

Original Research Article

Ethnobotanical study of medicinal and aromatic plants used in the Al-Hoceima region (Northern Morocco)

ABSTRACT

Objective: An ethnobotanical study of medicinal and aromatic plants was conducted in the region of Al-Hoceima (Morocco) to contribute to the knowledge of medicinal species used in traditional phytotherapy by the local population.

Methodology: Using 100 questionnaire sheets, a series of ethnobotanical surveys were carried out in the field during April and May 2019 among ordinary users of the plants. The ethnobotanical survey was carried out using a probability (random) sampling method.

Results: The results of this study showed that foliage is the most used part (46%), and the majority of the remedies are prepared as an infusion (46%). Medicinal plants are often used to treat digestive diseases (19%), and 42% of these plants are cultivated.

Conclusion: The surveys carried out made it possible to assemble information on medicinal and aromatic plants (the part used and the method of preparation) and on the profile of the informant (sex, age, academic level). Moreover, this study could have a great bibliographical value for scientific research in the fields of phytochemistry and pharmacology.

Keywords: Al-Hoceima, Ethnobotanical study, Medicinal and aromatic plants, Phytotherapy.

1. INTRODUCTION

Throughout the ages, man has been able to rely on nature to provide for his basic needs: food, shelter, clothing and medical needs. The therapeutic use of the extraordinary virtues of plants for the treatment of all human diseases is very old and evolves with the history of humanity [1].

In recent years, we have begun to hear more phytotherapy and herbal care. According to the WHO, only 2,000 to 3,000 medicinal plants have been studied at the scientific level, although there are more than 20,000 used worldwide for their medicinal properties. Morocco, due to its biogeographical position, offers a very great ecological and floristic richness and diversity, thus constituting a real phylogenetic reserve, with about 4,500 species belonging to 940 genera and 135 families, including about 1/4 of endemic species, the mountainous regions of the Rif and the Atlas being the most important sectors in terms of endemism [2].

This biodiversity, characterized by very marked endemism [3], allows it to occupy a privileged place among the Mediterranean countries that have a long medical tradition and a recognized traditional knowledge based on medicinal plants [4].

Aromatic and medicinal plants represent a little exploited sector in Morocco despite the multitude of varieties that exist there. Nearly 600 species have medicinal and/or aromatic properties and only 80 species are currently exploited [5]. As a result, the number used industrially remains very small [6].

In Morocco, medicinal plants occupy an important place in traditional medicine and play a major role in the national economy [7]. Indeed, according to Scherrer *et al.* (2005) [4], Morocco is one of the Mediterranean countries with a long medical tradition and traditional knowledge based on medicinal plants.

The medicinal and aromatic plants sector in Morocco is an important asset for settlement and rural development. Several products are known on the international market as being typically Moroccan products. This means that the MAP operating profession in Morocco, despite its weaknesses, has succeeded in introducing several new products on the international market. However, this sector suffers from several economic, social, ecological and institutional constraints.

With this in mind, we focused on the study of medicinal and aromatic plants recorded or inventoried in the Al-Hoceima region (Table 1), intending to identify information on the use of medicinal and aromatic plants by the population of this region to contribute to the development of the natural potential of the Al-Hoceima region in the field of medicinal and aromatic plants.

Table 1. Example of medicinal and aromatic plants in the Al-Hoceima region

Scientific name	Family	Arabic name	Amazigh name
<i>Origanum vulgare</i>	Lamiaceae	الزعرتر	Zaatr
<i>Mentha pulegium</i>	Lamiaceae	النعناع	Naanaa
<i>Arbutus unedo</i>	Ericaceae	ساسنو	Ssassno
<i>Ceratonia siliqua</i>	Fabaceae	الخروب	Thabgha
<i>Lavandula</i>	Lamiaceae	الخزامة	Rakhzamath
<i>Dittrichia viscosa</i>	Asteraceae	عرق الطيون	Manssaniya
<i>Eucalyptus camaldulensis</i>	Myrtaceae	شجرة الكينا	Asafssaf
<i>Mentha suaveolens</i>	Lamiaceae	نعناع حلو الرائحة	Naanaa lfoh
<i>Opuntia ficus-indica</i>	Cactaceae	صبيير التين الهندي	Tahndith
<i>Laurus nobilis</i>	Lauraceae	الرند	Tawriqt nsidna moussa
<i>Malva sylvestris</i>	Malvaceae	خبازة برية	Rabqor
<i>Portulaca oleracea</i>	Portulacaceae	الرجلة	Amarmur
<i>Nerium oleander</i>	Apocynaceae	الدفلى	Arriri
<i>Quercus ilex</i>	Fagaceae	سنديان أخضر	L'Kerrouch
<i>Agave americana</i>	Agavaceae	الصبار الأمريكي	Achfer
<i>Carlina gummifera</i>	Asteraceae	شوك الحليب	Leddad

