



An Ethnopharmacological Evaluation of Moroccan Medicinal Plants of the Middle Atlas and Pre-Rif of the Province of Taza

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ABSTRACT

Morocco is one of the Mediterranean countries that have a long history in traditional medicine. However, the Moroccan medicinal flora remains unknown and data on regional medicinal plants are very fragmented and dispersed, likewise, few people hold now this expertise. The present study aimed to document the medicinal plants used in traditional medicine and to gather all the information about the therapeutic uses practiced by the local population in the Province of Taza, it was also aimed to highlight novel medicinal plants that have never previously been reported in nearby areas. This was an ethnopharmacological survey conducted in the Province of Taza from 2015 to 2016. The data were gathered from traditional actors including traditional healers, medicinal plant sellers and population local using a semi-structured questionnaire mentioning informant's general data and uses of medicinal plants.

This study reports 57 medicinal plants belonging to 30 botanical families, with a predominance of Lamiaceae and Asteraceae. The leaves and aerial parts are the most used. In terms of the treated disease, digestive diseases occupy first place (26.5%), followed by respiratory diseases (18.4%), and diabetes (16.3%). The survey shows that *Origanum elongatum*, *Calamintha sylvatica*, *Mentha pulegium*, *Rosmarinus officinalis* are the most popular species for therapeutic applications and are also important for beekeeping, herbalists, and merchants.

The results are a very valuable source of information for the study area and to Moroccan medicinal flora. They could be a database for further research in the fields of phytochemistry, pharmacology and contribute to drug development in the future.

Keywords: Ethnopharmacology; Medicinal plants; Traditional medicine; Province of Taza; Middle Atlas; Pre-rif

INTRODUCTION

The therapeutic use of the properties of plants is a part of traditional practices. Indeed, humans have long used traditional remedies herbal without knowing what had caused their beneficial actions [1, 2]. At the present, the plants are still a valuable source of food and remedies, which use a large segment of the world population, particularly in developing countries [3, 4].

Moroccan populations, thanks to the ethnic and cultural intermingling strategic position and plant diversity, have perpetuated a valuable traditional medicinal knowledge. However, unfortunately, with the rapid erosion of biological and cultural diversity, an inestimable loss of traditional knowledge was observed and the knowledge related to medicinal plants has not escaped.

Today, a growing awareness of the medical and economic potential of natural resources should be noted. Indeed, there is a return to folk remedies that materializes through studies and research projects increasingly supported [5, 6].

The multidisciplinary science that deals with plants and their therapeutic use is ethnopharmacology. It first involves fieldwork around the world to collect traditional medicines, and then a laboratory research work will confirm or deny the therapeutic indications of plants [7, 8]. This discipline could lead to producing effective herbal medicines [9].

Morocco has in the field of medicinal and aromatic plants of ancient knowledge, based on how the principles of life, rural or pastoral, requiring familiarity with the plant resources of the surrounding medium [6, 10]. However, this knowledge has, unfortunately, tend to get lost today because of the own unlearning phenomenon of urban civilization. In addition, excessive consumption patterns that have begun to emerge slowly drove our old tradition of self-sufficiency. In this way, little by little, the plants have become foreign to today's youth [11]. Indeed, medicinal plants are a promising potential in science and economy of the country. It is, therefore, important to give them all the interest they deserve with regard to the richness they offer for socio-economic development in general and certain regions in particular but also contribute to drug development in the present and future.

In Morocco, some ethnopharmacological surveys have been conducted [6-16] but they have no study in our area study. Then, this work constitutes the first step for the study of plants from province of Taza rich in medicinal plants, some of which are endemic to the area study and which hosts Tazekka National Park, one of the oldest national parks in Morocco, created in 1950.

The main objective of the present study was planned to investigate, catalogue and record the folk knowledge used by the population of Taza and quantify the ethnomedicinal plant uses employing relative frequency of use. In addition to this, it was also aimed to highlight the most interesting and novel medicinal plants that have never previously been reported in nearby areas and whose phytochemistry and pharmacology should be further investigated.

It should be noted that according to the traditional healers and herbalists of the province of Taza, there are more than a hundred medicinal plants used by the population but not belonging to Taza region, so we were interested only in plants characteristic of the province, and that's what differs our study from others.

EXPERIMENTAL SECTION

Study area and its climate

Taza Province (on the date of completion of the field survey) belongs to the Taza-Al Hoceima-Taounate, which is characterized by the diversity and richness of its natural environment. Indeed, it is a hyphen between the Rif with its coastline and mountains on the one hand, and the Pre-Rif, the Middle Atlas, Fez-Taza corridor and steppe zone on the other. This relief diversity is accompanied by a multitude of climatic floors: sub-humid, humid, semi-arid and arid [17]. After the new administrative division of Morocco, Taza belongs to the Fez-Meknes region and not Taza-Al Hoceima-Taounate.

Taza Province covers a total area of 15 020 km²; its population is 528 419 inhabitants [18]. The Provinces of Al Hoceima and Nador, Province of Taourirte, Province of Boulmane, Taounate and Sefrou Provinces respectively bound it to the North, East, South and West [19].

The climate is Mediterranean, in particular, semi-continental Mediterranean influence, wet winter and semi-arid summer [20].

With 468 000 hectare (ha), forests and grass spaces occupy 42.5% of the Province of Taza; 401 339 ha corresponding to forests. Holm oak, Cedar, Aleppo pine, Cork oak and cedar (especially Tazekka National Park) invaded respectively 130 704 ha, 50151 ha, 30028 ha, 11737 ha and 9907 ha. On grazing and uncultivated land, they spread on 644 000 ha, or 44.7% of the surface of the Province [21, 22].

The Province of Taza harbors a large area of forests in the Middle Atlas or Pre-Rif, thus a striking diversity of flora and fauna and also lodges Tazekka parc, one of the oldest national parks in the Kingdom, established in 1950.

The altitudes are between 500 and 1980 m. This is a massive wetland in a dry region (Eastern Morocco). It so has a unique and rich phytobiodiversity, 64 taxa are endemic strict [12]. This floristic richness is the result of its geographical position, its orography, its edaphic structure, its geological history and past and current climate conditions.

Pre-Rif Taza is one of the early settlement areas considered with the Moroccan mountains as the cradle of the Moroccan humanity. Indeed, the Eastern Rif, in this case, its Southern slopes, was for long neglected and marginalized, these mountain areas are subject to strong natural imbalance, economic and spatial. It is among many Moroccan rural areas that remain unexplored in terms of ethnopharmacological research, although it would have a huge potential on phytotherapy [23]. The Rif is also home to many other common species endemic to the Cordillera in Andalusia [24]. Married to the orographic and regional geological diversity, promotes ecologically richness [25].

