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Research Article

A TAXONOMIC STUDY OF MEDICINAL PLANTS USED IN THE TREATMENT OF THE DIGESTIVE TRACT PATHOLOGIES IN TALASSEM-TANE'S NATIONAL PARK (WESTERN MOROCCO)

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ABSTRACT

An ethnobotanical study was followed up in order to set up a medicinal plants' catalog to be used in traditional phytotherapy against the digestive disorders in Talassem-tane National Park. According to a stratified sampling (10 administrative towns), and through the use of 930 questionnaires, we carried on a series of ethnobotanical field investigations during 2014. In order to collect all the information which concern, the one hand, the informant profile (sex, age, and level of studies), the treated symptoms, and on the other hand, the local phytotherapy (medicinal plants, treated ailments, method of preparation, form of employment and the used parts).

The obtained results made us able to list of 60 species distributed in 52 genera and 30 botanical families, which are used in soft medicine for the treatment of digestive ailments. The Apocynaceae, Asteraceae, Lamiaceae, Lauraceae, Myrtaceae and Polygonaceae are families which are mostly exploited in traditional phytotherapy. Among the species which are represented according to the percentage of citation, there is *Marrubium vulgare* (11.39%), *Matricaria chamomilla* (8.23%), *Lavandula stoechas* (5.06%), *Origanum grosii* and *Nerium oleander* (4.75% each), *Satureja grandiflora*, *Melissa officinalis* et *Laurus nobilis* (3.48% each), *Myrtus communis*, *Mentha pulegium* et *Eupatorium cannabinum* (3.16% each), *Calamintha officinalis*, *Cynara baetica*, *Rumex pulcheret* *Thymus zygis* (1.90% each). The latin vernacular and scientific names, the used parts of the plant, recipes, preparation methods of the ethno-medicinal use, as well as the phytotherapeutical actions are presented in a table. In addition, 55.70% of the surveyed women, regardless of their age, use the preparations of the therapeutical recipes on the basis of plants which are gathered from the park while men represent only 44.30%. Most of the interviewees reported that they practice soft medicine in order to treat the digestive system diseases thanks to its very low cost and also its therapeutical virtues which the medicinal plants represent.

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INTRODUCTION

Medicinal plants have long been the main source of medical care in many developing countries due to the absence of appropriate medical care (Tabuti *et al.*, 2003). Thanks to its biogeographic position, Morocco offers very wide ecosystem diversity reflected in floristic diversity. It is, therefore, considered as one of the Mediterranean countries whose populations have acquired the know-how in the use of medicinal plants (Scherrer *et al.*, 2005). Indeed, the Moroccan pharmacopoeia was developed and enriched by the knowledge provided by different ethnic groups who migrated to Morocco from different regions (Bellakhdar, 1997) and who made medicinal plants constitute a treasure trove of information for those deciding to approach their daily ailments differently and neglecting the chemical modern medicine (Hseini *et al.*, 2007). In Morocco, traditional medicine has become easily practiced by most users whether in urban or rural areas, and the

diagnosis of symptoms is mostly based on the phyto-therapeutic knowledge of herbalists or traditional healers themselves.

Medicinal plants and natural remedies in general have long been the principal and the only recourse to treat pathologies, as well as the raw material for modern medicine (Jean and Jiri, 1983). Several researchers have been carrying out studies to better understand the heritage of wildlife species used in traditional medicine. Their usage, their indications in various pathologies and their active principles has been studied for some twenty years (Djebaili, 1984, Bouattoura, 1988, Maizak *et al.*, 1993).

Within this perspective, the prospective and analytical ethnobotanical study on fresh medicine practiced by the population of the national park of Talassem-tane (Morocco's western Rif) aims at the transcription of the oral heritage in terms of the naturalist knowledge and the plant species

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inventory used traditionally in an ethno-pharmacological perspective against the diseases of the digestive tract. The scientific name, the vernacular name (s), the used parts, the local traditional uses of these species as well as the methods of preparation and the forms of administration of the remedies are reported in this study.

MATERIAL AND METHODS

Study area

Location

The National Park of Talassemtane covers an area of 58,950 ha, limited to the North by Tissikiste river, Amarhousse Douars, Arhiniame and Souk el Had and by Oued Kanar and Douars of Assimrane and Assifane to the East. Southward, the park is bounded by the trail linking Assifane to the main road 39 which is stretched till Bab Taza and it is bounded to the west by Douar Béni Zid, Aïn Tissimlane, Tarhzoute, Jbel Sidi Salah and Tamalout.

Administrative situation

The park straddles the two provinces of Chefchaouen (80% of its surface area) and Tetouan (20% of its surface area) including six rural communes belonging to Chefchaouen and four rural communes to Tetouan (Hmimsa, 2006).

Table 1 Administrative division of the National Park of Talassemtane (PDAPPNT, 2004).

Province	Cercle	Commune
Chefchaouen	Bab	Bab Taza
	Taza	Beni Derkoul
		Talembote
	Bou	Tassift
	Ahmed	Beni Selmane
Tétouan	Tétouan	Steha
		Al Ouad
		Al Hamra
		Bni Said
		Oulad Ali
		Mansour

The park territory corresponds to the southern portion of the the Rifian mountain chain, which includes the calcareous ridge, the Paleozoic zone (siliceous substrate, formed by schists) and the Tizighene nappes (being part of the ultra-rifian nappes formed by fine sand alternating with clayey shales). It is characterized by the high relief of **Jbel Lakrâa (2159 m)** and **Jbel Kelti (1926 m)** (Hmimsa, 2006).

Being located in the western Rif, the Talassemtane National Park has an original climate compared to other Moroccan mountains (Benabid, 1982):

- An oceanization and a general softening of the climate are translated into a reduction in the thermal deviations.
- An abundance of precipitation (rain and occult precipitation).
- A very clear contrast between the comparatively rainy Atlantic façade and the comparatively dry Mediterranean façade.

This geological and climatic diversification contributes to floristic differentiation, which gives birth to a species considered as endemic: the fir (*Abies maroccana*), and relict conifer of the Tertiary (Tarrier, 2007). They can be found in two large unique stands in the world: the fir trees of

Talassemtane (2,000 ha.), Tazaout (1,000 ha) and various scattered massifs.

Socio-economic environment

The local population is originally Amazigh of the Ghomara ethnic group although it has lost most of its original Tamazight language. It is unequally populated with the large central areas slightly inhabited and other areas with high population concentration. The population within this park is estimated at 20 000 inhabitants, with a density of 35 Hab. / Hectare (Hmimsa, 2006).