2. MATERIALS AND METHOD

2.1 PRESENTATION OF THE STUDY AREA

The ethnobotanical survey is carried out in the Al-Hoceima region, which has been chosen for its floral, ecological and climatic diversity and offers the local population a rich knowledge of traditional herbal medicine.

The city of Al-Hoceima is geographically located in the northern centre of Morocco on the Mediterranean coast, with an area of 3,550 km² characterized mainly by a slope ranging from 10% to 40% and 12,000 ha of plains. It is limited to the West by Chefchaouen and Taounate, to the East by Nador, to the South by Taza and to 120 km of Mediterranean coasts in the North [8]. Al-Hoceima is located in the Rif, a mountain range in Mediterranean Morocco. Its climate is Mediterranean: dry and moderately hot summers, rainy, snowy and cool winters.

Al-Hoceima and its province have about 300,000 inhabitants in the urban community. The population of this province has the particularity of tripling in the summer period, with the return of nationals living in Europe and seaside tourism [8].

The inhabitants of Al-Hoceima are the Hoceimi, a term rarely used in Morocco. The inhabitants are often identified by the term Ryafa in Arabic, a term that includes the inhabitants of the Rif region.

The province of Al-Hoceima **has composed** of five municipalities and four circles grouping 17 caïdats and 31 rural municipalities. Among these rural municipalities, the locality of Tamsamane was chosen in addition to the city of Al-Hoceima to conduct our survey.

Tamsamane is a locality located in the mountainous area of the Rif in northern Morocco between Nador and Al-Hoceima. The region is populated by several Berber communities that are part of the Rif cultural and linguistic space. To the west is the tribe of the Aït Ouriaghel, to the northeast is the tribe of the Aït Saaïd, to the east is the tribe of the Aït Oulichek, to the south is the tribe of the Aït Touzine, to the southeast is the tribe of the Tafersit, and the north is marked by the Mediterranean coast, its western part is bordered by the bay of Al-Hoceima.



Fig. 1. Location map of the study area.

2.2 DESCRIPTION OF THE SURVEY POPULATION

The ethnobotanical survey lasted through April and May 2019. To collect ethnobotanical data, a sample of 100 people was interviewed, 80 in the city of Al-Hoceima and 20 in the locality of Tamsamane. The respondents were questioned individually using a questionnaire form completed by oral questioning.

2.3 METHODOLOGY OF THE STUDY

The study method is based on 100 ethnobotanical questionnaire sheets submitted to the respondents during individual interviews, the dialogue was conducted in Amazigh or Arabic, depending on the case. The ethnobotanical survey form was completed with 100 people. This questionnaire covers subjects such as gender, age, academic level, family situation, profession and mode of use, local therapeutic and traditional applications of aromatic and medicinal plants in the Al-Hoceima region, the type of diseases treated by these plants...etc.

The data recorded on raw data sheets were transferred to a database and processed by the SPSS statistical processing software.

3. RESULTS AND DISCUSSION

Of the respondents, the majority, 30% use traditional medicine, 25% use modern medicine and 45% prefer to use a combination of herbal and modern medicine to treat themselves (Figure 2).

Several reasons can guide us towards the use of plants and their active ingredients to treat ourselves.

This choice can be explained by the limited means of subsistence. Often, access to modern medicine means going into town, as health infrastructures are non-existent or rudimentary in douar de Tamsamane. The costs incurred by this displacement may prove too expensive for the population, who are resigned to traditional treatment with the herbs at hand. Therefore, they

turn to modern medicine for very serious pathologies, while minor ailments are treated by traditional medicine (phytotherapy) [9].

