Ethnopharmacological and Ethnobotanical study of Medicinal plants in the High Atlas Central, Morocco

الدراسة الإيثنوفرمكولوجية والإثنوبولوجية للنباتات الطبية في الأطلس المتوسط الكبير للمغرب.

Souad Belhaj, Jamila Dahmani, Nadia Belahbib, Lahcen Zidane

Databases and Inventoiries

Abstract

Background: This ethnobotanical and ethnopharmacological study was conducted in the High Atlas Central of Morocco. Its aim is to promote the use of medicinal plants through the realisation of an inventory of these plants and their therapeutic uses in this region.

Methods: The ethnopharmacological surveys conducted in the field from 2015 to 2017 have allowed filling 1192 questionnaires. Information was collected by an ethnobotanical and a floristic survey with using open-ended and semi-structured interviews. Data were analyzed using ANOVA and Student's t test; Quantitative ethnobotanical indices such as Fidelity Level (FL), Relative Citation Frequency (RCF) Frequency (F), and Family Importance Value (FIV) were also used to compare data. The medicinal plants were collected, identified and kept at the Biodiversity and Natural Resources Laboratory, Ibn Tofail University, Kenitra.

Results: The study identified a total of 248 medicinal plants used by the local population. They belong to 70 families from which the leading family was Asteraceae, represented by 30 species. Most of these species are used to treat gastrointestinal diseases such as *Thymus broussonetii* Boiss, *Ceratonia siliqua* L. and diabetic diseases such as Anthemis nobilis L., *Euphorbia resinifera* Berg. These diseases are mainly cured using leaves of the plants cited. The predominant preparation method is decoction.

Conclusions: This study showed that indigenous people in the High Atlas Central use the plants recorded for the treatment of various diseases. This wealth of plants for therapeutic uses is accompanied by knowledge and practices in phytotherapy acquired by the inhabitants of the High Atlas Central over the centuries. This study keeps a transcribed

Correspondence

Souad Belhaj[1*], Jamila Dahmani[2], Nadia Belahbib[2], Lahcen Zidane[1]

[1]Department of Biology, UFR: Biodiversity and Natural Resources Laboratory, IbnTofail University, PB 133, 14000, Kenitra Faculty of Science, Morocco
[2]Department of Biology, Botanical, Biotechnology and Plant Protection Laboratory, IbnTofail University, PB 13314000, Kenitra Faculty of Science, Morocco

[*]Corresponding Author:
souadbelhaj2050@gmail.com

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trace of phytotherapy practices. The achieved results are a precious source of ethnomedicinal knowledge that allows the shifting of the researches towards phytochemistry and pharmacology.

Key words: Ethnomedicinal, Therapeutic uses, Medicinal plants, Biodiversity.

ملخص:

المقدمة: أجريت هذه الدراسة الإيثنوفرمكولوجية والإ ثنوبولوجية للنباتات الطبية في الأطلس المتوسط الكبيرللمغرب,والتي تهدف إلى تثمين هذه النباتات وذلك من
خلال جردها وتحديد استخداماتها العلاجية من قبل السكان المحليين لهذه المنطقة .

الأساليب: مكنت هذه الدراسة من ملء 1192 استمارة معلوماتية تظم دراسات استقصائية إثنوبولوجية ونباتية, أجريت في منطقة البحث, بين سنتي 2015 و 2017, وذلك بإجراء مقابلات مفتوحة وشبه منظمة ,وقد تم تحليل ومقارنة البيانات باستخدام (اختبار أنوفا واختبار ط ، حيث يكون الاختبار مهمًا عندما تكون القيمة ـ بـ ـ (ب ≥ 0.05)) و باستخدام مؤشرات نباتية إثنية كمية مثل قيمة استخدام الأسرة (ق.ا.أ) ، والتكرار النسبي للاستشهاد (ت.ن.ا)، ومستوى الإخلاص (م.إ). ليتم جمع النباتات الطبية ,تسميتها وحفظها في مختبر الموارد الطبيعية والتنوع البيولوجي ، جامعة ابن طفيل ، القنيطرة.

النتائج: مكنت هذه الدراسة من تحديد ما مجموعه 248 نوعا من النباتات الطبيةالمستخدمة من طرف السكان المحليين. حيت تنتمي هذه النباتات إلى 70 عائلة نباتية ,أكثرها تمثيلًا هي فصيلة النجميات ب 30 نوعًا,و يتم استخدام معظم هذه الأنواع لعلاج أمراض الجهاز الهضمي ,مثل تيميس بروسونتي و سيراطونيا سيليكا ,وأمراض السكري ,مثل أنتيميس نوبليس و أوفوربيا غيسينيفورا.ويعتبرالنقيع أكثرالطرق استعمالا لإعداد الوصفات, بينما تعد الأوراق الجزء الرئيسي المستخدم في العلاجات.

الاستنتاجات: أظهرت هذه الدراسة أن السكان المحليين في الأطلس المتوسط الكبيريستخدمون 248 نوعًا نباتيًا لعلاج مختلف الأمراض, هذه الثروة المعرفية مرتبطة بممارسات العلاج بالنباتات التي اكتسبها سكان هذه المناطق على مر القرون. و تعتبر النتائج المحصل عليها بمثابة مصدر غني من المعلومات, قد يمكن من معرفة النباتات الطبية وتوجيه الدراسات الكيميائية النباتية والدوائية.

الكلمات المفاتيح: الطب الإثني ، الاستخدامات العلاجية ، النباتات الطبية ، التنوع البيولوجي ؛

Introduction

Morocco is a geographical crossroad where several types of bio climates coexist and where the rainfall is irregular, which stimulates the development of a varied flora with a quite high rate of plant endemism within the Mediterranean region (Bellakhdar 2006). Therefore, the natural Moroccan ecosystem contains 4200 vascular plant species. Among these, 382 taxa (9% of the overall flora in Morocco) are exploited for therapeutic, medicinal and aromatic purposes and are classified as aromatic and medicinal plants (Aafi *et al*. 2005). In Morocco, at least 600 plants are used in phytotherapy (Rejdali 1996), and numerous ethnobotanical studies have been conducted in several regions of Morocco (Bammi & Douira 2002, Benlamdini *et al*. 2014, Chaachouay *et el*. 2019, El Yahyaoui *et al*. 2015, Hseini & Kahhouadji 2007, Salhi *et al*. 2010).

Besides this promising natural context, Morocco has an ancestral knowledge of herbal medicines, the use of plants for flavoring and preserving some food, as well as the extraction of aromatic principles...

The High Atlas central of Morocco offers a bioclimatic variety, and a distinctly unique geography which is characterized by an altitude gradient (plain, piedmont and mountains) that permits the installation of a rich flora. Despite the richness in plant biodiversity l data about the plants of this region is scarce and fragmentary (El Alami & Chait 2017, El Alami *et al*. 2016). Ethnobotany and ethnopharmacology examine indigenous people's knowledge of the use of plants manage or cure diseases. Therefore it is important to keep up a written record of all phytotherapy practices, whose transmission to futures generations, hitherto, is based on oral tradition. We present the results of the floristic study, ethnopharmacological and ethnobotany of medicinal plants used by local populations, as well as the study of the therapeutic diversity, the methods of preparation and use of plants, this work also records the list of all diseases treated.

Materials and Methods

Study area

Due to geographical position and its climate, the High Atlas Central of Morocco offers a tremendous ecological and floristic diversity. In addition, the indigenous population of the region has wide traditional phytotherapeutic knowledge. The study was conducted in the center of the atlas chain of Azilal North, Ouarzazate, and Tinghir South, in the High Central (Fig 1).

The communes of Tannant, Wawla, Ait Tamlil, Aït Majden, Aït M'hamed, Zaouiat Ahansal, Tabant, Aït abbas, Aït blal, Sidi-boulkhalef, Tifni, Tidli-Fetouaka, Ouzoud, Aït Bou Oulli, belonging to the city of Azilal which is geographically located in the center of the Kingdom and belongs to the economic region of Beni Mellal-Khenifra, which was born from the 2015 regional division of the three former regions: Meknes-Tafilalet, Chaouia-Ouardigha and Tadla-Azilal (Official Gazette, 2015). It covers an area of about 1 million hectares, all mountainous, with the exception of a tiny part of the Tadla plain.

Administratively, the Béni Mellal-Khenifra region comprises five provinces: Azilal, Béni Mellal, Fquih Ben Salah, Khenifra and Khouribga, 135 communes including 16 municipalities and 119 rural Communes (HCP, 2018).

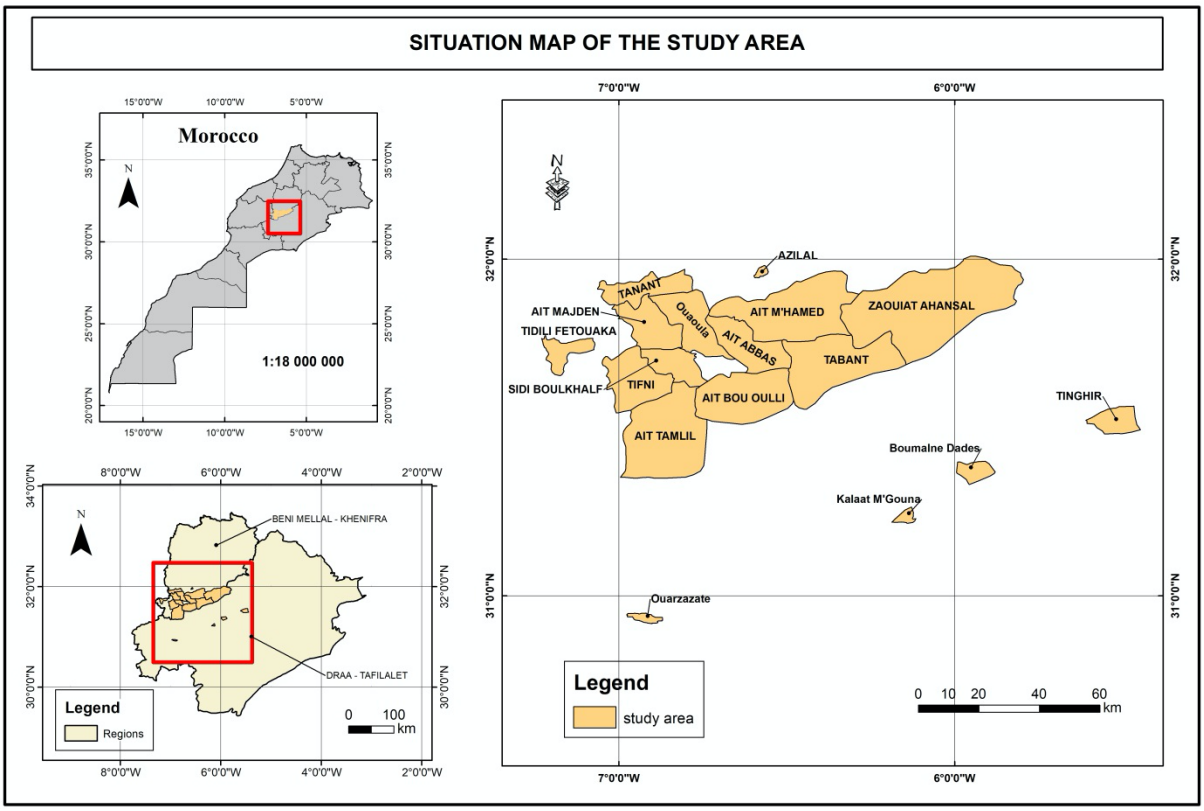

Figure 1:.Map situation of the study area: High Central Atlas (Realized by Belhaj according to the administrative division of 2015, Arcgis 10.3)

About 80% of the surface area of the Province is located at an altitude of more than 1000 m and 60% above 1500 m (Taibi *et al.* 1995).

The climate is generally Mediterranean and spreads over the four seasons. It is characterized by abundant rainfall during winter and spring and a very severe summer drought (Sauvage & Vindt1952, Ouchbani & Romane1995).

Geologically, the area of the province extends over nearly one million hectares and covers a large part of the high limestone Atlas of the secondary age (Pique 1994). Its population is 2520776 inhabitants, of which 1282037 are rural populations according to the national census of the population 2014 (HCP, 2018), which explains the high illiteracy rate, which is 52%. The main plant formations in the area are as follows: The Holm oaks, which occupy an area of 205,000 Ha or 57.59% of total forest area of the province followed by Junipers with 18.15%, while Maritime Pine is only represented by 0.29% and secondary species by 10.46%, although planted forests occupy 9149 ha or 2.61%.