Epistemological Approach to Research

The surveys were conducted in 2014 by using questionnaires with a sample of randomly selected individuals representing the population of Talassemtane National Park in order to gather as much information as possible about the local knowledge and uses of medicinal plants. The interviews were based on a survey sheet developed to collect the informants' comments and establish the list of medicinal plants traditionally used for the treatment of the digestive tract diseases. The answers were given on the nature of the remedies used. Then, we botanically identified the collected herbarium according to the following works:

- The traditional Moroccan pharmacopoeia (Bellakhder, 1997).
- The Practical Flora of Morocco, Volume 1 and 2 (Fanane et al., 1999-2007);
- The New Flora of Algeria and the Southern Desert Regions, Volume I and II (Quezel et al., 1962);
- The Medicinal Plants and Aromatic Moroccan, Economic Feasibility Study to Invest in the Sector of Medicinal and aromatic Plants (Hmamouchi, 1999).

Ethnobotany study

The location of the different survey environments was identified by stratified sampling techniques (Daget and Godron, 1982, cited by Kahouadji, 1986). These techniques seemed suitable for carrying out the several ethnobotanical surveys from one area to another throughout the study. We sought to delimit and prospect the maximum points in the studied area. For attaining this purpose, a campaign of five field missions (April, May, June, July, August) of 5 consecutive days was scheduled during 2014, and 930 questionnaires were prepared and corrected. We equally conducted ethnobotanical surveys in the study area (Figure 2), which allowed us to collect two types of data: the data on the informant's profile (sex, age, and level of study) on the one hand, and the medicinal plants on the other (method of preparation, and the used part, and the treated diseases).

In order to collect as much information as possible about the traditional pharmacopoeia practiced in the Talassemtane national park, investigations were carried out in 10 communes and 28 villages.

Moreover, the Fidelity Level (FL), which is the informants' percentage citing the use of a given species to treat a disease, is calculated according to the formula adopted by Gueye et al. (2012).

$$FL (\%) = (I_p / I_u) \times 100$$

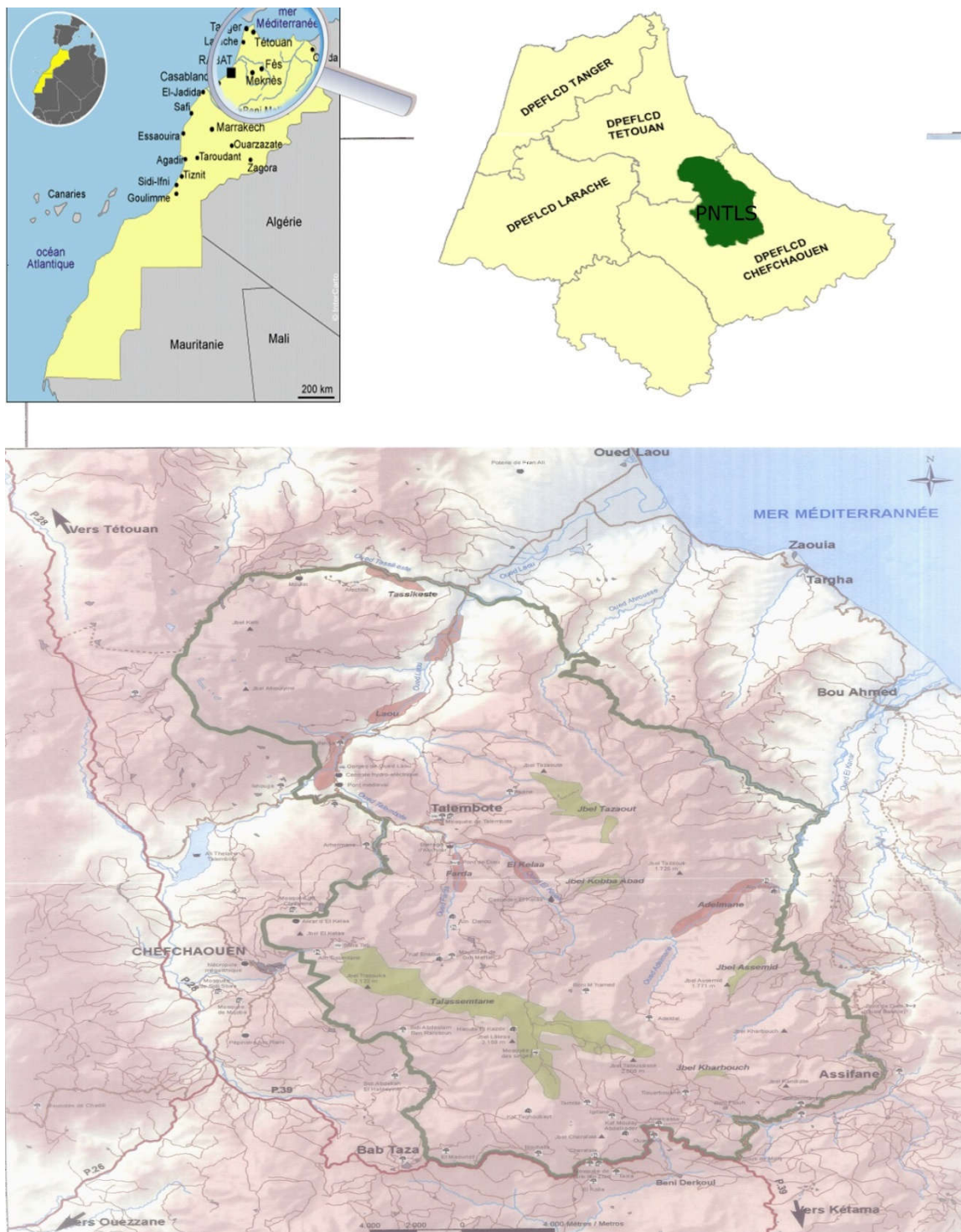


Figure 1 Talasemtane National Park boundaries (HCEFC, 2008)

With **Ip** as the number of informants who claimed the use of a given species to treat a disease, and **Iu** as the total number of informants interviewed.

Statistical analysis

The data collected during the ethnobotanical surveys were analyzed by using the computer software CRISTAL REAPORT V. 2010.

RESULTS AND DISCUSSION

The questionnaire sheet was adapted to collect the data concerning the locality, the informant, the practitioners of

digestive system and the used phytotherapy. The asked questions are semi-closed and aimed directly at the desired uses and their pharmacological effects (Bahassan *et al.*, 2014) for 37 disorders that look for the digestive tract in Talasemtane National Park (Table 2).