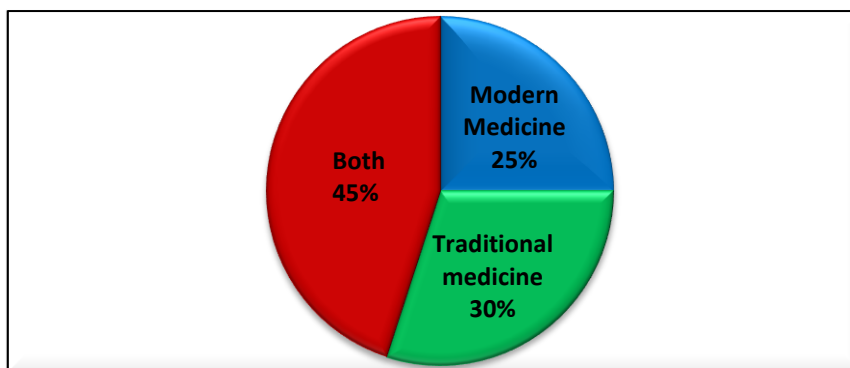


Fig. 2. The choice between traditional and modern medicine.

The survey results show that 70 per cent of women use MAP more than 30 per cent of the men surveyed (Figure 3). Indeed, plants have always been widely used by women because women have more knowledge about aromatic and medicinal plants than men, first as food sources, but also as materials, decorative objects and for their effects (toxic or beneficial) on one's health. These results confirm those of several ethnobotanical studies carried out on the national territory [10,11].

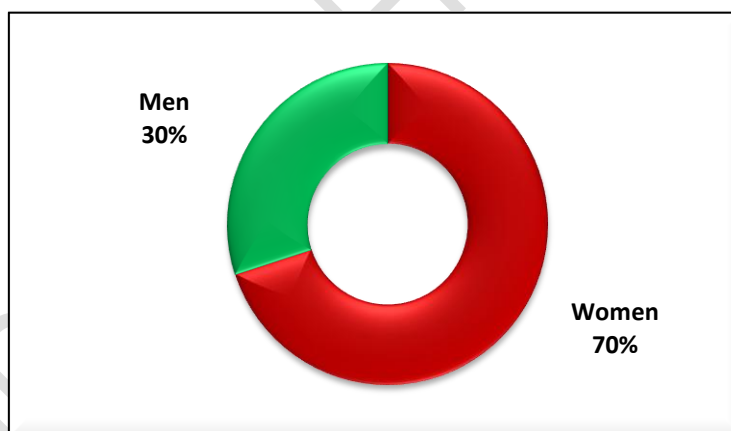


Fig. 3. Use of medicinal and aromatic plants according to sex.

Examination of the data shows that medicinal plants are used much more by married people (52%), while single people represent only 29%, 11% widowed and 8% divorced because they allow them to avoid or minimize the material burdens required by the doctor and the pharmacist (Figure 4).

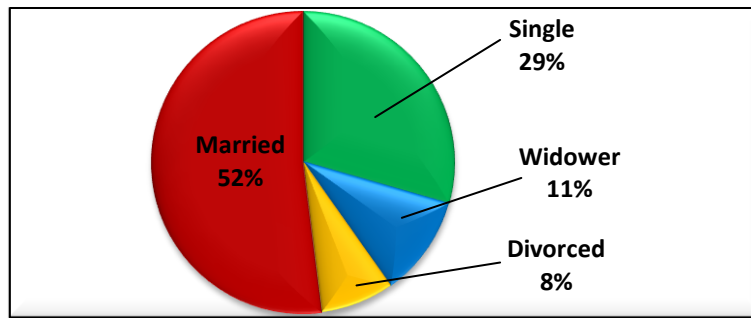


Fig. 4. Use of medicinal and aromatic plants according to the family situation.

The use of medicinal plants in the Al Hoceima and Tamsamane douars region is widespread among all age groups (Figure 5). The analysis shows that people aged 20-30 years and those >70 years are less likely to use plants, possibly due to distrust of traditional medicine [12]. From the age of 30 onwards, people are more likely to use those (13%) with a maximum for those in their forties at 18%. The use of medicinal and aromatic plants from the age of 50 is 27%, the use of plants by people over 60 is slightly lower (22%), with the next generations taking over.

It can only be noted that knowledge of the uses and properties of medicinal plants is generally acquired following a long experience accumulated and transmitted from one generation to the next. The transmission of this knowledge is currently in danger because it is not always assured. The results obtained do indeed show that people in the 50-60 age groups have more knowledge of medicinal plants compared to other age groups.

