-30] ☐ [30-40] ☐ [40-50] ☐ [50-60] ☐ plus of 60 ans ☐

Sex: Female ☐ Male ☐

Level of study: illiterate ☐ Prim ☐ Sec ☐ Univ ☐

Marital Status: Married ☐ Single ☐ Divorced ☐ Widowed ☐

Profession : ……

Do you use herbal medicine? Yes ☐ No ☐

If so, you used it because it's...?

Effective ☐ Cheaper ☐ Acquisition ☐ Ineffective drug ☐

The plants used by the respondent:

Vernacular name: …….

Scientific name: ……

Type of plant: Cultivated ☐ Spontaneously ☐

Use of the plant: Therapeutic ☐ Cosmetic ☐

Parts used: Stem ☐ Leaf ☐ Root ☐ Branch ☐ Fruit ☐

Condition of the plant: Fresh ☐ Dry ☐

Drying method: Shade drying ☐ Solar drying ☐

Method of preparation: Infusion ☐ Decoction ☐ Cataplasm ☐ Raw ☐ Cooked ☐

Mode of administration : Oral ☐ massage ☐ rinsing ☐

Harvest period: Summer ☐ Autumn ☐ Winter ☐ Spring ☐

Dosage: ……

Duration of treatment: ……

Diseases treated:

……..……

……...……..…

Side effects: Yes ☐ No ☐

If yes, what are these effects

……..……

……...……..…