To understand the mechanisms and functioning of the digestive system, we must first define the process of digestion which consists in the transformation of food into elementary substances.

These substances constitute the energy sources and the raw materials for the manufacture, repair and control of the organism various systems. Digestion is therefore indispensable to life (Fiteau, 2011).

Moreover, the alteration of one of the constituent organs of the digestive system, will contribute to the abdominal disorder in humans. To combat these problems, several people have opted for the use of certain medicinal plants that promote the relief and remediation of affections that affect the digestive system. Indeed, in this study, there were 316 people who reported the practice of traditional herbal medicine in the treatment of digestive disorders.

These uses are categorized according to sex and age groups. Among the 176 of the surveyed women (55.70%), there is a predominance of practice of alternative medicine that varies according to age group 26.90% [20 to 39], 24.05% [40 to 59] and 4.75% [60 to 79]. In comparison, men, whose ages vary according to the rate of use of medicinal plants in traditional herbal medicine, represent only 140, ie 44.30%, with 23.73% of age group [20 to 39], 5.70% of age group [40 to 59] and 14.87% of age group [60 to 79]. Concerning the users of medicinal plants, they are rather 'illiterate' with 50.95%, whereas for the secondary level represents 14,24% and the 'university level' is 34,81%. It thus appears that the therapeutic uses to treat the digestive affections are rather feminine, regardless of the age range, and who are notably illiterate. According to Bahassan *et al.* (2014), it appears that people use more traditional herbal medicine with age, which shows that the cumulative knowledge (experiences and / or knowledge transmitted) on the therapeutic effects of plants eventually convince people of the virtue of plants to heal. The treatment of the digestive disorders is done in a traditional way among the rural population of the national park of Talassemtane. Harvesting is carried out manually without any knowledge of the precautions to be taken. According to an annual calendar, the harvest takes place between the month of April and August.

The plant species and the botanical families

The plant species inventoried are divided into 30 botanical families including 52 genera and 60 species of medicinal plants (Table 3), which are used by the population of Talassemtane National Park to treat the digestive tract diseases. According to this catalog, which has been developed to highlight the species for the therapeutic use against digestive diseases, it has been found that a species may have several vernacular names which differ from one zone to another. For example, *Marrubium vulgare* with two vernacular names (Tafergana and Mchistrou), is used most often as food for these therapeutic virtues by relieving pain, stimulates appetite, soothes digestive disorders, gas and bloating. *Matricaria chamomilla*, designated by Babounej-Amlal, is used as an edible plant in the culinary preparation of the region, as well as for its therapeutic virtues as it combats inflammations and gastric ulcers, intestinal spasms, cramps and bloating. However, the species *Satureja grandiflora* is recognized by two vernacular names, namely (Ztratra - tazouknit - mantha) and it is used as digestive food, calms stomach pains, dizziness and headaches associated with it. *Laurus nobilis*, called Waraka sidna mousa - El ghar, promotes digestion and reduces flatulence and stimulates appetite. *Melissa officinalis* (Rand and Tourenjan) helps with digestion, and also it is spasmodic (Hmamochi, 1999). Its infusion is considered everywhere as

stomachic, digestive and refreshing (Bellakhdar, 1997). *Myrtus communis* (Elhbak, Arayhan and Ass) is also used as a condimental and anti-diarrheal plant (Hmamochi, 1999). It stimulates the digestive organs and as an energetic astringent against diarrhea. However, *Lavandula stoechas*, with two vernacular names namely Halhal and Khouzama), is used to treat the nervous digestive discomfort and bloating.

These species are the most used in the field of gentle medicine in the region to fight the pathologies of the digestive system.

The most used botanical families in phytotherapy of the pathologies of the digestive system in the respondents are largely represented in the elaborate catalog. The Lamiaceae are found [10 genera; 15 species], Asteraceae [7; 8], Apocynaceae [1; 1], Fabaceae [3; 4], Polygonaceae [1; 2], Lauraceae [1; 1], Apiaceae [1; 2], and Myrtaceae [1; 1]. The percentage of the most frequently exploited species by the population is different according to the number of citation.

Moreover, the loyalty index made it possible to calculate the percentage of the plants frequently used by all the quotations. In our case, *Marrubium vulgare* is the most consumed species in the population, with (FL (%) = 11.39% and a citation number of 36 times); following *Matricaria chamomilla* which represents (FL (%) = 8.23% and a number of citations of 26 times). *Lavandula stoechas* (FL (%) = 5.06% with a citation number of 16 times). *Origanum grosii* and *Nerium oleander* (FL (%) = 4.75% each presented a number of citations of 15 times). These Five species are among the most exploited for their therapeutic virtues on the stomach and intestines. Six other species are moderately used (*Satureja grandiflora*, *Melissa officinalis* and *Laurus nobilis*), cited 11 times with 3.48% for each of these species, and *Myrtus communis*, *Mentha pulegium* and *Eupatorium cannabinum*, cited 10 times, each with 3.16%.

For the other species, their citation is relatively low, especially the species *Calamintha officinalis*, *Cynara baetica*, *Rumex pulcher* and *Thymus Zygis* which are cited only 6 times, with 1.90% each; and 19 other species (*Achillea millefolium*, *Anthyllis vulneraria*, *Arbutus unedo*, *Astragalus armatus*, *Atropa baetica*, *Borago officinalis*, *Eryngium bourgatii*, *Eryngium triquetrum*, *Fumaria macrosepala*, *Geranium maculatum*, *Juniperus oxycedrus* *Lythrum hyssopifolia*, *Olea europaea*, *Opuntia maxima*, *Origanum majorana*, *Ricinus communis*, curly dock, and *Salvia argentea* *Satureja alpina*), which are quoted only 5 times, with 1.58% each. However, other species, which are cited only once, represent the lowest category exploited in herbal medicine for the treatment of digestive disorders.

The limited use of these species in the treatment of digestive disorders is due to a lack of knowledge of the therapeutic capacity of these plants by the majority of respondents (Bahassan *et al.*, 2014).

The Used Parts and State of Use

The easiest part to exploit is the leaf, which alone accounts for 64.24% of the other parts of the plant, namely the root (8.54%), the flowering head (6.65%), fruits / seeds (6.33%), flower (3.16%), fruits / seeds / bark and fruits / leaves (2.22%).