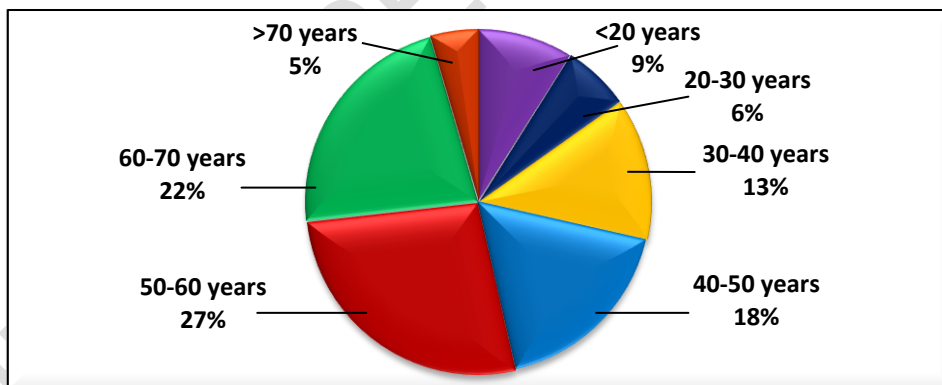


Fig. 5. Use of medicinal and aromatic plants according to age.

The analysis of the results obtained according to the respondents' level of education presented in Figure 6, shows that the vast majority of respondents are illiterate (67%), those with a secondary level represent 15%, while 10% have a primary level. In the end, the most striking result remains that of people with a university-level 8%, so we can see that the use of MAP decreases as the level of education increases.

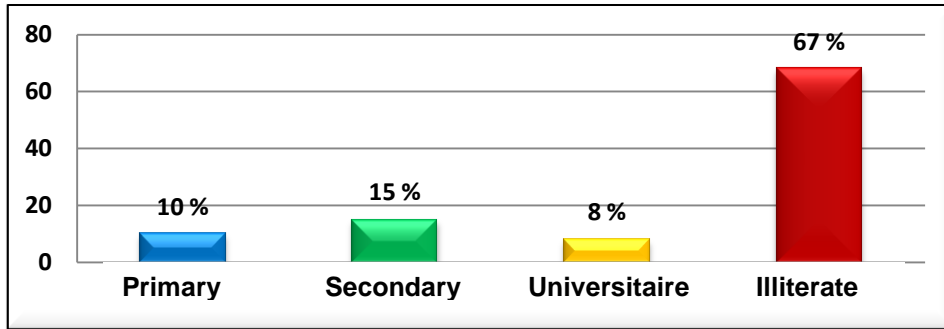


Fig. 6. Use of medicinal and aromatic plants according to the level of study.

This result was also obtained by other ethnobotanical studies revealing that the illiteracy rate was very high among plant users [13,14].

The majority of those interviewed were housewives and farmers (Figure 7).

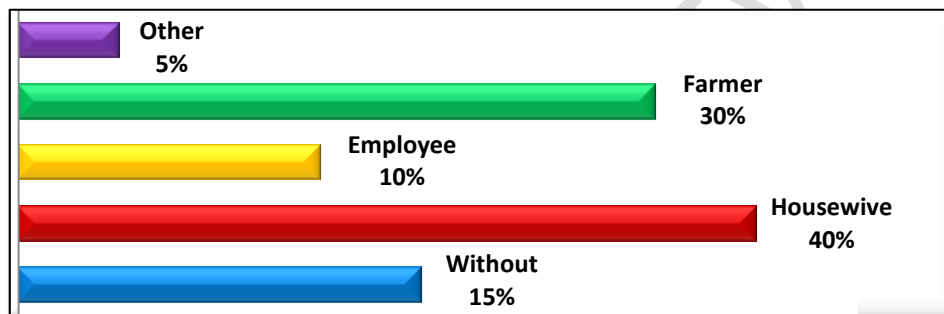


Fig. 7. Distribution of users of medicinal and aromatic plants according to their profession.

A main characteristic of plants is the great diversity of therapeutic uses that can be made of them. Each one of them (or almost) finds fields of application sometimes very different. Many are the fields in which phytotherapy is effective.

The survey also shows that it is the therapeutic side that takes precedence (39%), 31% in the food side and the use of plants at the expense of the cosmetic side 30% which is not very valued at all (Figure 8).

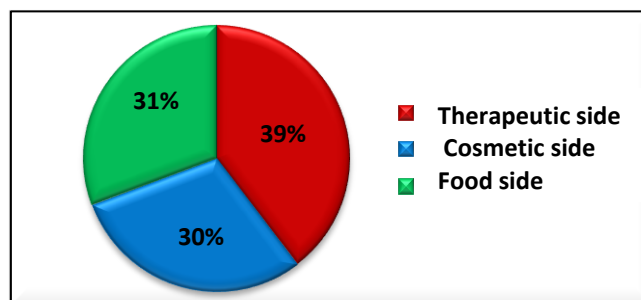


Figure 8. Field of use of medicinal and aromatic plants.