Informant selection and ethno-medicinal data collection

The ethnopharmacological survey was conducted from March 2015 to March 2016, in interview form guided by a semi-structured questionnaire form that we have prepared with reference to the work [10-29]. The survey aims to collect information on the interviewees (age, sex, level of education, ethnic group, profession, family situation), medicinal plants (part of plant used, route of administration, modes of uses and preparations, dose used, and toxicity) and the main diseases treated, in order to have an idea of floristic diversity of the pharmacopoeia of the study area. The participants (Table 1) were informed of the objectives of the study and that the information collected will be displayed for scientific studies and not for commercial use. According to International Society of Ethnobiology (ISE) Code of Ethics (www.ethnobiology.net/ethics.php). A total of 103 surveyed from 4 different villages were interviewed during the 1-year period. Mature men dominate the practice of traditional medicine, 71 of the interviewed were men with an average age of 54 years (Table 1).

So we adopted a working method with reference to earlier work: Benkhniue *et al* (2010), Libiad *et al* (2011), Khabbach *et al* (2012), Ouarghidi *et al* (2013), El Abbouyi *et al* (2014), Hosamo *et al* (2015) and fokou *et al* (2015). [14-33].

Our work is divided into 4 steps:

Step 1: Survey of traditional healers in the city of Taza (Location A) using a plug-questionnaire to find medicinal plants used by the local population and characteristics of the Province and their precise locations of harvest and their geographical origin.

Step 2: Survey among local people to compare their statements with the results of the first stage (the statements of the traditional healers of Location A).

Step 3: Perform botanical excursions to different locations (Bab Boudir, Aknoul, Gueldamane) based on declarations of traditional healers of (Locations A) conducted with a GPS [Garmin Oregon 550] and newsprint.

Step 4: Identification and herborizing flora harvested in laboratory Materials, Natural Substances, Environment & Modeling (LMSNEM) of Polydisciplinary Faculty of Taza (FP Taza), Sidi Mohamed Ben Abdellah University in Fez (USMBA Fez) based on a determination of botanical keys.

Table 1: Number of people surveyed in the different Stations

Survey Station	Geographic location	Man	Female
Taza city	Center of the Province	31	12
Aknoul	Pre-Rif	30	0
Gueldamane	Middle Atlas (East)	5	10
Bab Boudir	Middle Atlas (West)	5	10
Total		71	32

Botanical Identifications

The botanical identification was made using the online database (www.theplantlist.org) and botanical references (Tela Botanica, 2012; Quezel & Santa, 1962-1963; Valdés *et al.*, 2002; Bellakhdar, 2006; Nègre, 1962) [11-37] by Pr. Abdelmajid KHABBACH and Pr. Abdeslam ENNABILI. An example of herbarium species was crafted and placed in the laboratory (LMSNEM) of the Faculty of Polydisciplinary Taza, USMBA of Fez.

The different locations of harvesting medicinal plants are (Figure 1) :

Location B: 30 km from Taza, this center (Bab Boudir) is classified by the Cultural Affairs as built cultural heritage. It is part of the National Park Tazekka, which is the source of water, forests and mountainous terrain (Figure 2).

Location C: Aknoul is the capital of the Rif tribe Izenayane. Aknoul is located near other towns: 60 km from Taza, 45 km of Midar, 60 km from Driouch, and 115 km from Nador. According to the 2014 census, the population is 4403 inhabitants in 1 037 families (Figure 3).

Location D: Gueldamane is a town in the Taza Province. At the time of the 2014 census, the town had a total population of 10405 people in 2 154 families (Figure 4).



- **Figure 1 :** Map of Taza Province with different survey locations. (A) City of Taza: Geographical coordinates: N 34°13.605' W 004°01.711' Elevation 469 m, (B) Bab Boudir, (C) Aknoul, (D) Gueldamane



- **Figure 2:** Photo of the harvesting site of medicinal plants (Location B, geographical coordinates: N 34 ° 04'34.9 ''W 004 ° 08'04.7'' Elevation 1347 m)



- **Figure 3: Photo of the harvesting site of medicinal plants (Location C, geographical coordinates: X: E00639245, Y: N 00445692, Elevation 942 m)**



- **Figure 4: Photo of the harvesting site of medicinal plants (Location D, geographical coordinates: X: E00632512, Y: N00392675, Altitude 950 m)**

Data organization and analysis

Excel spread sheet was used to perform simple calculations and determines each plant frequency of use, their modes of uses and preparations, and the main diseases treated.

RESULT AND DISCUSSION

Personal data of informants' interviews

Ethnopharmacologic information gathered was registered on sheets of raw data then transferred to a database, treated and analyzed to obtain data standardized bearing on various aspects.

Age factor:

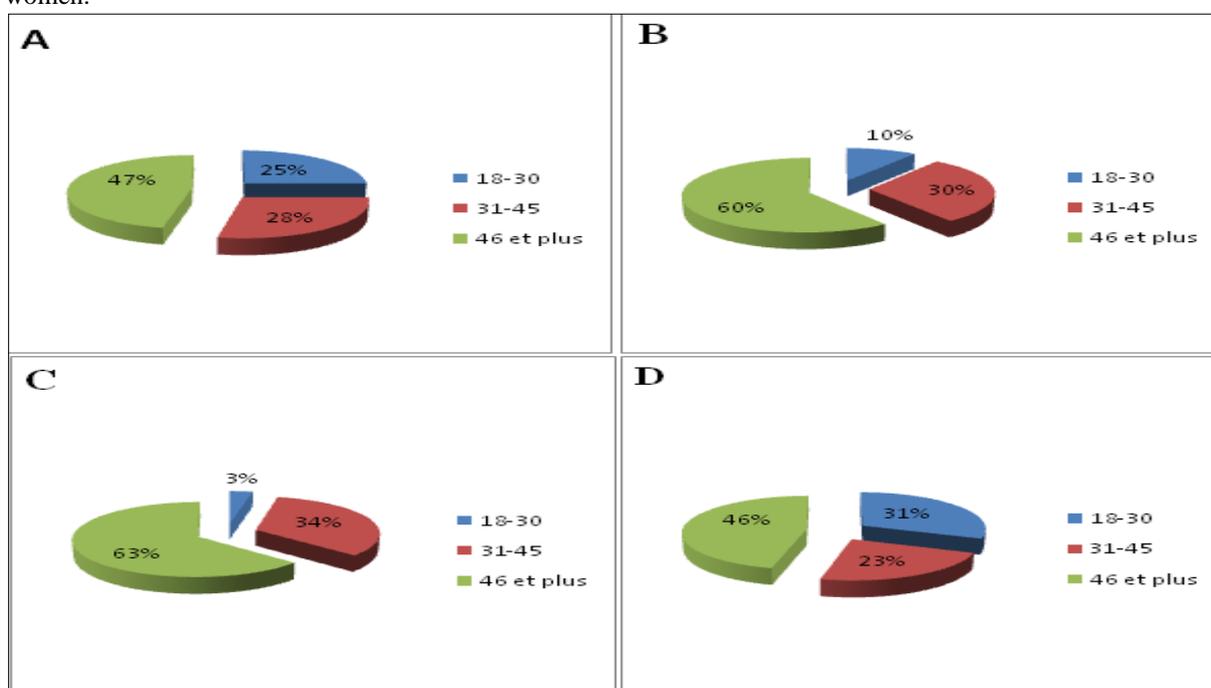
The analysis of the graphs obtained from the frequency distribute of use of plants according to the age group at the study area (Figure 5) shows that the age group above 46 years use much more plants for healing, with a higher frequency of 54%, followed by the age group (31-45 years) with a lower frequency of 28.8% and at the end of the age of 30 with a lower frequency of 17.3%. This result contradicts with the work of Benkhnigue and colleagues [14] in which the investigation announced that the slice (30-45 years) use more plants with a rate of 54.9% against 19.6% for people older more than 46 years.