In the southern slope, this work was carried out in the provinces of Tinghir, Ouarzazate belonging to the Draa-Tafilalet region, which was established like the 11 other regions of the Kingdom, in accordance with Decree of 20 February, 2015, and published in Official Bulletin No: 6340 of 05 March, 2015 (Bulletin officiel, 2015). It covers an area of 88,836 km: With a total area of 1,112,460 ha, the province of Ouarzazate is bordered to the north by the province of Azilal and Marrakech, to the east by the province of Tinghir, to the south by the province of Tata and Zagora and to the west by the province of Taroudant. It belongs to the arid bioclimatic zone with a continental tendency; the soils of this zone are 75% clayey-silt soils, with little evolution of alluvial inputs at 20% and skeletal inputs at 5 % (HCP, 2018).

Special crops in the province occupy small areas but still provide a substantial income for producer. This includes saffron, which occupies 85 hectares with an average annual production of 215 Kg (HCP, 2018).

-With a total area of 908,960 ha, Tinghir province is bordered to the north by the province of Azilal, to the east by the province of Errachidia, to the south and west by the province of Ouarzazate, it includes 2 circles, namely Tinghir, and Boumalne, 3 municipalities (Tinghir, Kelaa M'gouna and Boumalne Dadés) and 17 rural commons. It belongs to the arid bioclimatic stage with a continental tendency. The Total population of the province of Tinghir is 229666 inhabitants of whom 168,084 (73.19%) are rural. The soils of the two sub-basins, Todgha and Dades-Mgoun, are in most cases alluvial, undeveloped, deep, silty-sandy and sandy. These soils are 75% iso humic, 20% alluvial and 5% skeletal (HCP, 2018). Special crops in the province occupy small areas but still provide a substantial income to producers, particularly perfume roses, which have produced an average of 2743 tons over the past five years (HCP, 2018).

Data collection tools and procedures

Twosurveys (ethnopharmacological and floristic) were carried out in the study area usingsemi-structured questionnaires, personal inteviews and focus group discussion following the method of Martin (2004).

The field surveys were conducted between 2015 and 2017, by using 1192 questionnaires (Appendix A) administered to 824 residents and sellers of medicinal plants (herbalists and druggists) in the high central atlas of Morocco, the herbalists are a credible source of information, because they have a long expertise regarding the flora and fauna which helps gathering more information on these plants and how they are used.Field trips were also made to observe and collect the plant species, together with information about the vernacular names of the medicinal plants used in the area, types of treated diseases, parts of the plant used, methods of preparation and administration. Standard method was followed with regard to collection of plant materials, drying, mounting, preparation and preservation of plant specimens (Jain 1964). The taxonomic identification of these plants was done in the field and at the Laboratory of Biodiversity and Natural Resources (LBNR) Faculty of Science, Ibn Tofail University, and using available herbaria, directories and flora (Emberger & Maire, Year, Fennane *et al.* 1999, Fennane & Ibn Tattou 2005, Quezel & Santa 1962, 1963, Sauvage & Vindt1952). The identified plants were deposited in herbaria and reserved in our laboratory (LBNR).

Data analysis

The results obtained were analyzed using the descriptive and quantitative statistical method to compare the means between interviewed groups (ANOVA test and Student T test, The test is significant when ($P \leq 0.05$); using the level of fidelity (FL), Frequency (F), Relative Citation Frequency (RFC) and Family Importance Value (FIV). All statistical analyses were performed using SPSS (version 21) and Microsoft Excel Package 2010.

Fidelity Level (FL)

Fidelity level (FL) index is used to indicate the plant species more ideal for the treatment of specific ailment (Musa *et al.* 2011).The FL index was calculated using the formula of Friedman *et al.* (1986): FL (%) = Np / N x 100. Where Np
Is the number of informants that claim a use of a plant species to treat a particular disease, and N is the number of informants that use the plants as a medicine to treat any given disease.

Relative Frequency of Citation (RFC) and Frequency (F)

Relative frequency of citation (RFC) is a quantitative method that demonstrates the relative importance of plant species known locally, was also evaluated according to the formula of Vitalini *et al.* (2013) and Vijayakumar *et al.* (2015): RFC = F / N with ($0 < RFC < 1$). Where F is the number of informants reporting use of a particular species and N is the total number of the informants

The Family Importance Value (FIV)

FIV values show the importance of the plant families. It was calculated by using formula of Molares and Ladio, (2009): FIV = FCfamily / Ns. Where FCfamily = is number of families cited by informants and Ns is the total number of informants.

Results and Discussion

Socio-demographic characteristic of the participants

A total of 824 informants, including 427 women and 397 men, were interviewed at the High Atlas Centre in Morocco. Both sexes have a long history of using medicinal plants, but women (51.82%) have more knowledge about plant species and their medicinal uses than men (48.17%). There was no significant difference between the two sexes. (The Student's T test) ($P = 0.375$) (Table1). This result can be explained by the attachment of women to the traditional component as well as by the ease of transmission of this information between them, and they are concerned with the treatment of themselves and their families. These results are in agreement with those reported in other regions of Morocco (El alami *et al.* 2017, Idm'hand *et al.* 2019, Ziyyat *et al.* 1997). (Table 1)

On marital status, 65.05% were married, 17.23% were single, 11.65% were widowed and 6.06% were

divorced, These results can be explained by the fact that married people take care of their health and that of their children, especially in rural areas, in order to minimize the material expenses of the doctor and the pharmacist, the difference between families status was statistically significant (P = 0.000). Other ethnobotanical works have been done in this regard (Benlamdini *et al*. 2014, El Yahyaoui *et al*. 2015). (Table 1)

48.42% of the partcicipants were over 60 years old, while 24.51% were between 40 to 60 years old and 20.27% are aged 20 to 40 years old, however, among the informants the youth showed least interest for using the medicinal plants, they stay come in last position with only 6.79%. The difference between age groups and native informations was significant (P = 0.000). The accumulated experience with age is the main source of information locally for use of plants in traditional medicine, but we also noted a loss of medicinal plants information, especially the young people, who have tendency to no longer believe too much in this medicine traditional. This explains that the transmission of this information is currently in danger being it is not always ensured (Anyinam 1995). The results of our research are in conformity with precedent ethnobotanical works that were made in morocco (El hilah *et al.* 2015, Mehdioui et al. 2007, Tahri et al. 2012). (Table 1)

The majority (51.57%) of the participants were illiterate (29.97%) with a primary level (12.5%) have a secondary level, while those in university education rarely use medicinal plants (5.94%). As well, there is a significant difference among educational level and indigenous knowledge (P = 0.000). These results showed that the more the education level increases, the use of medicinal plants decreases,several studies confirm this result (Bouzid *et al.* 2017, Laadim *et al.* 2017, Rhatta *et al.* 2016). (Table 1)

In our study, it was found that the highest number of interviewees (54.85%) had a low socio-economic level, while (25.97%) were unemployed, 15.41% had an average level, and only 3.76% had a slightly higher level. there is a significant difference among income/month and indigenous knowledge (P =0.000), and this can be explained by the relative frequency of illiteracy in our study area, as well as the high cost of drugs and the average to low job performance of most respondents in this area. These values are in agreement with those reported in other regions of Morocco (Chaachouay *et al.* 2019, Douiri *et al.* 2007). (Table 1).

Table 1. Demographic profile of informants interviewed

Variables	Catrgories	Total	Percentages (%)	P-values
Gender	Female	427	51.82	0.375
	Male	397	48.17	
Age groups	< 20 years	56	6.79	0.000
	20-40	167	20.27	
	40-60	202	24.5	
	> 60 years	399	48.42	
Marital status	Married	563	65.05	0.000
	Single	142	17.23	
	Divorced	50	6.06	
	Widower	96	11.65	
Educational level	Illiterate	425	51.58	0.000
	Primary	247	29.97	
	Secondary	103	12.5	
	University	49	5.94	
Income/month	Unemployed	214	25.97	0.000
	350 - 1500 DH	452	54.85	
	1500 - 5000 DH	127	15.41	
	> 5000 DH	31	3.76	

Floristic Analysis

Diversity of Medicinal plant species in the study area

At the end of the survey, 248 species were identified. These medicinal species belong to 203 genera and 70 botanical families, of which only one family (Equisetaceae) belongs to the Pteridophyta besides three of Gymnosperms, namely Cupressaceae with four species, Pinaceae with two species, and Taxaceae with only one species. The 240 remaining species are part of the Angiosperm branching with a clear dominance of the Dicotyledonous species (217 species) on the monocotyledons (23 species) (Table 2).

Table 2. Medicinal plants used in the Central High Atlas of Morocco

Family	Scientific name	Voucher number	Common name	Vernacular name	Used part	Mode of preparation	Therapeutic uses	FL	FC	RFC	FIV
Aizoaceae	*Carpobrotus edulis* (L.) N. E.Br	(LBNR1)	Griffe de sorcier	Charbabbou	Leaves	Friction	Anti-eczema	100	32	0.038	0.038
Amaranthaceae	*Beta vulgaris* L.	(LBNR2)	Betterave sucrière	Chemandar	Seeds	Powder	Against weight loss (with honey).	86	56	0.067	0.11
	Chenopodium Ambrosioides L.	(LBNR3)	Anserine	Mkhinza	Green part of the plant	Infusion Maceration	Antimigraine. Stomachic.	100	146	0.177	
	Spinacia oleracea L.	(LBNR4)	Epinard	Sabanikh	Aerial part of the plant	Cooked	Stomachic	91.5	71	0.086	
Amaryllidaceae	*Allium cepa* L.	(LBNR5)	Oignon	Lbassala/ Azalim	The whole of Onion	Poultice Cooked Juice Raw	Ear-pain. Anti-ulcer. Hair care. Dermatological affections Antidiabetic.	96.2	85	0.103	0.149
	Allium sativum L.	(LBNR6)	Ail	Touma/ Tishert	Bulbs	Suppository Cooked Raw Friction Massag Others	Anti- hemeroide. Antidiabetic. Lowers blood-pressure. Decrease respiratory affections. Tooth ache. Hair care.	87.4	161	0.195	
Anacardiaceae	*Pistacia atlantica* Desf.	(LBNR7)	Pistachier de l'Atlas	Lbtam.	Leaves Barks Fruits	Decoction Inhalation Powder Others	Calming ventral. Stomachic. Heals kidney diseases. Antiseptic	80.16	103	0.125	0.125
	Pistacia lentiscus L.	(LBNR8)	Lentisque	Drou	Leaves Barks Roots	Decoction Infusion Poultice	Anti-ulcer. Lowers blood-pressure Antidiabetic. Anti-diarrhea. Pressure tooth ache and gum. Anti-migraine	53.4	122	0.148	

	Rhus pentaphylla (Jacq.) Desf.	(LBNR9)	Sumac vernis	Tazart/ âzâd, tazâd	Leaves Fruits	Decoction Infusion	Gastro-intestinal disorders. Anti-diarrhea.	100	86	0.104	
Apiaceae	*Ammi majus* L.	(LBNR10)	Ammi commun	Tabllawt	Seeds Roots Leaves	Maceration Poultice Decoction	Bucco infections. Emollient. Against intestinal pains.	89.6	131	0.158	0.107
	Ammi visnaga (L.) Lam.	(LBNR11)	Ammi visnage	Bechnikha	Seeds Fruits	Decoction	Antidiabetic.	100	62	0.075	
	Ammodaucus leucotrichus Coss & Dur.	(LBNR12)	Cumin Laineux	Kammûn sofi	Fruits	Infusion	Stomachic. Calming belly pain (mixed withthymus satureioides).	69.2	136	0.165	
	Anethum Graveolens L.	(LBNR13)	Aneth	Chibt	Seeds	Decoction	Stomachic. Diuretic	83.8	68	0.082	
	Angelica Archangelica L.	(LBNR14)	Angélique officinale	Hachichat Malaeka	Stems Seeds	Infusion Maceration	Treat the intestinal spasms. Stomachic. Sedative.	81.8	99	0.120	
	Apium graveolens L.	(LBNR15)	Céleri	Krafes	Leaves Leafy	Decoction Infusion	Diuretic. Antirheumatic.	95.2	76	0.092	
	Anethum graveolens L.	(LBNR16)	Aneth	Tabech	Flowers	Decoction	Calming stomach ache.	100	88	0.106	
	Carum carvi L.	(LBNR17)	Carvi	Karwia	Seeds	Infusion Powder	Antidiabetic. Antirheumatic. Carminative	84.09	122	0.148	
	Coriandrum sativum L.	(LBNR18)	Coriandre	Kezbour	Seeds Leaves Aerial parts	Infusion Poultice Decoction Powder Friction	Stomachic. Antidiabetic Anti-diarrhea. Diuretic. Antirheumatic.	93.8	95	0.115	
	Daucus carota L.	(LBNR19)	Carotte	Khizzo	Whole plant	Juice Infusion	Calms intestinal and urinary inflammations. Stimulates the blood circulation	94	61	0.074	
	Eryngium ilicifolium Lamk..	(LBNR20)	Panicaut	Zerriga	Whole plant	Powder	Heals angina (mixed with honey)	100	54	0.065	