In the Al-Hoceima region, the study showed a diversity of species used in ethnobotany in the region. Either 18% prefer to use a combination of spontaneous and cultivated plants. Spontaneous plants are solicited by the population in phytotherapy at 40% against 42% of cultivated plants (Figure 9).

Recent studies in El Jadida (Doukkala region) have shown that 61% of medicinal plants used locally in phytotherapy are spontaneous and only 39% are cultivated [15]. Similarly, in the Taza region (Pre-Rif), the spontaneous medicinal species used locally amount to 60.8% while those imported correspond to 20.8% and those cultivated represent 19.4% [16].

The use of local medicinal species is motivated by several reasons: (i) the availability of medicinal plants (ii) proximity (iii) the existence of ancestral knowledge (iv) the speed of preparation of remedies (v) poverty (vi) the fact that the raw material is free (vii) the high cost of pharmaceutical products and (viii) the distance from hospitals [17].

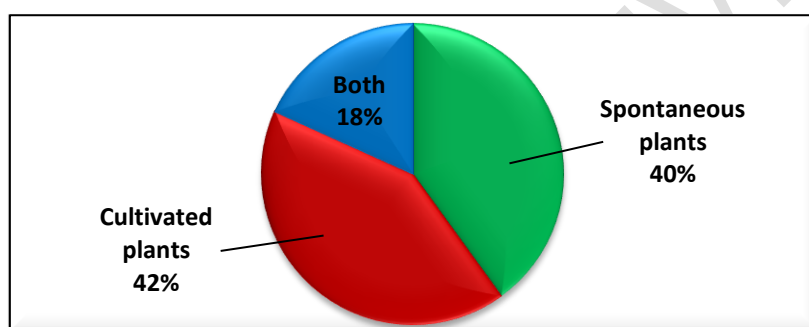


Fig. 9. The proportion of spontaneous and cultivated plants.

More than half of our medicines come from plants. They are at the origin of treatments commonly used to treat serious pathologies such as cancer, cardiovascular diseases, malaria, etc. Plants represent one of the most precious raw materials and an irreplaceable source of innovation.

A significant number of these plants are used as foodstuffs. The ethnobotanical survey shows that diseases of the digestive system are the most treated (19%) by medicinal plants (Figure 10). The same results were found by Tahri *et al.* (2012) [18] in the Province of Settât, Benlamdini *et al.* (2014) [19] in the Eastern High Atlas (Upper Moulouya), Slimani *et al.* (2016) [20] in the region of Zerhoun, El Alami and Chait (2017) [21] in the Central High Atlas, and Ghourri *et al.* (2012) [22] in the city of El Ouatia (Saharan Morocco). Next, come skin diseases (18%), genito-urinary diseases (14%), diseases of the circulatory system (11%), neurological diseases (9%), diseases of the respiratory system (8%), cardiovascular diseases (8%), diabetes (7%) and pyrexia diseases (6%).

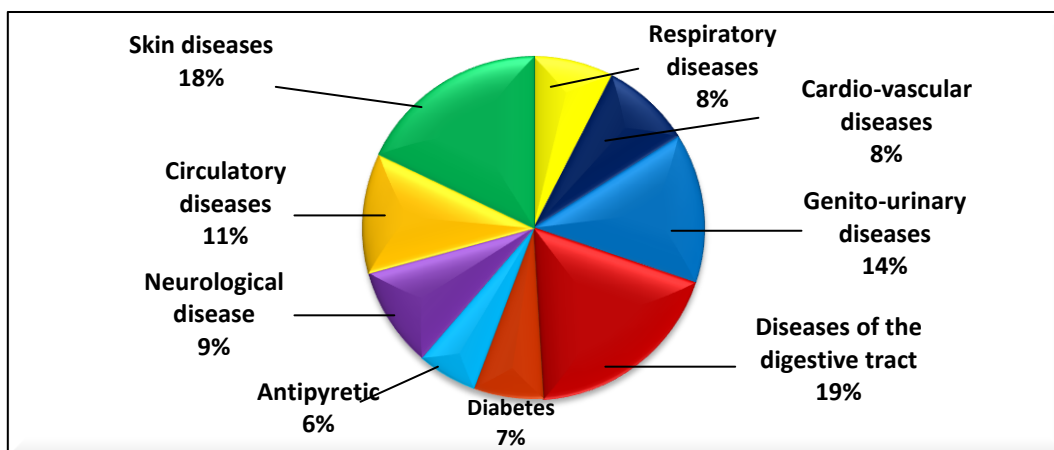


Fig. 10. Diseases treated by medicinal and aromatic plants.