The frequency of use among the elderly can be explained by a better knowledge of the uses and properties of medicinal plants, gained from the long experience accumulated at home [38]. However, the low frequency in another age class (less elderly) is due in part to poor knowledge of using these plants, and secondly to a distrust of these people, especially the youth, who tend not to believe in this traditional medicine [14].

Sex factor:

Analysis of the data from our survey found that the use of medicinal plants varies according to gender; and men use more herbs than women (Figure 6), in fact, 60.2% of men interviewed use these resources in traditional medicine against 39.8% of the female population. These results contradict the results obtained by various works [10-42] announcing that women use more medicinal plants than men.

In our case, this can be explained by the difficult or indirect access to knowledge holders (mothers) especially in the Pre-Rif area (Aknoul) because of local traditions and customs that prohibit communicating directly with women.



- **Figure 5: Distribution of the plant use frequency according to age group in different locations (A, B, C, D)**

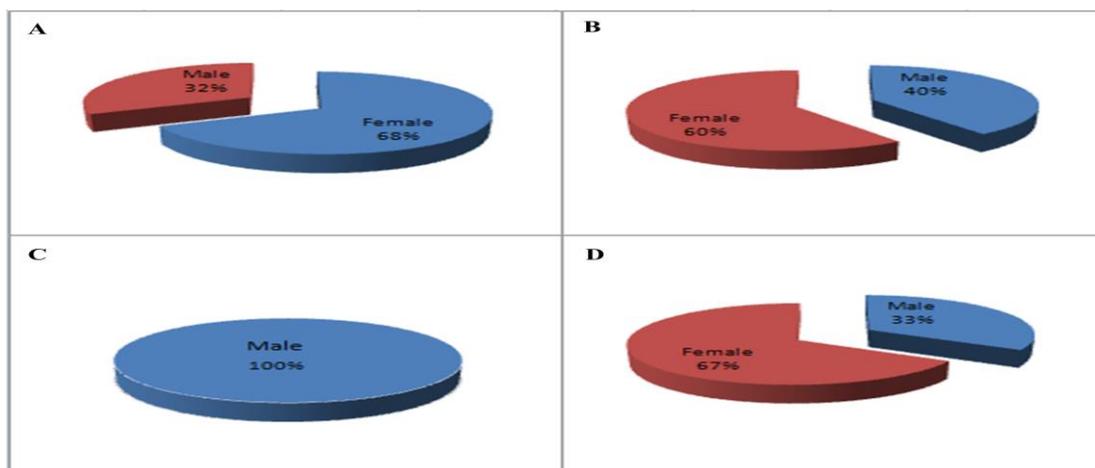


Figure 6: Distribution of plant use rate by gender in different locations (A, B, C, D)

Study level factor:

In our study area, the majority of users of medicinal plants having a level of primary school with a percentage of 55.3% (Figure 7). Nevertheless, illiterate people represent a significant percentage of 32.5%, while those with a high school or university level, use very little medicinal plants (6.5% and 5.8%). These results are contradictory to the results obtained by other authors [14-26]. The low rate of use of medicinal plants by the class that has a secondary and university level is explained by the fact that educated and cultured people are aware of plants toxicity and therefore avoid the possible uses and because surveys were carried out at different times and that practices have changed and evolved.

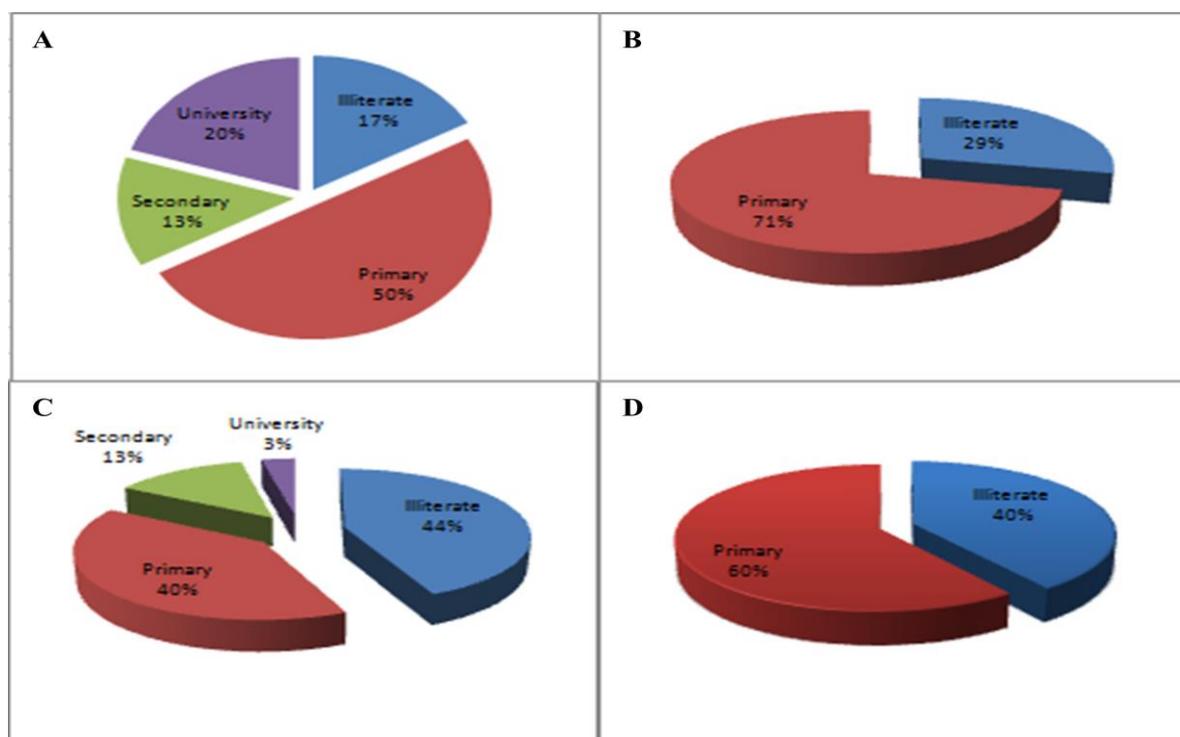


Figure 7: Distribution of the plant use frequency by the level of study in different locations (A, B, C, D)