	Foeniculum vulgare Mill.	(LBNR21)	Fenouil	Nafae	Whole plant	Poultice Decoction Infusion	Aperitif. Laxative. Antidiabetic. Antiseptic. Antirheumatic. Diuretic. Against bowel pains.	86.3	92	0.111	
	Ferula communis L.	(LBNR22)	Faux fenouil	Boubal	Fruits	Cooked	Improves blood circulation.	100	38	0.046	
	Petroselinum sativum Hoffman.	(LBNR23)	Persil	Maadnouss	Leafy stems	Decoction Infusion	Soothes the urinary pains. Against kidney stones. Emmenagogue	85.8	116	0.140	
	Pimpinella anisum L.	(LBNR24)	Anis vert	Habthlawa	Seeds	Decoction	Sedative. Antidiabetic.	91.1	102	0.123	
	Ridolfia segetum Moris	(LBNR25)	Aneth des moissons	Tebche	Seeds	Decoction Powder	Stomachic Antidiabetic.	94.4	71	0.086	
	Smyrnium Olusatrum L.	(LBNR26)	Maceron	Lhayar	Young shoots Leaves	Cooked Powder	Emmenagogue. Soothes and stops asthma attacks. Heals wounds	86.7	67	0.081	
	Thapsia garganica L.	(LBNR27)	Faux fenouil	Addryas	Leaves, Roots	Poultice	Antirheumatic (with honey). Heals the hair.	89	119	0.144	
Apocynaceae	*Caralluma europaea* (Guss.) N.E.Br.	(LBNR28)	Caralluma	Darmouss	Snowshoes	Decoction Juice Powder	Antidiabetic. Aperitif. Against cough and asthma Treats cysts of the genital tract (associated with honey)	68.7	112	0.135	0.111
	Nerium oleander L.	(LBNR29)	Laurier rose	Ddefla	Leafy stems	Infusion Poultice Fumigation Others	Reduce dandruff. Treat eczema especially feet. Treat leprosy Antidiabetic	96.9	72	0.087	

Araliaceae	*Hedera helix* L.	(LBNR30)	Lierre rampant	Lwwaya	Leaves	Infusion Poultice Decoction	Respiratory tract treatment Anti cellulite. Antirheumatic. Antiulcer. Against toothache and ears.	64	79	0.095	0.095
Arecaceae	*Chamaerops humilis* L.	(LBNR31)	Palmier nain	Ddoum	Roots Fruits	Cooked Raw	Antidiabetic. Stomachic.	89	48	0.058	0.061
	Phoenix dactylifera L.	(LBNR32)	Palmier dattier	Tmar	Fruits	Raw Decoction Cooked	Antidiarrhea. Antidiabetic Lowers blood-pressure Stomachic.	82.6	54	0.065	
Aristolochiaceae	*Aristolochia baetica* L.	(LBNR33)	Aristoloche climatite	Brztam	Leafy stems	Infusion Poultice	Stomachic. Antiseptic. Against bronchial inflammation for children.	74.8	31	0.037	0.037
Aspargaceae	*Agave americana* L.	(LBNR34)	Agave	Sabra	Leaves Seve Roots	Poultice Cream Decoction	Antirheumatic. Softens the hair. Heal syphilis (with honey).	96.2	32	0.038	0.05
	Asparagus albus L.	(LBNR35)	Asperge à tiges blanches	Skkoum	Leaves Stems Roots	Decoction	Against diseases of the kidneys. Antirheumatic. Diuretic.	46	69	0.083	
	Drimia maritima (L.) Stearn	(LBNR36)	Scille maritime	Basal eddib	Bulbs	Grinding	Heals eye pain.	92.6	25	0.03	
Asteraceae	*Achillea millefolium* L.	(LBNR37)	Achillée millefeuille	Khala	Aerial parts	Infusion Poultice	Aperitif. Stomachic. Emmenagogue. Lowers blood-pressure.	58.4	67	0.081	
	Achillea Lipiophylla M.Bieb.	(LBNR38)	Achille	El-qorte	Leaves	Decoction Infusion	Antidiabetic. Stomachic.	98.2	81	0.098	
	Achillea Santolinoides L.	(LBNR39)	Achille	Chouihiya	Capitulum	Infusion	Antidiabetic. Stomachic.	100	43	0.052	
	Anacyclus pyrethrum (L.) Link	(LBNR40)	Pyrèthre d'afrique.	Tiguentest	Whole plant	Decoction Infusion	Treat the toothaches.	89	63	0.076	

							Against intestinal worms				
	Anthemis nobilis L.	(LBNR41)	Camomille	Babounj roumi	Flowers	Infusion	Antidiabetic.	100	62	0.075	
	Antennaria dioica (L.) Gaertn.	(LBNR42)	Pied de chat	Ouden El-far	Leaves	Poultice Infusion	Antidiabetic. Against cough and pulmonary catarrh.	81	48	0.058	
	Artemisia absinthium L.	(LBNR43)	Absinthe	Chiba	Aerial parts	Poultice Decoction Infusion	Antiseptic. Antidiabetic. Emmenagogue. Stomachic.	84.2	92	0.111	0.097
	Artemisia campestris L.	(LBNR44)	Armoise	Chihi khorayss	Aerial parts	Decoction Infusion	Antirheumatic Against genitourinary diseases. Antidiabetic.	94	75	0.091	
	Artemisia Mesatlantica Maire	(LBNR45)	Armoise De montagne	Ifssi	Aerial parts	Decoction	Antidiabetic. Antispasmodic	86.3	102	0.123	
	Artemisia herba alba Asso.	(LBNR46)	Armoise blanc	Chih /izri	Roots Leaves	Decoction Infusion Powder Others	Against intestinal worms. Stomachic. Antidiabetic. Soothes the urinary pains.	75.5	136	0.165	
	Atractylis gummifera (L.) Less.	(LBNR47)	Chardon a glu	Tifroua Addad	Roots	Powder Fumigation Poultice	Astringent. Softens the hair. Facilitates delivery. Treats acne, and abscesses.	68.7	89	0.108	
	Calendula arvensis L.	(LBNR48)	Souci des champs	Jamra	Flowers	Infusion Compress Gargles	Stomachic. Against eye fatigue. Heals inflammation of the gums.	96.2	54	0.065	
	Calendula Scariosus (Ball) oberpr and vogt	(LBNR49)	Ormenis scariosa	Irzghi	Leaves Flowers	Raw Compress	Antiulcer. Antiseptic. Against eye infections. Heals the healing of wounds.	72.4	79	0.095	

	Carthamus lanatus L.	(LBNR50)	Carthame laineux	Nabta dlhanna	Flower heads Stems.	Powder	Hair care. (With olive oil). Fight the aging of the skin (with honey).	98.2	53	0.064	
	Centaurea maroccana Ball.	(LBNR51)	Centaurée	Tafgha	Roots	Powder	Analgesic. Stomachic.	94.1	65	0.075	
	Chrysanthemum coronarium L.	(LBNR52)	Chrysanthème à couronnes	Hmessou	Flowers	Decoction Infusion	Hepatic insufficiency treatment. Hypotensive Antidiabetic.	82.5	47	0.057	
	Cladanthus arabicus L.	(LBNR53)	Cladanthus	Tafsse	Aerial parts	Infusion	Soothes the urinary ailments. Antidiabetic.	93.8	62	0.075	
	Cynara cardunculus L.	(LBNR54)	Chardon	Khorchof /taggua	Capitulum Leaves Roots	Raw Decoction Powder	Stomachic. Treats liver and gall bladder disorders. Antidiabetic.	85.5	86	0.104	
	Cynara humilis L.	(LBNR55)	Petit artichaut	Tagemmit Taymant	Roots	Decoction Powder	Antidiabetic. Heals burns.	89.2	126	0.152	
	Echinops spinosus L.	(LBNR56)	Echinops	Tasekra	Roots	Decoction Infusion Fumigation	Stomachic. Soothes the urinary ailments. Against infection of the respiratory system. Facilitates delivery.	78.4	99	0.120	
	Dittrichia viscosa (L.) Greuter	(LBNR57)	Aunée visqueuse	Terhla	Leaves Flower heads Roots Stems	Poultice Decoction Infusion	Antiseptic. Antirheumatic. Soothes the urinary ailments. Emmenagogue. Antidiabetic.	74	87	0.105	
	Inula viscosa L.	(LBNR58)	Aunée visqueuse	Terhla	The root Stems	Decoction Infusion	Heals lung infections Promotes digestion Appetite stimulant Antidiabetic.	67.4	129	0.156	
	Launaea mucronata (Forssk.) Muschl.	(LBNR59)	Zollikoferia mucronata	Intrim	Aerial parts	Decoction	Laxative. Stomachic.	95.2	61	0.074	

	Mantisalca salmantica (L.) Briq. & Cavill.	(LBNR60)	Centaurée de Salamanque	Thazmourth	Leaves	Infusion	Reduces gastrointestinal disorders.	100	81	0.098	
	Matricaria chamomilla L.	(LBNR61)	La camomille	Lbabounj	Rounded flowers	Decoction Infusion	Against the pain of the rules. Antidiabetic. Heals bowel pains in infants.	74.8	113	0.137	
	Onopordum acaulon L.	(LBNR62)	Onopordon à feuilles d'acanthe	Addad	Roots	Decoction	Antianemic. Aperitif.	92.6	93	0.112	
	Pallenis spinosa (L.) Cass.	(LBNR63)	Pallénis épineux	Nouged	Aerial parts	Decoction Infusion	Stomachic. Antidiabetic.	86.9	131	0.158	
	Picris coronopifolia (Desf.) DC.	(LBNR64)	Picride	Lhaydwan	Whole plant	Powder	Stomachic	100	88	0.106	
	Scolymus hispanicus L.	(LBNR65)	Scolyme d'Espagne	Taghdut	Roots Young shoots	Decoction Cooked	Antidiabetic. Antiulcer.	93.8	102	0.123	
	Sonchus oleraceus L.	(LBNR66)	laiteron maraîcher	Tifaf	Leaves	Decoction	Antidiabetic.	100	75	0.091	
Berbéridaceae	*Berberis hispanica* Boiss & Reut	(LBNR67)	Les berbéris	Argîs/ izzirki	Leaves Fruits	Infusion Decoction	Heal gastrointestinal and hepatic atony. Antidepressant Antidiabetic.	75.5	41	0.049	0.049
Boraginaceae	*Borago officinalis* L.	(LBNR68)	La bourrache	Lsan al ard	Whole plant	Raw Poultice	Antirheumatic. Calm rashes.	81	52	0.063	0.056
	Echium plantagineum L.	(LBNR69)	Vipérine annuelle	Awnnass	Seeds	Powder	Against snake bites. (with honey)	100	41	0.049	
Brassicaceae	*Brassica oleracea* L.	(LBNR70)	Chou commun	Mkwwar	Fresh leaves	Poultice Juice	Antidiabetic. Antiulcer. Against the flu.	82.4	27	0.032	0.063
	Brassica rapa L.	(LBNR71)	Navet	Left	Roots	Syrup Cooked	Heal the flu. Antidiabetic. (With the leaves of Brassica oleracea).	87.3	71	0.082	