It is known that medicinal plants **can** cure simple illnesses such as colds, flu, headaches and prevent others. When their restorative, tonic, sedative, revitalizing or immunological properties are added, the importance of medicinal plants in daily life becomes clearer [23].

The active ingredients can be located in different parts of medicinal plants (leaves, flowers, roots, bark, fruits, seeds, rhizome...). In the study area, the leaves are the most used parts at 46%. Following, in descending order, the stem-leaf association (26%), the flower represents barely 11%, the fruit 9%, while the rest: root, bark and seed are used at 8% (Figure 11). The use of leaves can be explained by the ease and speed of harvesting [24] and by the fact that they are the site of photosynthesis and sometimes storage of secondary metabolites, responsible for the biological properties of the plant [25].

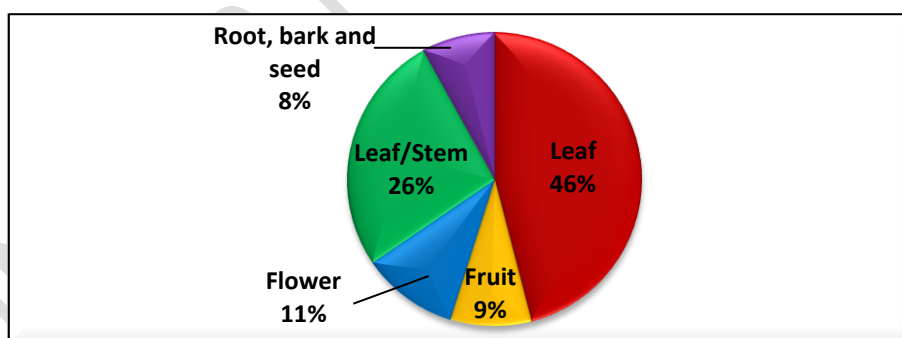


Fig. 11. Used parts of medicinal and aromatic plants.

In phytotherapy, the preparation of medicinal plants will be different according to the use that is intended: infusion, maceration, decoction and cataplasm.

Moreover, in the study we have started (Figure 12), it appears that infusion is the most used method of preparation representing 46%, followed by decoction 27%. Indeed, the roots generally require more energetic treatment to extract the active ingredients and reduce or

cancel the toxic effect and can thus be consumed within 48 hours [24]. Maceration at 18% and the cataplasms used with a rate of 9%.

Infusion is a priori the simplest method to use to prepare herbal medicines [13,26].

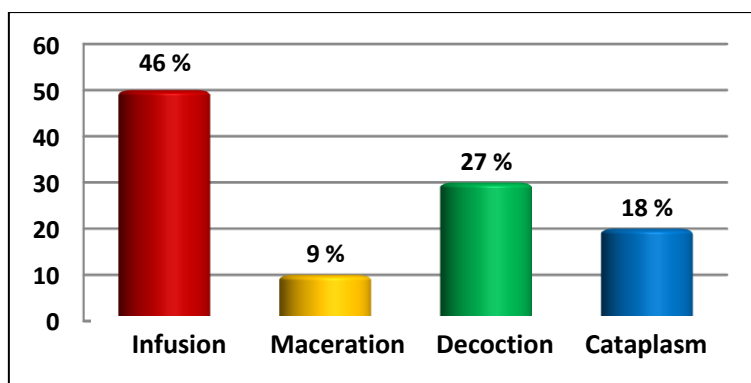


Fig. 12. Mode of preparation of the plants.

4. CONCLUSION

The domain of Al-Hoceima, with its abundant and varied flora, constitutes a reservoir rich enough in medicinal and aromatic plants that must be identified and standardized to enhance their therapeutic effects, among others.

This study has enabled us to show that traditional herbal medicine is still and always used by the inhabitants of the Al-Hoceima region, either out of necessity (lack of financial means or lack of sanitary infrastructures) or out of ancestral habit. This knowledge is transmitted orally from one generation to the next. However, the higher the level of education, the more patients turn to modern medicine. This will inevitably result, at some point, in the loss of this entire heritage if nothing is done to preserve it.