Table 3 Medicinal Plants Catalog For Treating The Digestive System Pathologies In Talassemtane National Park

Family	Species	French Name	Vernacular name	%	used part	preparation method	phyto-therapeutic usage	References
Acanthaceae	<i>Acanthus mollis</i>	Acanthe à feuille molles (Acanthus Soft leaves)	El akneth	0,32%	Leaf (Fresh)	Infusion	treating diarrhea and having an aperitif property	
	<i>Eryngium bourgatii</i>	Panicaut	Ezourayka - chouka zarka	1,58%	Root (Fresh)	Cooked	anti-inflammatory agents (1), Roots are edible and used as vegetables	(1) Wang et al., (2012).
Apiaceae	<i>Eryngium triquetrum</i>			1,58%	Root (dried)	Decoction	The root, in decoction, is used against intestinal pain and cooling (2). It is given to children against tonsillitis (3). A recipe based on <i>Thymus broussonetii</i> , <i>Herniaria hirsuta</i> (Harast lhjar) <i>Ammodaucus leucotrichus</i> (Kamoun reg), <i>Anastatica hierochuntica</i> (Kemcha), <i>Rosmarinus officinalis</i> (Lyazir) <i>Petroselinum sativum</i> (Ma'dnous) <i>Opuntia ficus-indica</i> (Nowar Aknari) , <i>Zea mays</i> (Hrirkbal) and <i>Eryngium triquetrum</i> (Zriyga), in decoction, is administered against lithiasis (4)	(2) Lahsissene et al. (2009) (3) Bellakhdar (1997) (4) Ghourri et al. (2013)
Apocynaceae	<i>Nerium oleander</i>	Laurier rose (Pink laurel)	Dafla	4,75%	Leaves (dried) (Fresh)	Poultice	According to the interviewees, the leaves are used against colic, abundant gases with bad odor, flatulence sometimes accompanied by fecal matter (5)	(5) http://www.homeophyto.com/oleander
Aristolochiaceae	<i>Aristolochia longa (ou Baetica)</i>	Aristolochie d'Afrique (Aristolochia African)	Berztem	0,32%	Racine (Fraiche)	Decoction	Digestive disorder (root) (6), used against bowel disease, acute intoxications (7)	(6) Hmamouchi (1999) (7) Lhsissene et al., (2009)
Asparagaceae	<i>Ruscus aculeatus</i>	Petit Houx (Petit Holly)	El ass Bari	0,32%	Leaves (Fresh)	Maceration	It decreases constipation (laxative properties) (8)	(8) http://www.doctissimo.fr/html/sante/phytotherapie/plante-medicinale/fragon.htm (7) Hmamouchi (1999)
Asteraceae	<i>Achillea millefolium</i>	verveine de rocher (verbena of rock)	Louiza lehjar	1,58%	Leaves (dried)	Infusion	Antispasmodic (7) the population stated that they use it against intestinal colic in children. It stimulates appetite, relieves digestive disorders, spasms of the stomach and intestines (8). Antispasmodic and decongestant: <i>Achillea millefolium</i> relieves digestive disorders, but also menstrual pains. Peptic: helps digestion and cures dyspepsia. Emmenagogue: the plant stimulates the blood flow of the pelvic region and the uterus (9)	(9) http://www.doctissimo.fr/html/sante/phytotherapie/plante-medicinale/achillee-millefeuille.htm
	<i>Artemisia herba alba</i>	armoise blanche (Arthritis white)	chih	0,32%	Leaves (Dried)	Decoction	Gastritis and gastralgia, gastroduodenal ulcer, dyspepsia, intestinal colic, spasm, helminthiasis, diarrhea (10); Indicated in cases of intestinal worms, gastric pains, effective in the cases of intestinal bloating, pyrosis and aerophagia (11)	(10) Hmamouchi (1999) (11) El Haji (1995)
	<i>Calendula officinalis</i>	Soussi ou calendule (Soussi or calendula)	Zahra Okehouan	0,32%	Leaves, flower (Dried)	Infusion	Digestive disorders: relieves gastric inflammations (12), ulcers, gastritis, colitis.	(12) http://www.doctissimo.fr/html/sante/phytotherapie/plante-medicinale/calendula-souci-officinal.htm
Asteraceae	<i>Carduus nutans</i>	Chardon penché (Throated Thistle)	Quouque El bari	0,32%	Leaves (Dried)	Infusion	Purifies blood; Used as diuretics, aperitifs	
	<i>Centaurea clementei</i>	Centauree	El kantouryoune	0,32%	Leaves (Dried)	Infusion	Fever; Stimulant digestive thanks to apéritives and febrifuges. Tonic of the liver and bile; Calming; Diuretic, sedative digestive, vermifuge, depurative. (13)	(13) Hmamouchi (1999)
	<i>Cynara baetica</i>	Cardon	Quouque baldi - El quanarya Kharchouf	1,90%	leaves, bracts, capitulated (dried) (Fresh)	Cooked	According to interviewees, it is used in food since it facilitates digestion and reduces bloating	
	<i>Eupatorium cannabinum</i>	<i>Eupatoire chanvrine (hemp toothpaste)</i>	<i>El Kahra</i>	3,16%	Leaves, Stems (Fresh)	Maceration	It is reputed to treat chills due to summer heat, nausea and gastrointestinal disorders. (14)	(14) https://fr.wikipedia.org/wiki/Eupatoire_%C3%A0_feuilles_de_chanvre#cite_note-15
	<i>Matricaria chamomilla</i>	<i>Camomille</i>	<i>Babounej-Amlal</i>	8,23%	Leaves (dried) (Fresh)	Infusion/maceration	stomach inflammation and ulcers, intestinal spasms, cramps and bloating (15)	(15) http://www.doctissimo.fr/html/sante/phytotherapie/plante-medicinale/matricaire-camomille-allemande.htm