	Brassica nigra (L.) W.D.J.Koch	(LBNR72)	Moutarde noire	Bu-hammou	Leafy stems seeds	Poultice Infusion	Antirheumatic. Stomachic.	91.2	64	0.077	
	Capsella bursa pastoris (L.) Medik	(LBNR73)	Capselle bourse	Tiffaf	Leaves	Decoction Infusion	Hemostatic diuretic	94	39	0.047	
	Eruca sativa Miller	(LBNR74)	Roquette	Al girjir	Fresh plant Seeds	Poultice Lotion Juice Powder	Disinfects and heals wounds. Promotes hair growth. Diuretic. Antidiabetic. (added to milk Fermented and Lepidium sativum)	78.1	102	0.123	
	Lepidium sativum L.	(LBNR75)	Cresson alénois	Hab rchad	Seeds	Decoction Powder	Treats cough, asthma, and bronchitis. Effective in cases of infertility. Antidiabetic	95.6	122	0.148	
	Nasturtium officinale R.Br.	(LBNR76)	Cresson de fontaine	Gernûne	Leafy stems	Cooked	Prevent anemia Heals infections of the respiratory system.	83	26	0.031	
	Raphanus sativus L.	(LBNR77)	Radis cultivé	Lefjel	Seeds Rhizome	Powder Raw	Antidiabetic. Stomachic. Heals liver problems.	96.4	42	0.05	
	Sisymbrium irio L.	(LBNR78)	Roquette jaune	Sibryan	Leafy stems seeds	Infusion Poultice	Soothes the fever of typhoid and smallpox. Against coughing. Facilitates the healing of wounds.	82.3	28	0.033	
Burseraceae	*Boswellia carterii* Birdy	(LBNR79)	Oliban/ encens vrai	Salabane/ loubane	Fruits	Decoction	Antidiabetic.	100	82	0.09	0.09
Buxaceae	*Buxus sempervirens* L.	(LBNR80)	Buis commun	Bakss	Leaves	Infusion Poultice	Antiseptic Antirheumatic.	89.7	21	0.025	0.025
Cactaceae	*Opuntia ficus indica* L. (Mill.)	(LBNR81)	Figuier de barbarie	Handiyya	Fruits Sap of the stems	Raw Cream Decoction	Soothes gastrointestinal pain Softens the hair.	52.8	98	0.118	0.118

					Flowers		Antirheumatic. Heals bladder and prostate problems.				
Capparaceae	*Capparis spinosa* L.	(LBNR82)	Câprier	Lkabbar	Leaves Roots Seeds Fruits	Powder Decoction infusion Powder	Carminative. Antiulcer. Diuretic. Anti-diarrhea Antidiabetic. Heals infections of the respiratory system.	74.8	89	0.108	0.108
Caprifoliaceae	*Sambucus nigra* L.	(LBNR83)	Sureau noir	Sembouqa	Leaves Fruits	Decoction Infusion Compress	Antidiabetic. Heals infections of the respiratory System.	96.2	22	0.026	0.026
Caryophllaceae	*Corrigiola telephiifolia* Pourret.	(LBNR84)	Corrigiole à Feuilles de Téléphium	Sarghina	Roots	Powder	Heals infections of the respiratory system	100	65	0.078	0.079
	Herniaria hirsuta L.	(LBNR85)	Herniaire.	Herrast lehjar	Whole plant	Decoction Infusion	Against kidney stones. Reduce bladder stones.	86.5	112	0.135	
	Paronychia argentea Lam.	(LBNR86)	Paronyque	Tahidourt	Fruits Leaves	Decoction	Heals heart disease.	97.3	22	0.026	
Cistaceae	*Cistus creticus* L.	(LBNR87)	Ciste de crête	Irgle	Leafy Stems	Powder	Treat irritation of burns and heal stomachic. Against aging and loosening of the skin	72.2	143	0.173	0.116
	Cistus Ladanifer L.	(LBNR88)	Ciste ladanifère	Touzalt	Seeds	Powder Infusion	Antidiabetic. Hemostatic.	98.5	79	0.095	
	Cistus Laurifolius L.	(LBNR89)	Ciste à feuilles de peuplier	Agullid	Seeds	Powder Decoction	Antidiabetic. Decrease sleep disorders	87.3	67	0.081	
Convolvulaceae	*Convolvulus arvensis* L.	(LBNR90)	Liseron des champs	Lwayya	Leaves Roots	Powder	Astringent.	100	85	0.103	0.103
Cucurbitaceae	*Bryonia dioica* Jacq.	(LBNR91)	Bryone dioique	Ineb-eddib	Stems. Fruits.	Decoction	Antidiabetic.	100	61	0.074	

	Citrullus vulgaris (L.) Schard.	(LBNR92)	Pastèque	Delah	Leaves	Decoction maceration	Antidiabetic.	96	48	0.058	0.083
	Cucumis melo L.	(LBNR93)	Melon	Swihla	Fruits	Raw	Diuretic. Promotes the elimination of kidney stones.	93.4	26	0.031	
	Cucumis sativus L.	(LBNR94)	Concombre	Lkhyar	Seeds	Powder	Antidiabetic.	100	84	0.101	
	Cucurbita maxima L.	(LBNR95)	Courge	Lgraa hamra	Pulp Seeds Fruits	Poultice Powder Decoction	Calming burns. Vermifuge. Antidiabetic.	93.6	109	0.132	
	Lagenaria siceraria (Molina) Standl.	(LBNR96)	Calebasse	Slawiyya	Fruits	Fumigation	Migraine Therapy	82	86	0.104	
Cupressaceae	*Juniperus communis* L.	(LBNR97)	Genévrier commun	Elarâr - Amzi	Leaves	Infusion Powder	Relieves stomach colic. Against falling hair.	86.3	26	0.031	0.032
	Juniperus oxycedrus L.	(LBNR98)	Genevrier	L arâar chrini	Stems Leaves	Decoction Infusion Maceration	Stomachic. Diuretic. Antidiabetic.	85	41	0.049	
	Juniperus Phoenicea L.	(LBNR99)	Genévrier rouge	L arâar El-horr	Aerial parts	Maceration Decoction	Antirheumatic. Aperitif.	94.2	19	0.023	
	Tetraclinis articulata (Vahl) Masters	(LBNR100)	Thuya de barbarie	Azougaâ -El arâar	Leaves Fruits	Poultice Compress Maceration	Migraine Therapy. Antiseptic. Antirheumatic. Calm the pains of decayed teeth.	78.6	22	0.026	
Cyperaceae	*Cyperus Longus* L.	(LBNR101)	Souchet odorant	Arouk Esaad	Roots	Maceration	Anti-inflammatory Dermal use Prevention of cardiovascular disorders.	98.4	35	0.042	0.042
Equisetaceae	*Equisetum ramosissimum* Des	(LBNR102)	Prêle	Dayl lhissan	Stems	Decoction	Antidiabetic.	100	23	0.027	0.027
Euphorbiaceae	*Euphorbia echinus* Hook.f. & Coss.	(LBNR103)	Annuelle euphorbe	Ddaghmus	Stems	Latex Powder	Treat eczema. Antidiabetic (mix with honey).	92	202	0.245	

	Euphorbia helioscopia L.	(LBNR104)	Euphorbe réveille-matin	Farbioun chamss	Leafy stems	Powder	Heals burns and some dermal uses at children	82	43	0.052	0.169
	Mercurialis annua L.	(LBNR105)	Annual mercury	Harryga lmalsa	Whole fresh plant	Decoction Infusion	Antidiabetic. Traite l'asthme.	96	42	0.05	
	Euphorbia resinifera Berg	(LBNR106)	Euphorbe résinifère	Zeggoum	Stems Fruits Flowers	Poultice Infusion Powder	Heals venomous stings. Against paralysis (kneaded with flour or semolina and egg white). abortifacient. Antidiabetic.	87.4	272	0.33	
Ericaceae	*Arbutus unedo* L.	(LBNR107)	Arbousier	Barnnou	Bark root Fruits Leaves	Infusion Raw Powder	Antidiarrheal. Relieves sore throats. Help to sleep. Antidiabetic.	77	123	0.149	0.149
Fabaceae	*Acacia gummifera* Willd	(LBNR108)	Gommier du Maroc	Telh	Leaves Barks	Poultice Powder	Heals wounds. Heals measles.	92.4	97	0.117	0.123
	Anagyris foetida L.	(LBNR109)	Anagyre fétide	Foul gnawa	Seeds Leaves	Powder Infusion	Aperitif (mix with honey). Antidiabetic.	96.4	88	0.107	
	Cassia absus L.	(LBNR110)	Cassia à feuilles obtuses	El habba sawdae	Seeds	Powder Decoction	Antidiabetic. Diuretics.	82.2	69	0.083	
	Ceratonia siliqua L.	(LBNR111)	Caroubier	Lkharoub	Fruits Leaves	Powder Infusion	Anti-ulcer. Emetocathartic. Laxative. Antidiabetic.	87.9	252	0.305	
	Cicer arietinum L.	(LBNR112)	Pois chiche	Lhomms	Seeds	Powder Infusion	Antidiabetic. Stomachic. Diuretic and antispasmodic.	8 4	73	0.088	
	Glycine max (L.) Merr.	(LBNR113)	Haricot oléagineux	Soja	Seeds	Decoction Powder	Antidiabetic. Increase the weight.	92.3	101	0.122	
	Glycyrrhiza glabra L.	(LBNR114)	Réglisse	Aarq ssuss	Roots	Decoction Infusion	Against stomach ulcers Antidiabetic. Soothes sore throats	78.8	61	0.074	

	Lupinus albus L.	(LBNR115)	Lupin blanc	Termis	Seeds	Powder Raw	Aperitif Antidiabetic.	89.3	53	0.064	
	Lupinus luteus L.	(LBNR116)	Lupin sauvage	Ssemkala	Seeds	Decoction	Diuretic Antidiabetic. Emmenagogue	94.2	71	0.086	
	Medicago sativa L.	(LBNR117)	Luzerne	Fessa	Leaves	Decoction Infusion	Antidiabetic. Reduce cholesterol levels. Heals diseases of the bladder.	73.5	152	0.184	
	Ononis spinosa L.	(LBNR118)	Arrète-bœuf	Chanboura	Whole plant	Infusion Decoction Powder	Diuretic. Soothes sore throats Aperitif (mix with honey).	87.3	135	0.163	
	Phaseolus vulgaris L.	(LBNR119)	Haricot Vert	Loubiyya	Gousse	Raw	Antidiabetic.	100	31	0.037	
	Retama monosperma (L.) Boiss	(LBNR120)	Rétam blanc	Rtam	Stems Roots Leaves	Infusion Decoction	Heals diseases of the gums. Antidiabetic. Hypoglycemic.	92.6	69	0.083	
	Trifolium pratense L.	(LBNR121)	Trèfle rouge	Rjal lrnb	Flower heads	Infusion Poultice	Diuretic and antispasmodic. Calms the itchy skin Care of dermatitis and eczema.	78.3	84	0.101	
	Trigonella foenum-graecum L.	(LBNR122)	Fenugrec	Halba	Seeds	Maceration Powder	Aperitif. Anti-anemic. Production of breast milk. Reduces gastrointestinal disorders. Antidiabetic.	83.6	231	0.28	
	Vicia faba L.	(LBNR123)	Fève	Lfoul	Flowers Seeds	Infusion	Calm the pains of the kidneys. Heal the face (mix with honey).	59	71	0.086	
Fagaceae	*Quercus rotundifolia* Lam.	(LBNR124)	Chêne vert	Abouhou ; kerrouch	Barks	Powder	Antidiarrheal. Stomachic (mix with honey). Reduce hemorrhoids.	92.4	71	0.086	0.086

Fumariaceae	*Fumaria officinalis* L.	(LBNR125)	Fumeterre	Lwarda D'lard	Roots Fresh plant	Decoction Poultice Infusion	Antidiabetic. Stomachic. Laxative. Heals skin. Treats eczema. Fight against nausea for pregnant women.	56.3	43	0.052	0.052
Gentianaceae	*Centaurium spicatum* (L.) Fritsch	(LBNR126)	Petit centaurée	Gosset El-hayya	Whole plant	Decoction Infusion Powder	Antidiabetic. Anti-hair loss. Treats gastrointestinal disorders. Aperitif.	67.3	38	0.046	0.046
Geraniaceae	*Pelargonium roseum* l'Hér	(LBNR127)	Géranium- rosat	Laattercha	Leaves	Decoction	Antidiabetic. Treats burns.	82.5	47	0.057	0.057
Iridaceae	*Crocus sativus* L.	(LBNR128)	Safran	Zaʿfarān	Stigmas	Decoction Infusion Massage	Antidiabetic. Hypotensive. Stomachic. Sedative. Relieves toothaches	94	114	0.138	0.138
Juglandaceae	*Juglans regia* L.	(LBNR129)	Noyer	Lgargaie	Barks Leaves	Chewing Decoction Powder	Whiten the teeth. Antidiabetic. Heals scars and wounds.	86.2	82	0.099	0.099
Lamiaceae	*Ajuga iva* (L.) Schreb.	(LBNR130)	Bugle	Chandgoura; Timarna	Aerial parts	Decoction Maceration Infusion	Antidiabetic Heals dental diseases. Antidiarrheal.	92.8	84	0.101	
	Ballota hirsuta Benth.	(LBNR131)	Ballota poilue	Merrouwt	Leafy stems	Decoction Infusion	Antidiabetic. Calm cough and painful spasms of the digestive tract.	76	118	0.143	
	Calamintha officinalis Moench	(LBNR132)	Menthe des montagnes	Manta	Aerial parts	Decoction Infusion Gargles	Antidiabetic. Calm the intestinal pains. Heals the affections of the mouth.	64.3	68	0.082	
	Hyssopus officinalis L.	(LBNR133)	Hysope	Azzoufa	Flower heads Leaves	Infusion Poultice Syrup	Stomachic. Antiseptic. Sedative.	54.3	62	0.075	