Our study is part of this perspective, it aimed to inventory the plants of the region, note the parts used for each one, their mode of preparation as well as the ailments treated. Thus, the results showed that leaves represent the most used parts with a rate of 46%. Infusion is the most common method of preparation. At the same time, we noted that digestive ailments are the most treated by traditional phytotherapy at 19%. Some of them are also used for cosmetic or dietary purposes.

The most used species are spontaneous. Inhabitants turn to natural plant remedies with the advantage of finding them at hand in nature. They use them according to traditional practices inherited from previous generations, believing that they have no side effects. Unfortunately, this is not always the case if they are administered in high doses.

We have found that younger generations are losing interest in plants out of mistrust or simply **lack interest**. In the long term, this can be detrimental to this part of our national heritage if nothing is done. Ethnobotanical studies should be carried out in all the regions of the kingdom **to** make an inventory of the plants, to record their uses with the elders and, why not, to try to integrate phytotherapy in the care as a complement to modern medicine. Also, it is very imperative to translate this traditional knowledge within the framework of **valorization** of the human and natural potential in particular by:

* Supervision and sensitization of the local populations in terms of production techniques, development and marketing of MAP.

* Support and technical assistance to the populations.

* The organization of the population into cooperatives and the training of young people, particularly women, in the importance and methods of developing the MAP.

* Knowledge of the real production potential and current uses of MAP through the integration of the sector in forest management studies.

CONSENT AND ETHICAL APPROVAL

It is not applicable.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

- [1] Gurib-Fakim A. Medicinal plants: Traditions of yesterday and drugs of tomorrow. *Mol Aspects Med.* 2006;27:1-93.
- [2] MATUHE (Ministry of Spatial Planning, Town Planning, Housing and the Environment - Department of the Environment). National Biodiversity Study, Synthesis Report. 2001;160 p. French.
- [3] Ghanmim Satrani B, Aberchane M, Ismaili MR, Aafi A, Elabid A. Aromatic and Medicinal Plants of Morocco, the miles and a virtue. Forest Research Center. Rabat, Morocco. 2011;130 p. French.
- [4] Scherrer AM, Motti R, Weckerle CS. Traditional plant use in the areas of Monte Vesole and Ascea, Cilento National Park (Campania, Southern Italy). *J Ethnopharmacol.* 2005;97:129-143.
- [5] APDN (Agency for the Promotion and Development of the North). The northern regions of Morocco. Territorial inventory. 2011. French.
- [6] Bourkhiss B, Ouhssine M, Hnach M, Amechrouq A. Phytochemical study of *Tetraclinis articulata* (Vahl) from Morocco. IInd International Symposium on Aromatic and

- Medicinal Plants, Marrakech, September 14-16, 2006 - SIPAM 2, 8pp. Cadi Ayyad University; Faculty of Sciences. Semlalia. French.
- [7] Bellakhder J. Medicinal plants in the Maghreb and basic care. Accurate of modern herbal medicine. Editions le Fennec. Casablanca, Morocco. 1997; 385 p. French.
- [8] HCP (HIGH COMMISSION OF THE PLAN). Al Hoceima Provincial Monograph. 2017. French.
- [9] Guedje NM, Ntungwen Fokunang C, Tafokou Jiofack RB, Fogou Dongmo R. Opportunities for sustained exploitation of medicinal plants in forest management. *International Journal of Biological and Chemical Sciences*. 2010;4 (4):1346-1372. French.
- [10] Rhattas M, Douira A, Zidane L. Ethnobotanical study of medicinal plants in Talassemtane National Park (Western Rif of Morocco). *J Appl Biosci*. 2016;97:9187-9211. French.
- [11] Daoudi A, Bammou M, Zarkani S, Slimani I, Ibijbijen J, Nassiri L. Ethnobotanical study of medicinal flora in the rural commune of Aguelmouss, province of Khenifra (Morocco). *Phytother*. 2016;14(4):220-228. French.
- [12] Mehdioui R, Kahouadji A. Ethnobotany study with the population living near the forest of Amsittène: case of the commune of Imi n'Tlit (province of Essaouira). *Bulletin of the Scientific Institute*. 2007;29:11-20. French.
- [13] Zaher A, Boufellous M, Jaber H, El Hartiti H, Barrahi M, Ouhssine M, Bourkhiss B. Ethnobotanical Study of Medicinal Plants Used in the Province of Sidi Slimane (Morocco). *J Biosci Med (Irvine)*. 2018;6:25-35.
- [14] Alaoui A, Laaribia S. Ethnobotanical and floristic study in the rural communes of Sehoul and Sidi Abderrazak (case of Maamora-Northern Morocco). *Algerian, Nature & Technology Journal*. 2017B(17):15-24. French.
- [15] El Abbouyi A, Filali-Ansari N, El Khyari S, Loukili H. Inventory of medicinal plants prescribed by traditional healers in El Jadida city and suburbs (Morocco). *International Journal of Green Pharmacy*. 2014;8(4):242-251.
- [16] Khabbach A, Libiad M, Ennabili A, Bousta D. Medicinal and cosmetic use of plants from the province of Taza, Northern Morocco. *Boletin Latinoamericano y del Caribe de Plantas Medicinales y Aromaticas*. 2012;11(1):46-60.
- [17] Bachar M, Zidane L, Rochdi A. Medicinal Plants and Traditional Phytotherapy used at the Bouhachem Regional Natural Park "Rif du Maroc" - case of the rural commune of Tazoute. *Journal of Materials and Environmental Science*. 2016;7(11):4175-4204. French.
- [18] Tahri N, El Basti A, Zidane L, Rochdi A, Douira A. Ethnobotanical study of medicinal plants in the Province of Settat (Morocco). Kastamonu Univ, *Journal of Forestry Faculty*. 2012;12(2):192-208. French.