Family situation factor:

Medicinal plants are much used by married people 90%, than by singles 10%, which is conformity with the results obtained by the work [14] because they allow them to avoid or reduce the required hardware costs by the doctor and the pharmacist.

Plant species used in traditional medicine in the Province of Taza**Most botanical families represented in the study area:**

We were able to prove fifty-seven (57) species belonging to thirty families that are used by the population of the Province of Taza (Table 2).

The most represented families in the Province of Taza are the *Lamiaceae* (15 species), *Asteraceae* (4 species), *Fabaceae* (3 species), *Caryophyllaceae* (3 species) *Cistaceae* (3 species), *Myrtaceae* (4%), *Punicaceae* (4%), *Rutaceae* (2%) and *Oleaceae* (2%), the rest of the families have only one or two species each. These results are conformity with the work done in Eastern Morocco [10-39] which showed that the five most represented in Morocco oriental botanical families are: *Asteraceae*, *Lamiaceae*, *Fabaceae*, *Apiaceae*, and *Liliaceae*. Scale studies of the Province reached similar findings [33]. The medicinal flora is dominated mainly by the *Lamiaceae* and *Asteraceae* [26,43-46] which are among the top nine families of the native flora of Morocco, with a large number of species [47]. Other studies in the Mediterranean climate also show that the *Asteraceae* and *Lamiaceae* are the most exploited in the Moroccan traditional medicine [46].

Medicinal plant diversity

Fifty-seven (57) medicinal species were identified (Table 2), thirty six (36) plants have been declared by herbalists and traditional healers, while for the other twenty one (21) plants, we were able to find with the local population in different locations. In other Moroccan regions, medicinal plants are higher and vary from 76 to 180 species, depending on weather and socio-economic and the affected area [31,43-48]. Its great diversity of plants and/ or a backup of local expertise [43] could explain the high number of species with medicinal properties in the watershed of Oued Lau (North West Morocco).

Medicinal plants with high frequent use:

The analysis of the collected information (Figure 8) shows that 14 medicinal plants used the most in the Province of Taza. *Origanum elongatum* (Zaâtar/Sahtar/ Azoy) *Calamintha sylvatica* (Manta/ Tmint) *Mentha pulegium* (Mchichtro/ Timrssitane), *Rosmarinus officinalis* (Azir) are the most popular species for therapeutic applications and are also important for beekeeping, herbalists, and merchants. These results are similar with regional [31-33] and international work particularly in Algeria [58] However, these species may disappear from the forest if the departments concerned, take no protective measures because of the intensity and the way of collecting these species.

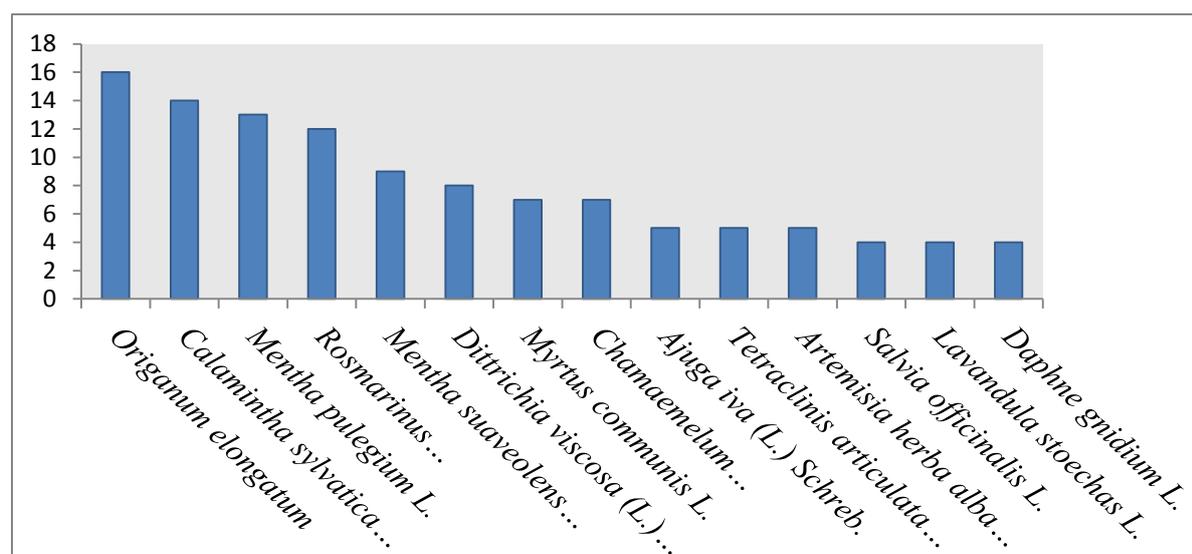


Figure 8: Major medicinal plants used in traditional herbal medicine in the Province of Taza

Vernacular names of medicinal plants in the study area

Vernacular nomenclature represents the local names of plant species used for medicinal or cultural purposes. In our study area, we noted that medicinal plant carry 2 to 3 vernacular names and are owed to the variety of the occupying ethnic groups in the area of study.

Both species *Centaurium maritimum* and *C. erythraea* carry the same vernacular name "Rbiâssam" in our study area. Moreover, *C.erythraea* is also called "Gassathaya", which is the name it is called in neighboring regions [31].

The plant *Daphne gnidium* carry two different common names in the Middle Atlas, which are "Lazaze" and "Lmatnane" while other studies claim that "Lmatnane" is intended for the specie *Thymelaea hirsuta* [31].

Both species *Herniaria hirsuta* and *Teucrium polium ssp. Polium* carry the same vernacular name "Harass lahjar", while in the Middle Atlas "Harass lahjar" intended for the plant *Teucrium polium ssp. Polium* and *Herniaria hirsute* for the Pre-Rif population.