							Heals the mucous membranes of the respiratory tract and chronic bronchitis.				
	Lamium amplexicaule L.	(LBNR134)	Lamier à feuilles embrassantes	Merrouwt tabldite	Aerial parts	Infusion Poultice	Anti-diarrhea. Antiseptic.	94	74	0.087	
	Lavandula dentata L.	(LBNR135)	Lavande à feuilles dentées	Lkhzama	Aerial parts	Decoction Poultice Infusion	Antidiabetic. Treat eczema. Stomachic.	85.7	42	0.05	
	Lavandula maroccana Murb.	(LBNR136)	Lavande marocaine	Iguiz	Flowers heads	Decoction Infusion	Stomachic. Diuretic.	94.8	227	0.275	0.145
	Lavandula multifida L.	(LBNR137)	Lavande à feuilles divisées	Wizghyoul	Flowers heads	Decoction Poultice Infusion Others	Migraine Therapy. Sedative. Antirheumatic. Fight colds and coughs Heals bladder pain.	74.2	77	0.093	
	Lavandula Stoechas L.	(LBNR138)	Lavande papillon	Lhlhal	Inflorescence	Decoction Infusion	Heals the mucous membranes of the respiratory. Anti-inflammatory. Antidiabetic.	82.4	191	0.231	
	Marrubium vulgare L.	(LBNR139)	Marrube blanc	Marouyt	Whole plant	Decoction Maceration Infusion Syrup	Antidiabetic. Hypotensive. Stomachic. Heals the nasal mucosa and sore throat.	92.2	193	0.234	
	Melissa officinalis L.	(LBNR140)	Mélisse	Naanaa trunj	Leaves	Infusion Maceration	Antidiabetic. Against stress and insomnia.	100	68	0.082	
	Mentha pulegium L.	(LBNR141)	Menthe pouliot	Fliyyou	Aerial parts	Decoction Poultice Maceration	Against the flu and cough. Antiseptic. Stomachic.	74	186	0.225	

	Mentha suaveolens Ehrh.	(LBNR142)	Menthe a feuilles rondes	Timijja	Aerial parts Leaves	Poultice Infusion Maceration Decoction	Antirheumatic. Heals ailments of the throat and bronchitis. Against scars. Antidiabetic.	96.4	189	0.229	
	Ocimum Basilicum L.	(LBNR143)	Basilic	Lhbaq	Whole plant	Infusion Decoction	Hypotensive Antidiabetic. Decrease the pains of the rules.	65.5	79	0.095	
	Origanum compactum Benth	(LBNR144)	Origan	Zaater	Leaves	Decoction others	Antidiabetic. Antiulcer.	92.6	156	0.189	
	Origanum Majorana L.	(LBNR145)	Marjolaine	Mardaduche	Leaves	Decoction Infusion Gargle	Calm painful rules. Hypotensive. Sedative. Against sores affecting the mouth.	56.3	82	0.099	
	Rosmarinus officinalis L.	(LBNR146)	Romarin	Azir	Leaves	Decoction Infusion Compress	Antidiabetic. Treat digestive and hepatic disorders. Against respiratory infections. Fight rheumatism and fatigue.	100	74	0.089	
	Salvia officinalis L.	(LBNR147)	Sauge officinale	Salmiya	Leaves	Infusion Decoction	Antidiabetic. Emmenagogue. Calm sore throats. Hypotensive.	98	102	0.123	
	Salvia Verbenaca L.	(LBNR148)	Sauge à feuilles de verveine	Kiyata	Leaves	Infusion	Against respiratory infections. Stomachic.	88.5	81	0.098	
	Teucrium polium L.	(LBNR149)	Germandée	Jiida	Aerial parts	Decoction Infusion	Antidiabetic. Antidiarrheal. Calm the gastrointestinal disorders.	72.3	171	0.207	
	Thymus broussonetii Boiss.	(LBNR150)	Thymus de Broussonet	Azukni	Leaves Flowers	Infusion Decoction	Antidiabetic. Against respiratory infections.	84	152	0.184	

							Soothes gastrointestinal upset.				
	Thymus maroccanus Ball.	(LBNR151)	Thym du Maroc	Azukni	Leaves Flowers heads	Maceration Infusion	Antidiabetic. Heals the affections of the mouth. Against hair loss (in olive oil). Against respiratory infections. Stomachic.	89.3	128	0.155	
	Thymus satureioides Coss. &Ball.	(LBNR152)	Thym-sarriette du Maroc	Azukni	Leaves Flowers heads	Decoction Infusion	Antidiabetic. Heals bronchopulmonary affections. Antiulcer. Antiseptic.	98	214	0.259	
	Thymus vulgaris L.	(LBNR153)	Thym commun	Zaitra	Leaves	Decoction /Infusion	Antidiabetic.	100	89	0.108	
	Vitex agnus castus L.	(LBNR154)	Arbre à poivre	Anguirf	Flowers heads	Infusion	Regularize the menstrual cycle of women.	100	52	0.063	
Lauraceae	*Cinnamomum Cassia* blum	(LBNR155)	Cannelle	El qarfa	Barks	Decoction Infusion	Heals liver diseases. Antidiabetic. Against menstrual pains.	89.9	89	0.108	0.091
	Laurus nobilis L.	(LBNR156)	Laurier noble	Ourak moussa	Leaves	Decoction Infusion	Antidiabetic. Stomachic.	92.5	62	0.075	
Linaceae	*Linum usitatissimum* L.	(LBNR157)	Lin	Zeriaa ketane	Seeds	Decoction Powder	Antidiabetic. For weight gain (mixed with honey)	86.3	92	0.111	0.111
Lythraceae	*Lawsonia inermis* L.	(LBNR158)	Henné	Lḥanna	Leaves	Powder	Soften skin (mixed with black soap) . Tint the scalp.	82.4	131	0.158	0.137
	Punica granatum L.	(LBNR159)	Grenadier	Rommane	Fruit barks	Infusion Powder	Heals bladder problems and gastrointestinal pain. (Mixed with fig and oleatral flowers). Antidiabetic.	68	96	0.116	

							Softens the hair (mixed with Lawsonia inermis).				
Malvaceae	*Althaea Officinalis* L.	(LBNR160)	Guimauve	Khatmiya	Roots	Decoction Maceration Infusion	Antiulcer. Heals urinary disorders. Against pharyngeal inflammations. Antidiarrheal.	87.6	68	0.082	0.076
	Hibiscus Esculentus (L.) Moench.	(LBNR161)	Moench	Lmlokhiyya	Flowers Leaves	Decoction Infusion Gargle	Antiscorbique Antidiabetic. Treats bronchitis.	82.4	52	0.063	
	Hibiscus sabdariffa L.	(LBNR162)	Thé rose	Karkadil	Flowers Leaves	Infusion Decoction	Antidiabetic. Anti-inflammatory. Diuretic. Reduce menstrual pain.	56.2	71	0.086	
	Malva parviflora L.	(LBNR163)	Mauve à petites fleurs	Amzgra	Aerial parts	Cooked Maceration	Laxative. Antianemic.	96.6	63	0.076	
Moraceae	*Ficus carica* L.	(LBNR164)	Figuier	Karmouss	Leaves Fruits	Maceration Evaporation	Antidiabetic. Treat cough, bronchitis and hypotensive (mixed with evaporated garlic and olive oil).	89	116	0.140	0.140
Myrtaceae	*Eucalyptus globulus* Labill.	(LBNR165)	Eucalyptus	Eucalyptus	Barks Leaves	Decoction Poultice Infusion	Antidiabetic. Treats coughs, flu and colds. Antiseptic.	84.2	286	0.347	0.165
	Eugenia caryophyllata Thunb	(LBNR166)	Giroflier	Qronfel	Cloves	Decoction Maceration Infusion	Antidiabetic. Heals gum disease (associated with lavandula officinalis and juglans regia). Soothes the pain of the rules.	69	146	0.177	
	Myrtus communis L.	(LBNR167)	Myrte	Rayhane	Flowers Leaves	Decoction Maceration Infusion	Antidiabetic. Fight against dandruff and gives shine to the hair.	47.3	62	0.075	

							Heals cough, and flu.				
	Jasminum fruticans L.	(LBNR168)	Jasmin jaune	Yasmin	Leaves Flowers	Maceration Infusion	Antidiabetic. Relieves intestinal cramps. Hypotensive.	56.2	52	0.063	
Nitrariaceae	*Peganum harmala* L.	(LBNR169)	Harmel	L-harmel	Seeds	Poultice Fumigation Infusion	Antirheumatic. Migraine therapy. Antidiabetic.	83.9	102	0.123	0.123
Oleaceae	*Fraxinus angustifolia* Vahl	(LBNR170)	Frêne oxyphylle	Dllam	Leaves Bark of the twigs	Infusion Maceration	Against urinary infections. Antirheumatic.	86.2	98	0.118	0.096
	Jasminum fruticans L.	(LBNR171)	Jasmin jaune	Yasmin	Leaves Flowers	Maceration Infusion	Antiseptic. Relieves cramps. Hypotensive. Sedative.	94	42	0.05	
	Olea europaea L.	(LBNR172)	Olivier	Zaytoun	Fruits Leaves	Raw Decoction Others	Antidiabetic. Against oral inflammation. Treat otitis.	84.8	106	0.128	
	Olea oleaster Hoffm. & Link.	(LBNR173)	Oléastre sauvage	Jabouj	Leaves	Infusion Decoction	Hypotensive. Antidiabetic.	48	58	0.07	
Paeoniaceae	*Paeonia corallina* Retz	(LBNR174)	Pivoine coralline	Pantabroun	Flowers	Infusion	Against coughing Sedative.	100	31	0.037	0.037
Papaveraceae	*Fumaria officinalis* L.	(LBNR175)	Fumeterre	Lwarda D'lard	Roots Fresh plant	Decoction Poultice Infusion	Antidiabetic. Stomachic. Laxative. Heals eczema. Fight against nausea for pregnant women.	57.8	68	0.082	0.096
	Papaver rhoeas L.	(LBNR176)	Pavot hybride	Belnaaman	Seeds Flowers	Decoction Powder Infusion	Against dry cough. Calm stomach ache. Eliminate fatigue. Calm sore throat and cough in children.	93.5	92	0.111	
Pedaliaceae	*Sesamum indicum* L.	(LBNR177)	Sésame	Zenjlan	Seeds	Decoction Infusion Powder	Antidiabetic. Diuretics.	75.5	78	0.094	0.094

							Against gastrointestinal disorders.				
Pinaceae	*Cedrus Atlantica* Manetti ex (Endl.)	(LBNR178)	Cèdre de l'Atlas	Arz	Barks	Decoction Infusion Maceration Powder	Fights flu, coughs and bronchitis. Heals urinary tract infections. Sedative. Against hair loss (in olive oil).	51	31	0.037	0.053
	Pinus halepensis Mill.	(LBNR179)	Pin d'Alep	Snaoibar-Tayda	Leaves Barks	Infusion Powder	Soothes catarrhal affections of the respiratory system. Heals burns of the skin (with clarified butter).	72.2	58	0.07	
Plantaginaceae	*Globularia alypum* L.	(LBNR180)	Globulaire buissonnante	Taslgha	Flower heads	Decoction Infusion	Antidiabetic. Antiulcer	86.5	77	0.093	0.108
	Plantago major L.	(LBNR181)	Grand plantain	Lmassas	Whole plant	Poultice Infusion Powder	Heal eczema. Against asthma and eliminates bronchial mucous membranes. Promotes the healing of wounds.	74.2	71	0.086	
	Plantago ovata Forsskal	(LBNR182)	Ispaghul	Zriaat zrktouna	Seeds	Decoction Powder	Diuretic. Hypotensive.	98.2	121	0.146	
Poaceae	*Arundo donax* L.	(LBNR183)	Canne de provence	Ksab	Roots	Powder	Against hair loss (in olive oil).	100	156	0.183	0.116
	Avena sativa L.	(LBNR184)	Avoine cultivée	Achoufane	Seeds	Infusion	Antidiabetic.	100	52	0.063	
	Avena sterilis L.	(LBNR185)	Avoine	Askoune	Fruits	Decoction Powder	Stomachic. Antidiabetic (mixed with the flowers of zea mays).	88.8	99	0.12	
	Cynodon dactylon (L.) Pers.	(LBNR186)	Cynodon	Njem	Roots	Decoction Powder	Stops nosebleeds. Calms burns and heals wounds.	92.3	84	0.101	
	Hordeum vulgare L.	(LBNR187)	Orge	Chaâir	Seeds	Maceration	Antidiabetic (mixed with fenugreek powder).	100	62	0.075	