Boraginaceae	<i>Anchusa Azurea ou Italica</i>	Buglosse bleue ou d'Italie (Blue or Italian Bugloss)		0,32%	Whole plant (Fraiche)	Decoction / Cataplasm	According to the local population, this plant is used as a diet to facilitate digestion.
	<i>Borago officinalis</i>	Bourrache officinale	El hricha - Lsan toure	1,58%	Leaves, aerial part (Fraiche)	Cooked	Diuretic and nutritional (16). It has a laxative effect: constipation treatment (17)
Cactaceae	<i>Opuntia maxima</i>	Figuier d'Inde; Cactus (Fig tree of India; Cactus)	Handia - Karmous Nsara	1,58%	Fruits, Seeds (Fraiche)	Crude	nutritional, anti diarrhea, antispasmodic, diuretic, (16) (17) http://www.doctissimo.fr/html/sante/phytotherapie/plante-medicinale/bourrache.htm
Cannabaceae	<i>Cannabis sativa</i>	Chanvre cultivé (Hemp cultivated)	Kif	0,32%	leaves and seed (Fraiche)	Infusion	Promotes appetite (resin and seeds); Functional colopathy, irritable bowel syndrome (especially the leaves); Combat nausea and vomiting; Balances the intestinal flora; Stomach pain, colic; Diarrhea, constipation (regulation of transit); Heartburn, gastric reflux; Menstrual pains, painful periods (association spirulina) (18) (18) http://mr-ginseng.com/cannabis/
Cupressaceae	<i>Juniperus communis</i>	Genévrier commun (Common Juniper)	Elarâr - Amzi	0,32%	Leaves (Fraiche)	Infusion	It relieves pain in the digestive system. Gastralgic, hiccups, diuretics, (19) (19) Hmamouchi (1999) (20) http://www.doctissimo.fr/html/sante/phytotherapie/plante-medicinale/genevrier.htm
	<i>Juniperus oxycedrus</i>	Genévrier oxycédre	El arâar - el gadi	1,58%	Leaves (Dried)	Infusion	Digestive tonic and aperitif, stimulates the stomach and promotes the elimination of gases. (20) (21) http://www.passeportsante.net/fr/Solutions/HuilesEssentielles/Fiche.aspx?doc=huile-essentielle-cade
Ericaceae	<i>Arbutus unedo</i>	Arbousier (Arbutus)	Bakhenou - El matroun - Sastou	1,58%	Fruits, Leaves (Fraiche)	Raw / decoction	Tonic digestive and Intestinal antispasmodic, arbutus is recommended to treat diarrhea and digestive spasms. (22) It is used against diarrhea. Decoction of leaves is also useful against nephritic colic (23) (22) http://www.doctissimo.fr/html/sante/phytotherapie/plante-medicinale/arbousier.htm (23) http://medecine.savoir.fr/arbousier-arbutus-unedo-l-proprietes-medicinales/
Euphorbiaceae	<i>Ricinus communis</i>	Ricin	El kharwaâ - Ouryour	1,58%	Roots (Dried)	Maceration	Castor oil forms a special category in the world of stimulant laxatives because it contains no anthranoids. It owes its purgative activity to a fatty acid, ricinoleic acid, which forms sodium salts. Medical authorities recognize its effectiveness in treating constipation on an ad hoc basis. (24) (24) http://www.passeportsante.net/fr/Maux/Problemes/Fiche.aspx?doc=constipation-pm-approches-complementaires
	<i>Anthyllis vulneraria</i>	Anthyllide vulnérable triolet, trèfle jaune des sables, thé des Alpes, (Anthyllid Vulnerable Triolet, Yellow Clover of the Sands, Tea of the Alps)	Enafla	1,58%	Roots (Fraiche)	Decoction / Infusion	Castor oil has long been used as a purgative; its laxative effect is powerful. Conversely, Ricinus is used to treat all abundant diarrheas. Digestive sphere: diarrhea very abundant, painless with dehydration. Hepatic colic. (25) (25) http://www.passeportsante.net/fr/Solutions/MedicamentsHomeopathiques/Fiche.aspx?doc=medicament-homeopathique-ricinus
Fabaceae	<i>Astragalus armatus</i>	<i>Astragale</i>	<i>Chouk El guedad</i>	1,58%	Roots (Fraiche)	Maceration	Astragalus also has remarkable virtues for digestion. It reduces acidity in the stomach and therefore promotes better waste disposal. Astragalus is beneficial for people with stomach ulcers or acid problems. (27) (27) http://www.mr-plantes.com/2014/10/astragale/
	<i>Cassia acutifolia</i>	Séné, Séné d'inde (Sena, Senna of India)	Sena bida	0,32%	Fruits, Leaves (Fraiche)	Crude	According to the testimony of the local population, this plant Stimulates intestinal transit as a powerful laxative: constipation, digestive disorders. Promotes loose fecals and to lose weight. So it is a laxative and purgative plant (24) (28) Hmamouchi (1999)
	<i>Ceratonia siliqua</i>	Caroubier (Carob tree)	El kharoub	0,32%	Fruits, Leaves (Fraiche)	Crude	Anti diarrheal, gastrointestinal affection, laxative (28)