- [19] Benlamdini N, Elhafian M, Rochdi A, Zidane L. Floristic and ethnobotanical study of the medicinal flora of the Eastern High Atlas (Haute Moulouya). *J Appl Biosci.* 2014;78:6771-6787. French.
- [20] Slimani I, Najem M, Belaidi R, Bachiri L, Bouiamrine EH, Nassiri L, Ibijbjen J. Ethnobotanical study of medicinal plants used in the region of Zerhoun -Morocco. *Int J Innov Appl Stud.* 2016;15(4):846-863. French.
- [21] El Alami A, Chait A. Ethnopharmacological and ethnobotanical survey on medicinal plants in the Central High Atlas of Morocco. *Algerian Journal of Natural Products.* 2017;5(1):427-445. French.
- [22] Ghourri M, Zidane L, El Yacoubi H, Rochdi A, Fadli M, Douira A. Floristic and ethnobotanical study of medicinal plants in the city of El Ouatia (Saharan Morocco). *Kastamonu Univ, Journal of Forestry Faculty.* 2012;12(2):218-235. French.
- [23] Benarous K. Effects of the extracts of some local medicinal plants on the enzymes alpha amylase, trypsin and lipase. End of studies dissertation with a view to obtaining the state engineer diploma in biology Option: Biological Engineering. Amar Telidji University, Laghouat, Algeria. 2006. 94p. French.
- [24] Salhi S, Fadli M, Zidane L, Douira A. Floristic and ethnobotanical studies of medicinal plants in the city of Kenitra (Morocco). *Lazaroa.* 2010;31:133-146. French.
- [25] Bigendako-Polygenis MJ, Lejoly J. Traditional pharmacopoeia in Burundi. Pesticides and drugs in animal health. *Near. Univ. Namur.* 1990; pp. 425-442. French.
- [26] Mikou K, Rachiq S, Jarrar Oulidi A. Ethnobotanical study of medicinal and aromatic plants used in the city of Fez in Morocco. *Phytother* 2016;14(1):35-43. French.

APPENDIX

Questionnaire sheet

- Informant:

- Function: Employee Farmer Housewife Without Other

- Age:

- Family status: Single Married Widower Divorced

- Sex: Men Female

- Academic level: Illiterate Primary Secondary Universitaire

Use of the plant	Therapeutic	
	Cosmetics	
	Food	
Part used	Flower	
	Leaf	
	Leaf/stem	
	Root, bark and seed	
	Fruit	
Mode of preparation	Cataplasm	
	Maceration	
	Infusion	
	Decoction	
Types of diseases	Respiratory diseases	
	Cardiovascular diseases	
	Genito-urinary diseases	
	Diseases of the digestive tract	
	Diabetes	
	Antipyretic	
	Neurological disease	
	Circulatory diseases	
	Skin diseases	
Choice between traditional and modern medicine	Traditional medicine	
	Modern medicine	
	Both	
Choice between spontaneous and cultivated plants	Spontaneous plants	
	Cultivated plants	
	Both	