	Lolium perenne L.	(LBNR188)	Ivraie vivace	Zouane	Seeds	Decoction infusion	Antidiabetic.	72.4	69	0.083	
	Panicum miliaceum L.	(LBNR189)	Millet commun	Tafsout	Seeds	Decoction Infusion	Antidiabetic. Promotes digestion.	92.6	81	0.098	
	Pennisetum glaucum (L.) R. Br	(LBNR190)	Millet	Ïllân	Seeds	Powder	Antianemic. Antidiabetic.	94	203	0.246	
	Phalaris canariensis L.	(LBNR191)	Alpiste des canaries	Zwan abiyad	Seeds	Powder	Antidiabetic.	100	69	0.083	
	Phragmites australis (Cav) Steud.	(LBNR192)	Roseau	L-qasseb	Leaves Roots	Decoction Powder	Against bronchitis. Anti-hair loss.	72.3	113	0.137	
	Triticum Durum Desf.	(LBNR193)	Blé	Lkamh	Seeds	Maceration	Antidiabetic (mix with Coriandrum sativum and Trigonella foenum-graecum). Anti-hair loss.	78.8	81	0.098	
	Zea mays L.	(LBNR194)	Mais	Draa	Stigma of corn	Infusion Decoction Powder	Hair care. Against disorders of the bladder Antianemic.	94	102	0.123	
Polygalaceae	*Polygala rupestris* Pourret	(LBNR195)	Polygala des rochers	Laachba dlhlib	Roots	Decoction	Heals asthma attacks. Laxative.	100	101	0.122	0.122
Polygonaceae	*Rumex bucephalophorus* L.	(LBNR196)	Rumex tête de boeuf	Tismmam	Whole plant	Decoction Infusion Compress	Aperitif. Soothes the pain of the bladder. Antiseptic.	89.6	89	0.108	0.1
	Rumex pulcher L.	(LBNR197)	Oseil sauvage	Hommayda	Whole plant	Decoction Infusion	Against bladder pain. Stomachic.	83.3	76	0.092	
Portulacaceae	*Portulaca oleraceae* L.	(LBNR198)	Pourpier potager	Rejla	Aerial parts	Infusion Decoction Cooked	Laxative. Soothes the pain of the bladder. Antidiabetic.	72.2	102	0.123	0.123
Primulaceae	*Anagallis arvensis* L.	(LBNR199)	Mouron des champs	Chahmet l'falüss	Leaves Stems	Decoction Poultice	Against kidney and bladder stones. Heals skin diseases.	100	62	0.075	0.075

Ranunculaceae	*Clematis flammula* L.	(LBNR201)	Clématite brûlante	Nar el-barda	Aerial parts	Poultice	Antirheumatic.	83.3	91	0.11	0.133
	Delphinium pentagynum Lam	(LBNR202)	Dauphinelle staphysaigre	Habbet râs	Leaves	Decoction Poultice	Antidiarrheal. Anti-lice (mixed with olive oil).	96.2	71	0.086	
	Nigella sativa L.	(LBNR203)	Nigelle	Sanouje	Seeds	Powder	Antidiabetic. Stomachic. Treats liver diseases (mixed with honey).	78.5	87	0.105	
	Ranunculus bullatus L.	(LBNR204)	Renoncule boursouflée	Mrniss, Wdan Alhalouf	Roots Leaves	Decoction Poultice	Regulates the rules and hormones in women. Stomachic. Facilitates childbirth.	64	131	0.158	
Resedaceae	*Reseda alba L.*	(LBNR205)	Réséda blanc	Tabaddit	Leaves	Infusion	Antidiarrheal. Diuretic.	100	101	0.122	0.122
Rhamnaceae	*Ziziphus lotus* (L.) Lam.	(LBNR206)	Jujubier	Ssedra, Azgour	Leaves Fruits	Decoction Powder Infusion	Antidiarrheal. Antiulcer. Aperitif. Antidiabetic. Promotes the healing of wounds.	87	131	0.158	0.158
Rosaceae	*Crataegus monogyna* Jacquin	(LBNR207)	Crataegus à épines aiguës.	Azzairour	Flower heads.	Powder Infusion	Against heart and respiratory problems (mixed with honey) Promotes the circulation of blood.	78.6	99	0.12	0.126
	Cydonia oblonga Mill.	(LBNR208)	Cognassier	Sferjel	Leaves seeds	Friction Gargle	Heals hemorrhoids. Heals sore throats.	92.8	52	0.063	
	Prunus amygdalus Batsh.	(LBNR209)	Amandier amer	Loz lharr	Leaves	Decoction Infusion	Antidiabetic. Laxative Soothes cough	72.9	82	0.099	
	Prunus armeniaca L.	(LBNR210)	Abricotier	lmchmach	Fruits	Powders	Antidiabetic. Antidiarrheal.	94	71	0.086	
	Prunus domestica L.	(LBNR211)	Prunier	Lbrkouk	Leaves Fruits	Raw	Laxative. Diuretic.	89.2	26	0.031	
	Prunus dulcis Mill.) D.A.Webb	(LBNR212)	Amandier	Louz	Leaves Fruits	Infusion Powder	Calm the cough. Laxative.	91.9	68	0.082	

	Rosa canina L.	(LBNR213)	Églantier	Nisrîn	Leaves. Fruits. Flower buds.	Infusion Powder	Antidiarrheal. Antianemic. Heals burns (mixed with olive oil).	89.3	76	0.092	
	Rosa centifolia Mill	(LBNR214)	Rosecentfeuilles	El ward	Dried buds	Decoction Maceration	Stomachic. Treat the sores.	97.3	132	0.16	
	Rosa damascena Mill.	(LBNR215)	Rose rouge de Damas	El ward el beldi	Flowers	Compress Powder	Antiseptic. Soften the hair.	94	184	0.223	
	Rosa gallica L.	(LBNR216)	Rosa rubra Black	El ward	Flower buds.	Infusion	Treats scars. Hemostatic.	87.2	163	0.197	
	Rubus ulmifolius Schott.	(LBNR217)	Ronce	Laallik, Tabgha	Fruits Flowers Leaves	Infusion Decoction Infusion	Antidiabetic. Anti-wrinkle. Against the pain of menstruation.	56	225	0.273	
	Sanguisorba minor Scop.	(LBNR218)	Sanguisorbe	Faggass laklab	Aerial parts Roots	Infusion Gargle Powder	Antidiarrheal. Heals gastrointestinal disorders. Fights gum infections and infectious tonsillitis. Relieves burn and heals eczema.	66.4	78	0.094	
Rubiaceae	*Rubia tinctorum* L.	(LBNR219)	Garance	Fouwwa\ Taroubiya	Roots Leaves	Decoction Cooked	Against jaundice and liver diseases. Antianemic.	85.9	126	0.152	0.152
Rutaceae	*Citrus aurantium* L.	(LBNR220)	Oranger amer	Larange	Fruits Flowers	Juice Poultice	Antidiabetic. Promotes blood circulation. Heal the sunburns.	79.4	108	0.137	0.099
	Citrus limon (L.) Burm.f.	(LBNR221)	Citronier	Leymun	Fruits Barks	Gargle Juice	Against angina. Heal the intestinal pain.	100	76	0.092	
	Citrus limette	(LBNR22)	Bergamia	El hamed lbldi	Flowers	Infusion	Antidiabetic. Anti-migraine.	94	58	0.07	
	Citrus sinensis (L.) Osbeck	(LBNR223)	Oranger doux	Leymun	Fruits barks Fruits	Powder Cooked	Treat acne (mixed with a Unsweetened natural yoghurt). Against the flu.	82.8	68	0.082	

	Ruta graveolens L.	(LBNR224)	Rue officinale	L-Fijel	Roots	Decoction	Antidiabetic. Relieves sciatic. Promote digestion	91.5	96	0.116	
	Ruta Montana (L.) L.	(LBNR225)	Rue sauvage	Awrma	Roots Flower	Decoction Maceration Fumigation	Stomachic. Heals liver diseases. Antidiabetic. Fight against lice (in vinegar). For the insomnia of children.	51.7	102	0.123	
Schisandraceae	*Illicium verum* Hook. F	(LBNR226)	Anis étoilé	Badiana	Fruits Leaves	Decoction Powder	Against digestive problems and in particular bloating. Migraine Therapy.	74.2	68	0.082	0.082
Solanaceae	*Capsicum annuum* L.	(LBNR227)	Poivron	Felfla	Fruits	Cooked Other	Aperitif. Antiseptic. Diuretic. Antidiabetic	86.3	61	0.074	0.094
	Capsicum frutescens L.	(LBNR228)	Poivre de cayenne	Flfla harra	Fruits	Decoction Powder	Vermifuge (in olive oil). Strengthens the hair (in apple vinegar).	82	87	0.105	
	Datura stramonium L.	(LBNR229)	Stramoine	Lkoukhra	Seeds	Decoction Powder	Soothes the cough. Antiseptic. For weight gain (with couscous beans).	92	79	0.095	
	Hyoscyamus niger L.	(LBNR230)	Jusquiame	Guingate	Leaves Flowers	Decoction	Relieves sciatic or rheumatic pains. Treat eczema.	94	146	0.177	
	Solanum dulcamara L.	(LBNR231)	Morelle	Ainab dib	Stems Leaves	Poultice Decoction Powder	Anti-rheumatic. Against chronic bronchitis (in milk), Migraine Therapy.	83.5	92	0.111	
	Solanum lycopersicum L.	(LBNR232)	Tomates	Maticha	Fruits	Juice	Antianemic.	100	86	0.104	
	Solanum nigrum L.	(LBNR233)	Morelle	Adil n'Ouchn	Leaves	Decoction Powder	Antiulcer. Promotes the healing of wounds.	73	28	0.033	
	Solanum tuberosum L.	(LBNR234)	Pomme de terre	Bttata	Tubers	Poultice Juice	Antiseptic. Stomachic	84.8	58	0.07	

	Withania frutescens (L.) Pauquy	(LBNR235)	Morelle	Tirnet	Leaves Roots	Decoction Juice Infusion Powder	Heals asthma Heals otitis. Antidiabetic Treat wounds, abscesses and smallpox.	72.7	64	0.077	
Taxaceae	*Taxus baccata* L.	(LBNR236)	If commun	Igen	Leaves Roots	Compress Decoction	Against the bites of vipers. Antidiabetic	92	68	0.094	0.082
Thymelaeaceae	*Daphne gnidium* L.	(LBNR237)	Daphne garou	Lazzaz	Leaves	Decoction Infusion	Heals toothache Strengthens the hair and stops their fall.	72.2	63	0.076	0.106
	Thymelaea hirsuta (L.) Endl	(LBNR238)	Passerine dioïque	Mtnane	Leaves Stems	Decoction Infusion	Against the fungi of the feet. Treatment of urinary tract infection. Antidiabetic.	89	112	0.135	
	Thymelea virgata Mill.	(LBNR239)	Thymelée	Metnan	Leaves stems	Decoction	Antidiabetic. Diuretic.	79.3	89	0.108	
Urticaceae	*Parietaria mauritanica* Durieu	(LBNR240)	Pariétaire	Herrast lehjar	Leaves	Poultice Dcoction	Anti-hemorrhoids. Antiulcer. Against nephritic lithiasis	96	121	0.146	0.117
	Urtica urens L.	(LBNR241)	Ortie	Tikzint	Flower heads Leaves	Poultice Infusion Powder	Against eczema and hair loss. Inflammation of the urinary tract. Antirheumatic. Antidiabetic.	66.9	73	0.088	
Verbenaceae	*Aloysia citriodora* Palau.	(LBNR242)	Verveine odorante	Lwizza	Aerial parts.	Decoction Infusion Poultice	Antidiabetic. Calming. Against intestinal disorders in infants.	73.6	79	0.095	0.095
Vitaceae	*Vitis vinifera L.*	(LBNR243)	Vigne rouge	Laanab	Leaves	Poultice Compress Decoction	Heals hemorrhoids. Anti-migraine. Promotes blood circulation. Antidiabetic.	82.2	81	0.098	0.098
Xanthorrhoeaceae	*Aloe vera* (L.) Burm.f.	(LBNR244)	Aloès	Sibr	Leaves	Decoction	Antidiabetic. Anti Ulcer. Sedative.	100	101	0.122	0.105