Gentianaceae	<i>Centaurium erythraea</i>	petite centaurée (small cornflower)	Rbiâa elhaya / Nouara elhaya	0,32%	Leaves (Fresh)	Crude	Aperitif, gastralgic, stomachic, laxative, digestive, cholagogue, vermifuge; Febrifuge, anemia, (28) It is a plant of disorders and intestinal diseases whose priority is to remedy the dysenteries and diarrhea. It calms stomach aches and treats irritable bowel syndrome, it is a treatment of peptic ulcers, ulcerative colitis and inflammations of the mucous membranes especially in cases of hemorrhoids. It is also said to be very beneficial in Crohn's disease (chronic inflammatory bowel disease). (29)	(29) http://www.complements-alimentaires.co/geranium-american/
Geraniaceae	<i>Geranium maculatum</i>	géranium sauvage (wild geranium)	Mrirou (Bâali)	1,58%	The root, aerial parts	Essential oil		
Iridaceae	<i>Crocus sativus</i>	Safran cultivé (Saffron cultivated)	Safran Beldi	0,32%	Stigma (Fresh)	Infusion	To remedy stomach upset (29) Metabolic disorder; Treatment of menstrual pain. Tonic, digestive and hepatic (30)	(29) http://www.ventebulbesafran.com/#!bulbes/c21r (30) http://www.doctissimo.fr/html/sante/phytotherapie/plante-medicinale/safran.htm
	<i>Calamintha officinalis</i>	Calament	Mentha	1,90%	Leaves (Fraiche)	Infusion	Diuretic, anti-inflammatory, emmenagogue, stomachic, digestive (31) treats digestive disorders; Such as dyspepsia, flatulence, stomach ulcers, gastritis and aerophagia (32)	(31) Hmamouchi (1999) (32) http://www.mrplantes.com/2010/11/calament-calamintha-officinalis/
	<i>Lavandula dentata</i>	Lavande à feuille dentées (Lavender with toothed leaves)	Halhal = Khouzama	0,32%	Leaves (Fraiche)	Infusion	It is used in popular medicine to cure stomach and kidney ailments. (33) Digestive disorders: difficult digestion due to stress or nervousness, ulcerations. (34)	(33) López <i>et al.</i> , (2007) (34) http://www.doctissimo.fr/html/sante/phytotherapie/plante-medicinale/lavande.htm
	<i>Lavandula stoechas</i>	Lavande (Lavender)	Halhal = Khouzama	5,06%	Flowering summers	Maceration	Treat nervous digestive discomfort, bloating and, in balneotherapy, traffic disorders (35)	(35) http://www.passeportsante.net/fr/Solutions/PlantesSupplements/Fiche.aspx?doc=lavande_ps
	<i>Marrubium fontianum</i>	Marrube	El mariwa	0,32%	Leaves (Fresh)	Infusion	relieves pain; Stimulates appetite, soothes digestive disorders, gas and bloating (36)	(36) http://www.doctissimo.fr/html/sante/phytotherapie/plante-medicinale/marrube-blanc.htm
	<i>Marrubium vulgare</i>	Marrube blanc ou Marrube Commun (Marrubium white or Marrube Common)	Tafergana=Mchistrou	11,39%	Leaves (Dried) (Fresh)	Infusion	Gastric mucous membranes; Relieves pain; Stimulates appetite, soothes digestive disorders, gas and bloating (37). Food, intestinal spasm (38) helps digestion. Spasmodic (39)	(37) http://www.doctissimo.fr/html/sante/phytotherapie/plante-medicinale/marrube-blanc.htm (38) Hmamouchi (1999)
Lamiaceae	<i>Melissa officinalis</i>	Melissa	Rand/ Tourenjan	3,48%	Leaves (Dried)	Infusion / raw	Its infusion is considered everywhere as stomachic, digestive and refreshing. (40)	(39) Hmamouchi (1999) (40) Bellakhdar (1997)
	<i>Mentha pulegium</i>	Menthe pouliot	Flayou Sakoui/Bâali	3,16%	Leaves (Fresh)	Infusion	Food, gastric, antispasmodic, stomachic (39)	
	<i>Origanum grosii</i>	origon compact/sauvaeg (origon compact/sauvaeg)	Zaâtar	4,75%	Leaves, Flowered Head (Dried)	Infusion	Stomach dilation, aerophagia, stomach pain, lack of appetite, constipation, intestinal parasites, gastric and biliary disorders, diarrhea (39)	
	<i>Origanum majorana</i>	Marjolen origano (Marjolen origano)	la menthe citronnée (lemon mint)	1,58%	Leaves (Fresh)	Infusion	It is used much as calming, antispasmodic intestinal. (41) And according to the local population it is used as a condiment to relieve the stomach and help digestion	(41) Bellakhdar (1997)
	<i>Rosmarinus officinalis</i>	Romarin (Rosemary)	Azir	0,32%	Leaves (Dried)	Infusion	Leaf infusion is used as aperitif, cholagogue and stomachic. (41) And according to the local population it is used to promote digestion, and to treat indigestion	

	<i>Salvia argentea</i>	Sauge argentée (Silver sage)	El kouissa	1,58% Leaves (Dried)	Infusion	Dyspepsia by gastrointestinal atony, slow digestions, inappetence, Diarrhea (tuberculosis and infants). (42)	(41) Bellakhdar (1997)
	<i>Salvia officinalis</i>	La sauge (Sage)	Salmia	0,32% Leaves (Fresh)	Infusion	Sage facilitates gastric digestion. It also helps to treat vomiting, diarrhea and abdominal pain. (43) it is also considered as cholagogue and anti dyspeptic (41)	(42) http://www.matemius.fr/articles/medecine-hermetique/sauge.html (43) http://www.doctissimo.fr/html/sante/phytotherapie/plante-medicinale/sauge.htm
Lamiaceae	<i>Satureja alpina</i>	Sarriette (Savory)	Zâaytra - Tazouknit	1,58% Leaves (Dried)	Infusion	Used against gastrointestinal pain (41)	(44) http://www.doctissimo.fr/html/sante/phytotherapie/plante-medicinale/calament.htm
	<i>Satureja grandiflora</i>	Calaminthe	Zîtra - tazouknit - mantha	3,48% Leaves (Dried)	Cooked	And according to the local population it is used against the digestive affections, condiment	(44) http://www.doctissimo.fr/html/sante/phytotherapie/plante-medicinale/calament.htm
	<i>Thymus Zygis</i>	Thym (Thyme)	Zîtra - tazouknit - mantha	1,90% Leaves (Dried) (Fresh)	Infusion	Eupeptic: Calcium promotes digestion, calms stomach pains, dizziness and headaches associated with it (44)	(45) Hmamouchi (1999)
Lauraceae	<i>Laurus nobilis</i>	Laurier sauce	Waraka sidna mousa - El ghar	3,48% Leaves (Dried)	Cooked	Stomachic, diuretic, antispasmodic, intestinal antiseptic, (45)	(46) http://www.doctissimo.fr/html/sante/phytotherapie/plante-medicinale/laurier.htm
Lythraceae	<i>Lythrum hyssopifolia</i>	Lythrum	Rayhan elmaa – sabon elmaa	1,58% Flowers (Fresh)	Infusion	it is condimental and aromatic. It promote digestion, stimulates appetite, promotes digestion and reduces flatulence (46)	(47) http://www.doctissimo.fr/html/sante/phytotherapie/plante-medicinale/lythrum.htm (47) Anonyme, (2009)
Myrsinaceae	<i>Anagallis arvensis</i>	Le mouron rouge (Red chickweed)	Anagallis	0,32% Leaves (Fresh)	Infusion	Antidiarrhea. (47)	(48) http://www.homeophyto.com/anagallis-arvensis/
Myrtaceae	<i>Myrtus communis</i>	Myrte commum (Myrtle commum)	Elhbak=Arayhan-Ass	3,16% Leaf and flowers (dried) (Fresh)	Cooked	In anthroposophic medicine, its action on the digestive is remarkable, notably on the components stress and pain. This medication is part of formulas for liver drainage. (48)	(49) Hmamouchi (1999) (50) http://www.complements-alimentaires.co/myrte/
Oleaceae	<i>Olea europaea</i>	olivier sauvage (wild olive)	Zaytouna Bari	1,58% Fruits, Seeds, Bark (Fresh)	Maceration	Condiment and anti diarrhea (49)	(49) Hmamouchi (1999) (50) http://www.complements-alimentaires.co/myrte/
Paeoniaceae	<i>Paeonia coriacea</i>	Pivoine sauvage (Wild peony)	El fawanya – Ouard zouan	0,32% Leaves (Fresh)	Decoction / Infusion	Food, constipation, purgative, laxative, intestinal occlusion, gastric burns, biliary stones; Nephrotic colic (49)	(49) Hmamouchi (1999)
	<i>Fumaria macrosepala</i>	Fumeterre	Debaba	1,58% flowered aerial part (Fresh)	Nebulizer, Syrup, mother tincture, Powder, Dry extract	It relieves gastrointestinal spasms (49)	(49) Hmamouchi (1999) (51) http://www.doctissimo.fr/html/sante/phytotherapie/plante-medicinale/fumeterre.htm (52) http://www.mr-plantes.com/2010/08/fumeterre-fumaria-officinalis/ (53) http://www.complements-alimentaires.co/fumeterre/
Papaveraceae	<i>Papaver setigerum</i>	Poppy de Troie ou Nain Bread seed Poppy (Poppy of Troy or Nain Bread seed Poppy)	El khachkhach	0,32% Leaves (Fresh)	Maceration	Depurative (essentially digestive), aperitif, tonic, stomachic and choleric.	(51) http://www.doctissimo.fr/html/sante/phytotherapie/plante-medicinale/fumeterre.htm (52) http://www.mr-plantes.com/2010/08/fumeterre-fumaria-officinalis/ (53) http://www.complements-alimentaires.co/fumeterre/
	<i>Papaver setigerum</i>	Poppy de Troie ou Nain Bread seed Poppy (Poppy of Troy or Nain Bread seed Poppy)	El khachkhach	0,32% Leaves (Fresh)	Maceration	Antispasmodic: digestive and dermatological spheres. Amphocholeeretic: regulation of the production of bile (51). It promotes the proper functioning of the gall bladder and eliminates any material liable to obstruct the vessels in the liver. It can act as a laxative and it also acts on the intestine and promotes intestinal transit, relieves and treats digestive disorders (52). It also treats constipations, painful biliary spasms, difficult digestion, and nausea (53).	(54) http://www.complements-alimentaires.co/pavot/
Pinaceae	<i>Abies maroccana</i>	Sapin du Maroc (Morocco Fir)	Chouh Marocain – Sanawbar	0,32% Leaves (Fresh)	Infusion	Nutritional and Anti diarrhea: The parégoric elixir (with poppy extract) remains used against diarrhea (54)	(55) http://www.doctissimo.fr/html/sante/phytotherapie/plante-medicinale/sapin.htm
	<i>Abies maroccana</i>	Sapin du Maroc (Morocco Fir)	Chouh Marocain – Sanawbar	0,32% Leaves (Fresh)	Infusion	Antispasmodic: Fir treats gastric and abdominal pain, as well as aerophagia. (55)	(55) http://www.doctissimo.fr/html/sante/phytotherapie/plante-medicinale/sapin.htm