Plants part used:

Different parts of plants used in traditional medicine including the leaves, the aerial part, roots, bark, inflorescence, stem, and fruit. The percentage of use of these different parts in our study shows that the leaves are the most used (52%), followed by the aerial part (29%), all the remaining parts used namely root, bark, stem, fruit, inflorescence is represented by a cumulative rate of 19% (Figure 9).

The high use frequency of leaves can be explained by the ease and speed of harvesting and require less effort than other parts such as root [49], but also by the fact that they are the site of photosynthesis and sometimes storage of secondary metabolites responsible for biological properties of plants. Another significant reason is that use of leaves can conserve the plant but the use of root can kill them.

Although Figure 9 shows that the use of the leaves represented a percentage of 52%, we noticed that in the field users tend to pull the plant instead of interest only to the desired part (mainly leaves). Knowing that there is a clear relationship between the used part of the plant operated and the effects of this operation on its existence [50]. This collection of fashion seriously jeopardizes the sustainability of medicinal species especially bulbous [26]. It is noteworthy that health facilities in the region are now insufficient to meet the needs of the population in health care. The remoteness and inaccessibility of the areas partly explain the weakness of health coverage. In addition, soil erosion is exacerbated by overgrazing and clearing activities in the region [51].

Preparation method:

Several preparation methods are used to find out the infusion, decoction, powder, fumigation, poultice, maceration, and white washing. Our survey made it possible to classify the methods of preparation (Figure 10).

Figure 10 shows that the decoction is the most common method of preparation (49%), followed by poultice (18%) and powder (13%), which is in conformity with the work of [15, 26, 41] The infusion has a low percentage of 10% from the decoction mode. Indeed, the decoction is considered by the population allow to collect as active ingredients and mitigate or avoid the toxic effect of certain revenues [10]. The majorities of herbal medicines were prepared from dried plant material rather than fresh material.

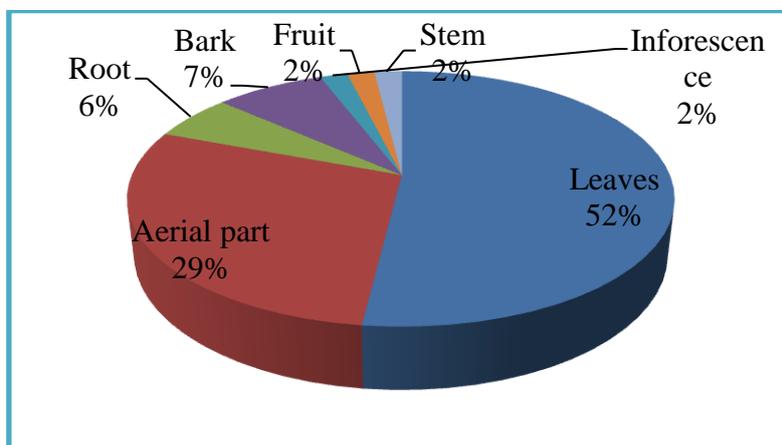


Figure 9: Distribution of the percentages of different parts used medicinal plants

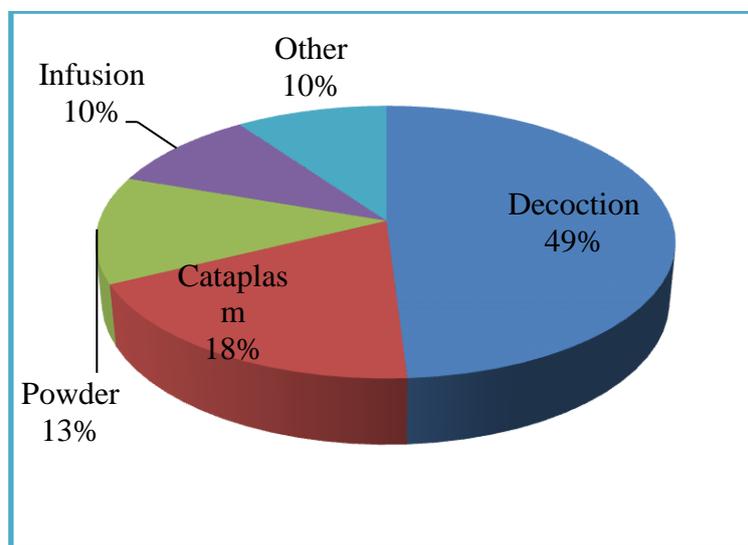


Figure 10: Distribution of medicinal plants preparation methods of the Province of Taza

Treated diseases:

The ethnopharmacological investigation allowed us to identify a number of chronic diseases treated by medicinal plants. The results show that most plants are involved in the treatment of digestive disorders (26.5%), respiratory diseases (18.4%), diabetes (16.3%) and neurological disorders 11.3%. This result is consistent with that obtained by the work [10]. Other diseases are represented by anemia, cancer, alopecia, and injuries.

Use modalities of medicinal plants:

In our study, we found that the recipes are prepared by either a single plant by 57% or plants and/ or other materials associated 43%. Nevertheless, the plants used in combination seem to be valued by their synergy in the treatment of the disease concerned.

Comparative analysis of our findings with previous works:

The present study is the first ethnopharmacological investigation of Taza province. However, the findings of the current study were compared with those of previous ethnobotanical investigations carried out in neighboring regions, as well as other countries. This study revealed 57 medicinal plants used by the local population, which belong to 30 botanical families; the family Lamiaceae is the most represented together by a staff of 15 species followed by Asteraceae, Fabaceae, Caryophyllaceae, Myrtaceae, and the Cistaceae. This family (Lamiaceae) is well known for food and fodder species. Most of the members of this family are well known of having many phytochemicals (alkaloids, tannins, flavonoids, terpenoids and carbohydrates) [81].

Interestingly, indigenous knowledge of plants and their uses change with respect to geographic area and ethnic group. For instance, the Aerial part of *Rosmarinus officinalis* L. is used to treat Rheumatic pain in the district of Acquapendente (Latium, Central Italy) [29], but in Taza province, the leaves are used to treat diarrhea and respiratory tract. The comparative medicinal knowledge of the ethnobotanical flora of the study area reveals diverse regional uses in the region of Taza. The Aerial part of *Mentha pulegium* L. is used as an insecticide; deodorant in the province of Taounate (North of Morocco) [31], the same species is used as anti-rheum, anti-flu in our study area also with the study of khabbach [71].