	Asphodelus microcarpus Salzm & Viv.	(LBNR245)	Asphodèle à petite fruit.	Blîluz	Roots Leaves Tubers	Maceration Decoction	In olive oil to cure the problems of the ears. Clean the abscesses. Antidiabetic.	77.3	73	0.088	
Zingiberaceae	*Alpinia officinarum* (L.) Willd.	(LBNR246)	Le galanga	khoulandjan	Roots	Decoction Powder	Antiemetic. Anti-inflammatory. Treat digestive disorders Aperitif.	67	73	0.088	0.098
	Zingiber officinale Rosc	(LBNR247)	Gingembre	Skinjbir	Roots	Decoction Poultice Infusion	Antidiabetic. Heals rheumatic (in olive oil). Against the cold.	83.5	89	0.108	
Zygophyllaceae	*Zygophyllum gaetulum* Emberger & Maire	(LBNR248)	Zygophylle	Aaggaya	Leaves	Infusion	Antidiabetic. Antiseptic Antispasmodic Anti-eczema.	85.1	108	0.131	0.131

The families are presented in alphabetical order. For every identified species is assigned: a scientific name, the common name, the used part, the method of preparation appropriate by the interviewees and the therapeutic use of these plants in the given area of study also the data of FIV, RFC, FC and FL.

Frequency of botanical familiesthe most used and their family use value (FIV):

Among the 70 families, the dominant families were Asteraceae (30 species), Lamiaceae (25 species each), followed by Apiaceae (18 species), Fabaceae (16 species), Poaceae and Rosaceae (12 species eachBrassicaceae and solanacae (9 species each), Cucurbitaceae and Rutaceae (6 species each), the families of Cupressaceae, Euphorbiaceae, Malvaceae ,Myrtaceae, Oleaceae,and Renonculaceae were represented in the area by 4 species each, Amaranthaceae, Anacardiaceae, Aspargaceae, Caryophlaceae, Cistaceae, Papaveraceae, Plantaginaceae and Thymeleaceae were represented by 3 specieseach. These families alone represent 191 species or 77.02%.The remaining 55 botanical families hold only one or two species each (57 species used or 22.98%) (Fig .2).

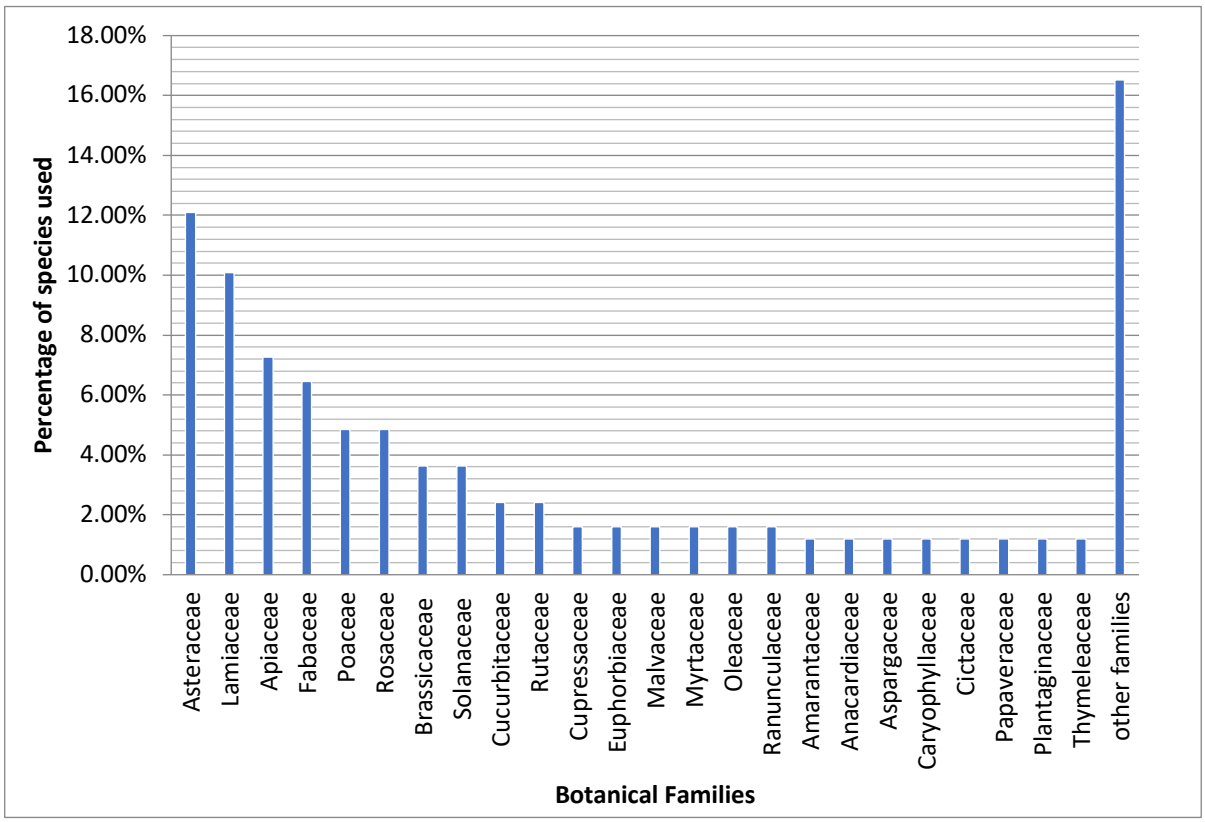

Figure 2. Percentage of species used (according to family).

Several ethnobotanical studies in Morocco revealed that Lamiaceae and Asteraceae were the most dominant (Mehdioui *et al.* 2007, Lahsissene *et al.* 2019*).*

Based on the FIV index, the10 most cited families were Euphorbiaceae (FIV=0.169), Myrtaceae (FIV=0.165), Rhamnaceae (FIV=0.158), Rubiaceae (FIV=0.152), Ericaceae and Amaryllidaceae (FIV=0.149), Lamiaceae (FIV=0.147), Iridaceae (FIV=0.138), Lyrthaceae (FIV=0.137) and Ranunculaceae (FIV=0.133) (Fig. 3).

The abundance of these families may be explained by the geological nature in the study area, because the mountains offer a high availability of medicinal plants, which allow several species adapt easily to the climatic, geological and edaphic conditions from this region, for example *Euphorbia resinifora* (Euphorbiaceae), that exhibited a higher FIV (0.169) is at the same time an endemic species of the atlas of Azilal.

RFC and FL plant species:

The relative frequencies of citation (RFC) were used for evaluating the most used plant species by the interviewed. In this study RFC values ranged from 0.019 to 0.347, and the most cited species by participants were *Eucalyptus globulus* Labill (RFC=0.347) and *Euphorbia resinifera* Berg (RFC=0.33), because these plants were mentioned

by a large number of informants, these species should be taken into account in future studies, to properly determine their efficiency, and they can also be used for phytochemical and pharmaceutical analysis to identify their active constituents for any drug extraction (Vitalini *et al*. 2013). On the other hand, the species having lowest values of RFC, such as, *Buxus sempervirens* L. (RFC=0.025) and *Paronychia argentea* Lam (RFC=0.026) ,should not be abandoned, in order to be able to preserve the transcribed traces of phytotherapeutic practices, the transmission of which is essentially oral. This makes it a treasure that is diminishing over time in a society where orality is still a modus vivendi vivace (Table 2).

Fidelity level (FL), is an ethnopharmacological quantitative tools used to select for each disease which is the most effective medicinal plant, in the present study, FL values varied between 46% to 100%.The calculation of the results showed that the most medicinal plants (140species), had a high fidelity value (>80%), 33 species had a (=100%), 55 medicinal plants had a FL>60% ,and only the 18 remaining species show low fidelity values (< 60%) (Table2). These results show that the majority of the medicinal plants reported by the respondents have a high level of fidelity, that is to say a better healing potential, because they have been used to treat a single category of disease. In general, a FL of 100% for a specific plant indicates that all of the use-reports mentioned the same method for using the plant for treatment extraction (Srithi *et al*. 2009).

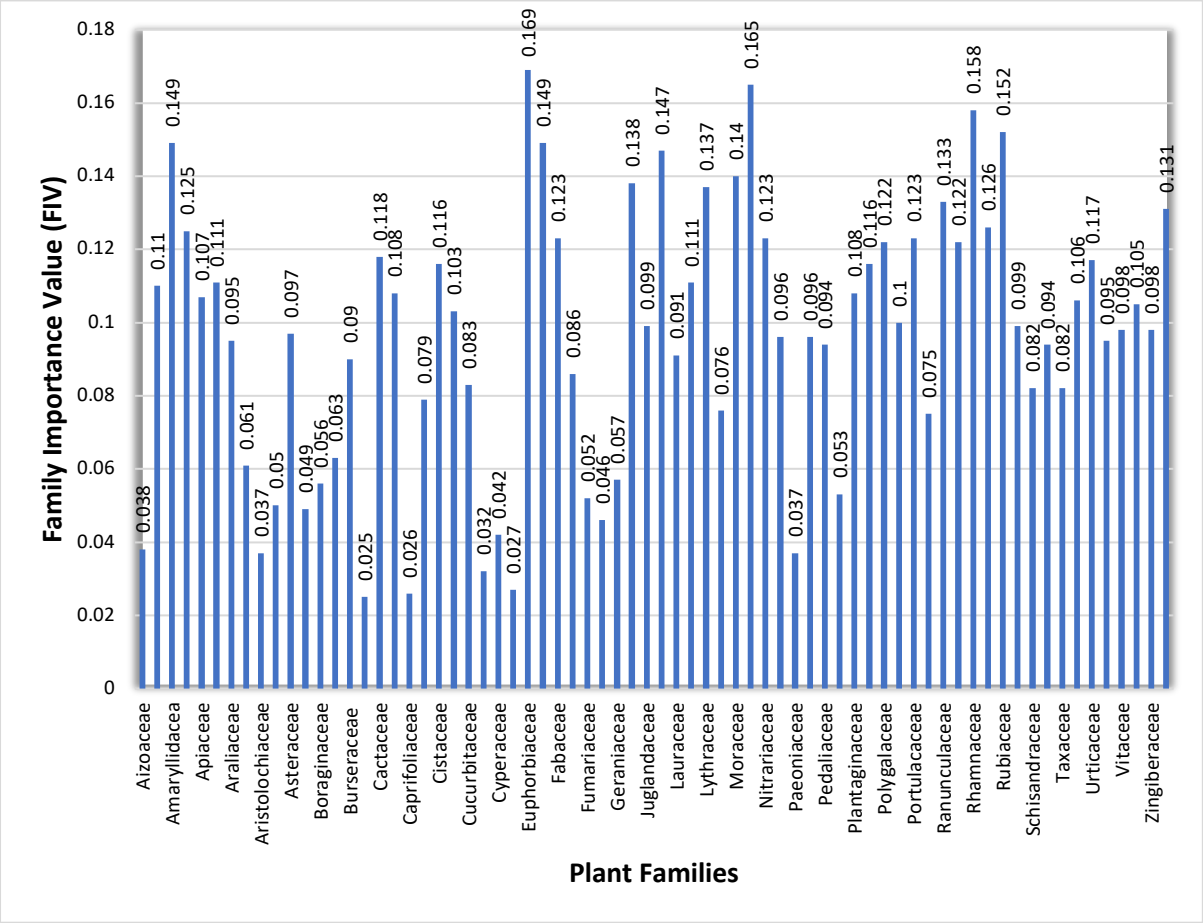

Figure 3 Family Importance Value (FIV) of medicinal plants.