Polygonaceae	<i>Rumex crispus</i>	Oseille (sorrel)	El hamad - Hmida - Tasemoumt	1,58%	Fruits, Seeds (Dried)	Raw/ cooked	According to the testimony of the local population, this plant promotes digestion, hence the use in bread preparation. it is also used to treat constipation, ailments or problems that can be treated with <i>Rumex crispus</i> : Diarrhea (56).	(56) http://www.passeportsante.net/fr/Solutions/MedicamentsHomeopathiques/Fiche.aspx?doc=medicament-homeopathique-rumex-crispus
	<i>Rumex pulcher</i>			1,90%	Fruits, Seeds, Roots (Dried) (Fresh)	Raw/ cooked /Infusion	According to the testimony of the local population, this plant is used in culinary preparation for its aperitif action. It is laxative, cholagogue, anti-anemic. It also cleanses the liver and intestines (57)	(57) http://naturealpha.skyrock.com/3245006374-Patience-violon-Rumex-pulcher.html
Saxifragaceae	<i>Saxifraga tri-crenata</i>	Saxifrage	Kaser Lahjer	0,32%	Fruits, Seeds, Barks (Fresh)	Raw	This medicinal plant stimulates the digestive system, effectively eliminating unwanted fat. It also has beneficial effects on the various disorders related to digestion. Its active ingredients also act on other organs, including the stomach, liver and bladder, facilitating the evacuation of various toxins and urine. (58)	(58) http://www.mr-plantes.com/2011/04/saxifrage-saxifraga/
Solanaceae	<i>Atropa baetica</i>	Belladone bétique	Bleydour	1,58%	Fruits, Seeds, (Fraiche)	Raw/ Decoction	In small doses, it treats dizziness, Colitis, nausea, etc. (59)	(59) Lombardo et al., 2009
	<i>Atropa belladonna</i>	Belladone	Bleydour	0,32%	Leaves / seed (Fresh)	Infusion	Belladone extracts are used to treat various gastrointestinal disorders. The combination of extracts of belladonna and opium is particularly useful to combat diarrhea and some visceral pain (60)	(60) http://saintesante.com/traitements/phytotherapie/plantes-psychotropes/atropa-belladonna.html
Urticaceae	<i>Urtica membranacea</i>	Ortie (Nettle)	El hourika el malsaa	0,32%	Leaves / seed (Fresh)	Raw/ cooked / infusion	According to the testimony of the local population, this plant cured anemia and diarrhea	
Verbenaceae	<i>Verbena officinalis</i>	verveine officinale, verveine commune, verveine sauvage, herbe sacrée, herbe aux enchantements, herbe aux sorciers, herbe de sang (verbena officinale, common verbena, wild verbena, sacred grass, enchanting grass, sorcerer's grass, blood grass)	Elouiza	0,32%	Leaves/ Floral summit (Fresh)	Decoction / Cataplasma / Infusion	Action on the digestive system: digestions Difficulty, stomach ache, diarrhea (61). It eliminates sleep, bowel and digestive disorders (62) a verbena (sacred herb) is aperitif and digestive; it combats vertigo, migraines and somnolences due to poor digestion. It is used mainly to facilitate digestion. Both aperitif and digestive, it stimulates the stomach to be secreted and thus struggles against vertigo and migraines, headaches and drowsiness resulting from poor digestion. (63) indigestion; Intestinal parasites; Digestive disorders following pest control; Liver trouble with nausea; Headache; depression; Intestinal irritation syndrome with stool mucus; asthma; Sensations of oppression; Gastric, intestinal or menstrual cramps (64)	(61) http://www.doctissimo.fr/html/sante/phytotherapie/plante-medicinale/verveine.htm (62) http://www.mr-plantes.com/2010/12/verveine-officinale-verbena-officinalis/ (63) http://www.complements-alimentaires.co/verveine-officinale/ (64) http://robin.arma.perso.neuf.fr/cariboost_files/zzplantesmedicinales.pdf . P:322.