The Aerial part of *Chamaemelum fuscatum* (Brot.) Vasc. are used to treat Affection genito-urinary, neurologic, and alopecia in our study area, but according to [33], they are used as an antidepressant, and against anemia. In the same way, a leaf cataplasm of *Urtica dioica* L. is used as anti-inflammatory in the study area as well as in another region of Morocco [14, 41], but it is used for kidney and urinary tract, gastrointestinal tract, locomotor system, skin, hemorrhage, cardiovascular system in Austria [82]. The leaves of *Chenopodium ambrosioides* L. is found to be effective for gastrointestinal disorders, against fever, but [32] reported its use to treat Buruli ulcer in three West African countries Benin, Ghana, and Ivory Coast.

In the study area *Eucalyptus globules* Labill. is used to treat respiratory tract while it used to treat liver diseases in the Russian Pharmacopoeia [32]. As far as ethnobotanical importance is concerned, the uses of certain

medicinal plants are the most significant (Table 2), as there is zero similarity in uses with other countries [29-82] and many similarities with work carried out at the national level [10- 84].

Results of the present study revealed that 8 out of 57 species were the first time explored for the medicinal values. These species are *Thymus manbyanus. ssp ciliatus* Bois & Rent. *Tanacetum annuum* L. *Fumana scoparia* Pomel. *Ziziphus zizyphus* H.Karst. *Clematis flammula* L. *Tamarix Africana* Poir. *Selaginella spp.* *Salvia verbenava* L. These species belong to seven different families. Two species (*Thymus manbyanus. ssp ciliatus* Bois & Rent. & *Salvia verbenava* L.) belong to family Lamiaceae. These two species are used for the treatment of gastrointestinal disorders, respiratory tract and injuries respectively. *Tanacetum annuum* L. belong to family Asteraceae. This family is rich in many active compounds like saponin, glycosides, steroids, tannins, diterpenoids, triterpenoids and flavonoids [83]. *Fumana scoparia* Pomel belongs to family Cistaceae, which it's used to treat gastrointestinal disorders, *Ziziphus zizyphus* H.Karst. belongs to family Rhamnaceae, it's recommended in the context of disease, *Clematis flammula* L. it's used to treat rheumatism. *Tamarix Africana* Poir.(Tamaricaceae), this species is reported for the treatment of diabetes. *Selaginella spp.* (Selaginellaceae) used against alopecia. This information may lead toward the discovery of a new number of phytochemicals to give another alternative way to compensate the drug needs. That's why; this finding will help many pharmacologists in near future to determine many new pharmacologically active constituents from these plant species.

Table 2: Preparation and modes of administration of the various medicinal plants of the Province of Taza

Family/ scientific name	Voucher specimen number	Vernacular name (s)	Used part (s)	Mode of preparation/ administration	Dose used	Diseases treated	Fu	Previous citations
<i>Lamiaceae</i>								
<i>Origanum majorana</i> L.	SB2015/13	Mardadouch مرددوش	Ap	D/ Orl	2 Gl/ Dy	Aff Resp, Dbt	0.62	[6-82]
<i>Calamintha sylvatica</i> Bromf.	SA2015/07	Manta/ Tmint مانتا	Ap	D in milk/ Orl	2 Gl/ Dy	Aff Resp, Pn Abd	8.75	[31-33]
<i>Marrubium vulgare</i> L.	SD2015/12	Mariwa/ Mariw مروة	Ap / Le	D/ Orl Ct/ Loc	1 Gl/ Dy	Allergie, Aff Dig, Dbt	1.25	[14-71]
<i>Mentha suaveolens</i> Ehrh.	SD2015/03	Mchichtro/ Timrssitane مششتر	Le	D/ Orl	2 Gl/ Dy	Aff Neuro, Fertility	5.62	[6-57]
<i>Salvia officinalis</i> L.	SA2015/02	Salmiya سالمية	Le	IF/ Orl	2 Gl/ Dy	Affe Dig, Menstruate	2.5	[14-82]
<i>Origanum</i> spp.	SC2015/16	Zaâtar/ Sahtar/ Azoy الزعر	Le	IF/ Orl Pdr with honey/ Orl	1 Gl/ Dy	Aff Dig, Dbt, Bug	10	[15-57]
<i>Origanum elongatum</i> .	SD2015/01	Zaâtar/ Sahtar/ Azoy الزعر	Le	IF/ Orl Pdr with honey/ Orl	1 Gl/ Dy	Aff Dig, Dbt, Bug	10	[15-55]
<i>Thymus zygis</i> L.	SC2015/14	Zâitra/ Zdouchan زعيرة	Ap / Le	IF/ Orl	2 Gl/ Dy	Aff Resp, Aff Dig	1.87	[15-71]
<i>Thymus manbyanus</i> . ssp ciliatus Bois & Rent.	SD2015/05	Touchent توشنت	Ap / Le	IF/ Orl	2 Gl/ Dy	Aff Resp, Aff Dig	1.87	[55]
<i>Rosmarinus officinalis</i> L.	SC2015/15	Azir أزير	Le	D/ Orl	2 Gl/ Dy	Affe Resp, Drh	7.5	[14-71]
<i>Ajuga iva</i> (L.) Schreb	SD2015/02	Changora/ Chantgora شنتغورة	Ap	Pdr with honey/ Orl	1 Gl/ Dy	Dbt, Aff Dig	3.12	[15-71]