It is found that the leaf is the most used part compared to the other parts mentioned above. This can be explained by the ease of the harvest but also and above all by the fact that this organ carries out photosynthesis which favors the biosynthesis and sometimes the storage of secondary metabolites, hence, the concentration of active ingredients in this organ (Bahassan *et al.*, 2014).

However, plant conservation techniques are in most cases, drying in the shade without washing for regular and permanent use. While the underground parts are cleared of soil and rinsed before being dried in the sun or in an oven for a period of two to three days before being dried in the shade. There are also plants that are eaten fresh.

It is clear that freshly consumed organs are more biodegradable, non-preservative and unsuitable for consumption, inefficient or toxic due to the degradation of chemical molecules (Bahassan *et al.*, 2014).

Methods of preparation, administration and dosage

The use of medicinal plants in the fresh or dry state depends on the techniques of preparation and the mode of administration for the treatment of diseases of the digestive tract. Concerning the methods of preparation, the infusion (44.30%), maceration (15.19%), boiling (13.61%), raw (7.91%) and poultice (4.75%) are the most common methods of preparation region.

According to the medical encyclopedia AUZOU, 2015, the mode of use also conditions efficiency; the art of galenics, that of transforming the plant or its active part into a remedy, has resulted in very varied forms. The most common and ancient example is herbal tea, which may result from an infusion, a decoction or a maceration, depending on the time the plant takes in boiling water or not.

However, the mode of preparation of the therapeutic dosages requires certain vigilance on the part of the users because there are plants which represent certain toxicity in the event of fusion with other plants.

Concerning the mode of administration and the dosage of medicinal plants exploited in the study area, they are mostly oral since any type of dosage preparation is intended to remedy the digestive disorders. Thus, the doses prescribed for taking these recipes are measured by spoon (38.61%) or by a cup (31.65%) in order to be sure of the effectiveness of the remedies and also not to be subject to the dangers of poisoning.

Moreover, the harmful effects of fresh medicine are not due to the plants themselves, but to the misuse and the dose taking, which will lead to poisoning, and also to the ignorance of the active ingredients that can contain a plant and the method of preparation of receipts. There are times when it is advisable not to amalgamate between two plants because of its active substances, as there is also the need to merge between several species to achieve an effective recipe.

Phyto-therapeutic action

The 37 disorders affecting the digestive system were reported 316 times in the total of the questionnaires. The treatment of these diseases, according to their pre-eminence, depends on the effectiveness of the medicinal plants used by the local population. The diseases are ranked in a decreasing way from the percentage of citations:

- Gastric mucosa, disgust, digestive disorders, gas and bloating, intestinal spasm, 11.39% of which 36 plants are used for therapeutic purposes;
- Plants that treat inflammations and gastric ulcers, intestinal spasms, cramps and bloating represent, 8.23% of which 26 plants are used for this purpose;
- For the treatment of nervous digestive discomfort and bloating, 5.06% corresponding to the use of 16 plants;
- For species that treat colic, abundant gas, flatulence, stomach expansion, flatulence, stomach pain, poor appetite, constipation, intestinal parasites, gastric and biliary disorders and diarrhea, 4.75% corresponding to the use of 15 plants for each disease;
- Plants that are condimental and aromatic, promote digestion, stimulate appetite, and reduce flatulence, have a spasmodic and stomachic effect, 3.48% corresponding to the use of 11 plants for each disease;
- The exploited plants used to treat the digestive and the gastric disorders, antispasmodic, anti-diarrheal, stimulate the digestive organs and treat nausea and gastrointestinal disorders, 3.16% including 10 medicinal plants are used;
- As for plants that are antiseptic intestinal, aid digestion, reduce bloating, treat digestive disorders such as dyspepsia and flatulence, stomach ulcers, gastritis, and flatulence, and have a laxative effect, Cholagogue, antianemic, 1.90% corresponding to the use of 6 plants for each disease.

From these results, most of the symptoms are related to the stomach that is part of the abdomen, also consisting of other organs such as the intestine, liver, pancreas, vesicle and genital system; but our study is limited to the treatment of symptoms related to the digestive systems.

According to the medical encyclopedia AUZOU (2015), the symptoms are numerous: pain, burning, eructations (rôt), hiccups, vomiting, nausea, bloating. In fact, all these symptoms can be caused by a condition of any part of the intestine. The stomach is therefore often the first incriminated with the liver.

CONCLUSION

This study showed that there is diversity in medicinal species in the Talassemiane national park, exploited in traditional herbal medicine for the treatment of the digestive system. It resulted in showing us that among the 930 respondents, 316 people declared that they use medicinal plants to fight the digestive ailments, including the intestinal spasms, colic, stomach dilatation, aerophagia, pain stomach, lack of appetite, constipation, intestinal parasites, gastric and biliary disorders, diarrhea, flatulence, stomach disorders, dyspepsia, stomach ulcers, gastritis, visceral pain, bloating. Therapeutic recipes are always prepared by women, often illiterate.

The results also show that the medicinal flora includes 60 plant species distributed in 52 genera and 30 families, with the dominance of 8 families, namely Apiaceae, Apocynaceae, Asteraceae, Fabaceae, Lamiaceae, Lauraceae, Myrtaceae, Polygonaceae. The most widely used species against digestive diseases are: *Nerium oleander* (Apocynaceae), *Matricaria chamomilla*, *Cynara baetica*, *Eupatorium cannabinum* (Asteraceae). Others are used for therapeutic purposes: the case of *Marrubium vulgare*, *Lavandula stoechas*, *Origanum*

Grosii, Satureja grandiflora, Melissa officinalis, Mentha pulegium, Calamintha officinalis, Thymus zygis of the family Lamiaceae, *Laurus nobilis*, of the Lauraceae family; *Myrtus communis*, of the family Myrtaceae and *Rumex pulcher* of the family Polygonaceae.

Once the plant is picked, the most exploited part in the treatment of the digestive affections is the leaf as it is easy to pick. The most common mode and route of administration in this region is oral infusion while the dosage is done by spoon to avoid the uncertainty of the efficacy of the plants used for therapeutic purposes.

The catalog mentions the plants which have a physiological effect on the abdomen, and also which can be studied for better handling. Indeed, this study is the result of an exploration on the place, to extract subtle answers concerning the therapeutic uses for the treatment of the digestive affections.

The abuse of these natural resources will lead to their destruction in the future; therefore, we must advocate our efforts to preserve this natural and living heritage.

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