Family/ scientific name	Voucher specimen number	Vernacular name (s)	Used part (s)	Mode of preparatio n/ administra tion	Dose used	Diseases treated	Fu	Previous citations
<i>Mentha pulegium</i> L.	SD2015/10	Fliyo فليو	Ap	D in milk/ Orl	3 Gl/ Dy	Aff Resp	8.12	[6-71]
<i>Lavandula stoechas</i> L.	SB2015/03	Halhal/ Azri حلحال	Le	D/ Orl	2 Gl/ Dy	Aff Resp, anemia, Drh Dbt	2.5	[15-71]
<i>Salvia verbenava</i> L.	SD2015/06	Khiyata خياطة	Le	Ct/ Loc	Nd	Inj	1.25	
<i>Teucrium polium</i> ssp. Polium.	SD2015/04	Harass lahjar هراس الحجر	Ap	D/ Orl	2 Gl/ Dy	Aff Rnl	1.25	[26-55]
<i>Asteraceae</i>								
<i>Artemisia herba - alba</i> Asso.	SC2015/08	Achih الشيح	Ap	D/ Orl	1/2 Gl/ Dy	Aff Neuro, Dbt, Pn Abd, sedative	3.12	[15-71]
<i>Chamaeme lum fuscatum</i> (Brot.) Vasc.	SC2015/18	Babounej البابونج	Ap	D/ Orl Ct/ Loc	3 Gl/ Dy	Aff genito- urinary, Aff Neuro, Alp	4.37	[33]
<i>Tanacetum annuum</i> L.	SC2015/12	Timarssad/ Jaâda جعدة	Le	Ct/ Loc	Nd	Inj	0.62	[33]
<i>Ditrichia viscosa</i> (L.) Greuter.	SD2015/09	Magraman/ Tarinal مغرامان	Ap /Fe	D/ Orl Ct/ Loc	1 Gl/ Dy	Aff Dig, Tonic, Inj	5	[31-78]
<i>Fabaceae</i>								
<i>Ononis natrix</i> L.	SC2015/10	Afzaz أفزاز	Ap	Ct/ Loc	Nd	Vs hemorrhage	0.62	[33]
<i>Quercus ilex</i> L.	SB2015/12	Balot البلوط	Br	D/ Orl	1 Gl/ Dy	Aff Dig	0.62	[16-57]
<i>Anthyllis cytisoides</i> L.	SC2015/09	Talgut تالغيت	Le	Ct/ Loc	Nd	Inj	0.62	[33-71]
<i>Caryophyllaceae</i>								
<i>Herniaria hirsuta</i> L.	SC2015/19	Fatat lahjar فتات الحجر	Ap	D/ Orl	2 Gl/ Dy	Aff Rnl	1.25	[10-33]
<i>Silene vulgaris</i> (Moench) Garcke.	SD2015/11	Tighighacht تغيجشت	Le	Pdr/ Orl	1 Gl/ Dy	Vs Cold	1.87	[16-33]
<i>Corrigiola telephifoli a Pourret.</i>	SB2015/05	Sarghina سر عينة	R	Pdr/ Orl	1 Sp/ Dy	Aff Dig	1.87	[6-73]

Family/ scientific name	Voucher specimen number	Vernacular name (s)	Used part (s)	Mode of preparatio n/ administra tion	Dose used	Diseases treated	Fu	Previous citations
<i>Cistaceae</i>								
<i>Cistus ladanifer</i> L.	SB2015/02	Tazoult تَزُولت	Fr	Pdr/ Orl	2 Cr	Aff Dig	1.25	[33-73]
<i>Cistus salviifolius</i> L.	SC2015/13	Tangroucht تانغروشت	Le	IF/ Orl	1 Gl/ Dy	Aff Dig	0.62	[26-73]
<i>Fumana scoparia</i> Pomel.	SD2015/13	Touchent توشنت	Ap	IF/ Orl	2 Gl/ Dy	Aff Dig	0.62	
<i>Punicaceae</i>								
<i>Punica granatum</i> L.	SA2015/03	Raman الرمان	Br	D/ Orl	1 Gl/ Dy	Aff Resp, Drh, Aff Dig	1.25	[15-74]
<i>Aristolochiaceae</i>								
<i>Aristolochi a fontanesii</i> Boiss. & Reut.	SC2015/20	Barztem بارزطم	Le	Pdr with honey/ Orl	2 Sp /Dy	Cancer, Dbt	0.62	[15-68]
<i>Apocynaceae</i>								
<i>Nerium oleander</i> L.	SB2015/08	Dafla دافلة	Le/ Stolon	IF/ Orl	2 Gl/ Dy	Aff Dig	1.87	[15-57]
<i>Cupressaceae</i>								
<i>Tetraclinis articulata</i> (Vahl) Mast.	SD2015/07	Aarâar العراعار	Le	D/ Orl Ct/ Loc	1 Gl/ Dy	Aff Dig, Pn Abd, Rheumatism	3.12	[6-71]
<i>Oleaceae</i>								
<i>Phillyrea latifolia</i> L.	SC2015/01	Amlilas أمليلس	Le	D/ Orl	1 Gl/ Dy	anemia	0.62	[33-57]
<i>Euphorbiaceae</i>								
<i>Euphorbia resinifera</i> O.Berg.	SD2015/14	Daghmous داغموس	Ap	Mixture with milk/ / Orl	2 Gl/ Dy	Vs cysts	1.87	[56-66]
<i>Myrtaceae</i>								
<i>Eucalyptus globulus</i> Labill.	SA2015/04	Kalitous أكاليتوس	Le	D / Inhalation	Nd	Aff Resp	1.25	[10-75]
<i>Myrtus communis</i> L.	SB2015/10	Rayhan الريحان	Le /Fr	Mixture with « <i>Lawsonia inermis</i> »/ Mask D/ Orl	2 Gl/ Dy	Alp, Aff Neuro menstruate	4.37	[6-85]

Family/scientific name	Voucher specimen number	Vernacular name (s)	Used part (s)	Mode of preparation/ administration	Dose used	Diseases treated	Fu	Previous citations
<i>Urticaceae</i>								
<i>Urtica dioica</i> L.	SA2015/06	Horiga l'horriga l'harcha خريفة	Le	Ct/ Loc	Nd	Inflammation	0.62	[41-82]
<i>Rhamnaceae</i>								
<i>Ziziphus lotus</i> (L.) Lam.	SA2015/05	Sidr سدرة	Le / Fr	Ct/ Loc D/ Orl	Nd	Alp, Aff Dig	1.25	[15-71]
<i>Ziziphus zizyphus</i> H. Karst.	SC2015/21	Bozofor بزفور	R	hydraulic maceration/ Orl	1 GI/ Dy	Context of disease	0.62	[31-33]
<i>Rutaceae</i>								
<i>Ruta montana</i> L.	SC2015/05	Figel/ Warma الفجل	Le / St	D/ Orl	1 GI/ Dy	Hunting spirit	1.25	[6-57]
<i>Thymelaeaceae</i>								
<i>Daphne gnidium</i> L.	SB2015/06	Lazaz/ Lmatnan لزاز	Le	Mask	Nd	Alp	2.5	[6-55]
<i>Verbenaceae</i>								
<i>Aloysia citriodora</i> Palau.	SA2015/01	Lwiza/ malwiza لوية	Le	D/ Orl	2 GI/ Dy	Aff Resp, Aff Neuro	1.25	[31-57]
<i>Ericaceae</i>								
<i>Arbutus unedo</i> L.	SB2015/11	Sasno/ Bakhno سانسنو	R/ Fr	D/ Orl	2 GI/ Dy	Asthma, Aff Dig	0.62	[31-71]
<i>Juncaceae</i>								
<i>Juncus acutus</i> L.	SC2015/17	Smar/ Junkss سمار	infl	D/ Orl	1 GI/ Dy	Aff Dig	1.25	[16-78]
<i>Chenopodiaceae</i>								
<i>Chenopodium ambrosioides</i> L.	SB2015/09	Mkhinza مخينزا	Ap / Le	Ct (mixture with « <i>Allium cepa</i> ») D/ Orl	1 GI/ Dy	Aff Dig, Vs fever	1.87	[31-56]
<i>Ranunculaceae</i>								
<i>Clematis flammula</i> L.	SC2015/03	Nar barda نار الباردة	Ap	Ct/ Loc	Nd	Rheumatism	0.62	[14,15]
<i>Anacardiaceae</i>								
<i>Pistacia lentiscus</i> L.	SC2015/11	Tro/ fadis طرو	Le	D/ Orl	1 GI/ Dy	Aff Dig, Drh, Alp	1.25	[6-57]

Family/scientific name	Voucher specimen number	Vernacular name (s)	Used part (s)	Mode of preparation/ administration	Dose used	Diseases treated	Fu	Previous citations
<i>Plantaginaceae</i>								
<i>Globularia alypum</i> L.	SC2015/07	Tassalgha/âinlarnb/Wdan Ifar تاسلغا	Le	IF/ Orl	1 Gl/ Dy	Aff Dig, Dbt	1.84	[14-67]
<i>Plantago major</i> L.	SD2015/15	Massassa ماساسا	Le	Ct/ Loc	Nd	Aff Derm	0.62	[69-82]
<i>Juglandaceae</i>								
<i>Juglans regia</i> L.	SA2015/08	Gouz الجوز	Br	Ct/ Loc	Nd	Aff Dental Inflammation	0.62	[29-65]
<i>Tamaricaceae</i>								
<i>Tamarix africana</i> Poir.	SC2015/06	Tanmacht تانماشت	Le	D/ Orl	1 Gl/ Dy	Dbt	0.62	[41]
<i>Gentianaceae</i>								
<i>Centaureium Erythraea</i> Rafn.	SC2015/22	Gassat lhaya/Rbiâ ssam غاست الحيا	Le	D/ Loc	1 Gl/ Dy	Aff Dig, Dbt	1.25	[10-79]
<i>Centaureium maritimum</i> (L.) Fritsch.	SC2015/04	Rbiâ ssam ربيع السم	Ap	Ct/ Loc	Nd	Venom	0.62	[69-78]
<i>Rosaceae</i>								
<i>Crataegus monogyna</i> Jacq.	SB2015/14	Zaâror زعرور	Ap	D	2 Gl/ Dy	Hypertension	2.5	[31-69]
<i>Apiaceae</i>								
<i>Ammoides pusilla</i> (Brot.)	SD2015/08	Nokha نوخا	Le	D	2 Gl/ Dy	Dental gum	0.62	[16]
<i>Selaginellaceae (Ptéridophytes)</i>								
<i>Pinus pinaster</i> aiton	SC2015/02	Tayda تايدا	Br	D	1 Gl/ Dy	Poisoning	0.62	[29-82]
<i>Selaginellaceae (Ptéridophytes)</i>								
<i>Selaginella</i> spp.	SD2015/16	Sanbel سنبل	Le	Mask	Nd	Alp	0.62	

Caption : Abd : Abdominal, Aff : Affection, Ct : Cataplasm, Sp: Spoon, D : Decoction, Derm : Dermatological, Dig : Digestive, Pn: Pain, Br: Bark, Le : Leaves, Fu : Frequency of use, Fr : Fruit, IF : Infusion, Infl : Inflorescence, Dy : Day, Neuro : Neurological, Ap : Aerial part, Pdr : Powder, R : Root, Resp : Respiratory, St: Stem, Gl : Glass, Vs : Against, Dbt : Diabetes, Inj: Injuries, Drh : Diarrhea. Rnl: Renal. Alp: Alopecia. Orl: Oral. Loc : Local. Nd : Not determined.

Dose used:

According to our investigation, we found that the majority of medicinal plants are used with non-specific doses. The dose is still random as manifested by adverse health effects because it says "No substance is poison itself, it is the dose that makes the poison." Indeed the dose used of medicinal plants can cause side effects such as liver necrosis in the plant genus *Origanum* spp., gas stomach level for *Calamintha sylvatica* and sleep for the plant *Ruta montana*. However, users of medicinal plants are not aware of the side effects of most medicinal plants.

Medicinal flora in bee virtues:

Our study also allowed us to take a census of medicinal plants with virtues mellifère, among them represent *Origanum* spp., *Mentha pulegium*, *Rosmarinus officinalis*, *Artemisia herba-alba*, *Ajuga iva*, *Mentha pulegium* and *Thymus zygis* which were identified as bee flora of the Pre-Rif of Taza by studies of Khabbach and its collaborators [71].

These species are the most sought for therapeutic applications in the local population, are also important for beekeeping, herbalists, and merchants.

Medicinal plants with special status:

All taken a census plants are of wild type, they are present in a unprompted way in the province of Taza; some of them were signaled as fast disappearing plants, such as *Origanum* spp. [Zaâtar], *Mentha pulegium* [Fliyo] and *Ajuga iva* [Chantgora], seen the high operating by riverians of the forest areas.

11.7 % of the taken a census flora have a particular status, we name here by being based on the work [71]: *Thymus zygis* sharing out of which is restricted to the West North of Africa and to the West South of the Iberian Peninsula, *Mentha suaveolens* which is a rare plant, *Calamintha sylvatica* is a very rare plant, *Origanum elongatum* which is an endemic kind of vulnerable Morocco and could become rare in the short term [12]; on top of that *Anthyllis cytisoides* which is taxon of Western Mediterranean Sea (Spain, Balears. France, Algeria and Morocco) (Ibn Tattou, 2001), which is rare and threatened, *Centaurium maritimum* and *Tanacetum annuum* which are very rare, *Urtica dioica* which is very rare [12], and *Euphorbia resinifera* which is an endemic Moroccan kind [77].

CONCLUSION

The traditional herbal medicine was and is being used by the population trusting popular uses and not having the means to withstand loads of modern medicine. This without forgetting the significant current return to alternative medicine.

In the province of Taza, there was a lack in data on medicinal plants used by the local population. Our study, the first report in this field, showed that Taza province has an important plant biodiversity that is exploited by the indigenous traditional healers. These traditional healers have knowledge that shares certain similarities with the traditional healers in other parts of the world, according to previous reports. However, some plants cited by the traditional healers and the local population have not yet been studied for their pharmacological effects, for example the species *Thymus manbyanus. ssp ciliatus* Bois & Rent. *Tanacetum annuum* L. *Fumana scoparia* Pomel. *Ziziphus zizyphus* H.Karst. *Clematis flammula* L. *Tamarix Africana* Poir. *Selaginella* spp. *Salvia verbenava* L.

This precious cultural heritage is a monograph must be experimentally validated by rigorous scientific protocols. The phytochemical and pharmacological studies are underway on plants in the province of Taza.

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