Parts of the medicinal plants used in the study area:

The used parts of plants differed according to the plant itself, and the pathology treated. For example, the leaves of *Pistacia lentiscus* Desf are used for the treatment of gastric maldies, while its root is used to treat diarrhoea and the barks are antidiabetic. In contrast, only one part of the plant can be used for the treatment of different conditions, for example the roots of *Cynaria humilis* L. in powder are indicated for the treatment of the burns, and their decoction like anti-diabetic. The surveys carried out in the Central High Atlas make inferences to 16 parts: the leaves, the fruits, the seeds, the roots, the whole plant, the bark, the leafy stems, the aerial parts, the flowers, the flower heads, the stems, bulbs, young shoots, snowshoes, stigmas, nails. Results are illustrated in Fig 4.

Leaves are the most used parts in traditional medicine recipes with a percentage of 21.25%; also this high frequency of use of leaves can be interpreted by the ease and speed of their harvest (Bitsindou & Lejoly 1996). Then come fruits and seeds with respective rates of 11.8% and 11.15%. These two high percentages are probably related to the fact that these parts are accessible because they are apparent.

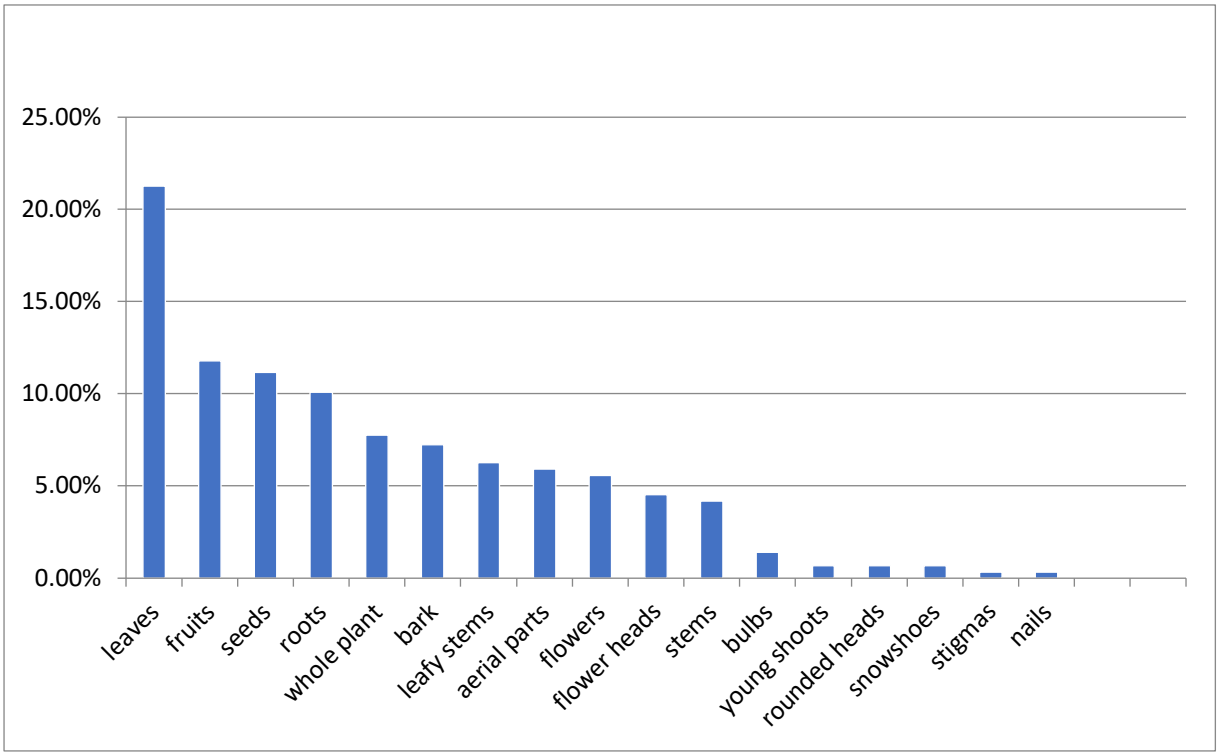

Figure 4. Percentage distribution of the different plant parts used

If taking the leaves as the most used organ of the plant into account, we noticed during our field prospections that the users remove the entire plant completely instead of looking only for the desired part (leaves). Since there is a clear relationship between the used part of the exploited plant and the effects of this exploitation on its being (Cunningham *et al.*1997). This collecting method seriously compromises the sustainability of the medicinal species concerned, especially the bulbous ones.

So, it is therefore in the leaves that photosynthesis takes place and sometimes constitutes the storage of secondary metabolites that are responsible for the biological properties of plants (Bigendako-polygenis & Lejoly 1990), they are also characterized by their ease and rapid harvest (Bitsindou & Lejoly 1996), and this may explain the high rate of foliage used by the population of the region.

Methods of preparation:

The plants harvested by the interviewee were prepared by the users themselves, on the other hand, the plants obtained at purchase were in prepared form (dried and sometimes crushed), so the same plant can be prepared differently, depending on the part used and the disease treated, for example: Eucalyptus globulus Labill leaves in decoction are antiseptic, and in poultice treat cough, flu and cold, while the bark decoction is antidiabetic. The methods of preparation most used and most feasible have been classified in descending order of magnitude: decoction (31.62%), infusion (25.69%), poultice (14.58%), raw (5.9%), maceration (5.55%), cooked (3.29%), compress (2.61%), fumigation (1.73%). The rest consists mainly of preparation methods rarely mentioned by the population and representing a rate of 9.03% (Fig. 5).

This shows that decoction was the most common method of preparation in the study area. Similar results are obtained in other studies conducted in Morocco (Chaachouay et al. 2019, El Rhaffari et al. 2002, Lahsissene et al. 2009, Mehdioui et al. 2007, Slimani et al. 2016).

It should also be noted that the majority of these preparations (31.62%) are made by the herbal tea form (Fig. 6), because it is easily assimilated by the body, and it can collect the majority of active ingredients existing in medicinal plants, and by using the fresh parts of these plants (Fig. 7). Similar studies

have shown that herbal tea is the most usable form of herbal remedies (El Alami et al. 2015, Hachi et al. 2015 Slimani et al. 2016), and that fresh parts are the most recommended (Abdurhman 2010).

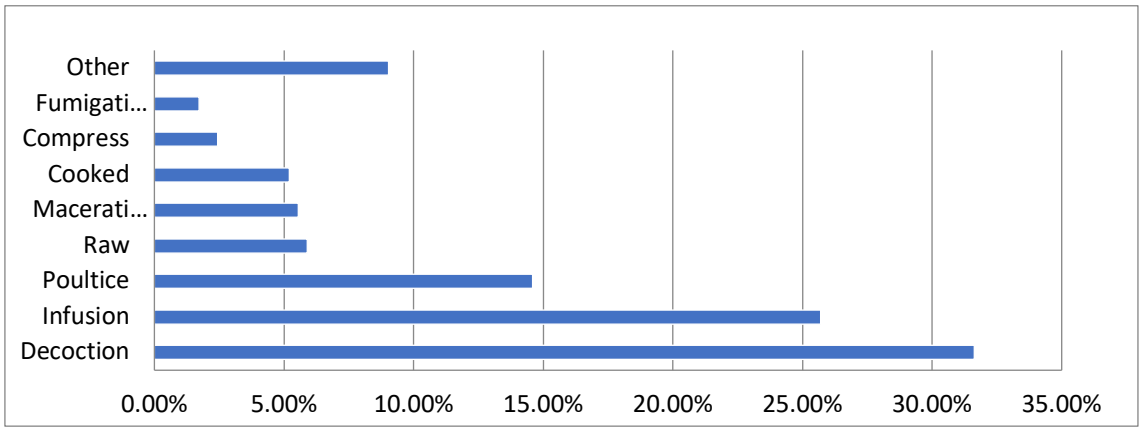

Figure 5. Percentage methods of preparation

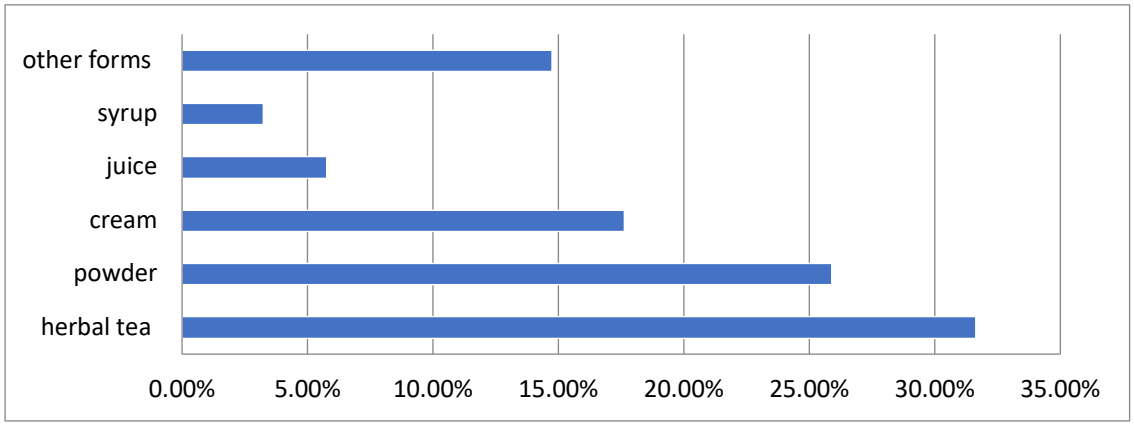

Figure 6. Forms of preparation

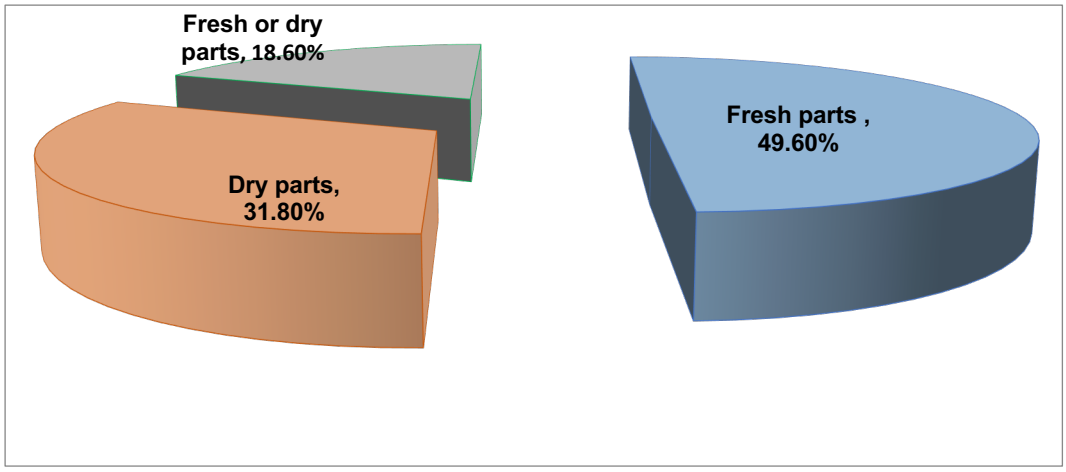

Figure 7. Percentage conditions of preparation

Methods of Administration

Several methods of employment were mentioned during our investigation, including the oral route, massage, brushing, gargling and rinsing were the main modes of employment, other modes of administration were less cited (Fig. 8).

The respondents believed that the oral route is the most practical and safest way that facilitated the absorption of the active principles of medicinal plants, to transport them easily in the body, and consequently the cure of the target diseases. Similar findings indicated predominance of oral employment in Africa (Bousta *et al.* 2014, Cher-mat & Gharzouli 2015, El Rhaffari *et al.* 2002, Rhattas *et al.* 2016).

Distribution of medicinal plants according to the group of diseases treated

The ethnopharmacological analysis has shown that the populations of the central High Atlas use the medicinal plants to treat different types of diseases. Nevertheless, it should be noted that a single plant can be used for the treatment of several ailments, and a single disease condition can be treated by several plants. For example, *Artemisia herba-alba* Asso is widely used in the study area, for its properties: antidiabetic, antispasmodic, anti septics, anthelmintics, and hypertensive and to treat urinary ailments. While dibetic diseases can be treated by several plants, for example, *Euphorbia resinifera, Trigonella foenum, Salvia officinalis, Zygophyllum album*. This study revealed that most of the plants represented in our region are used to treat gastrointestinal diseases(18.76%), diabetic diseases (13.9%), genitourinary infections (9.49%), respiratory disorders (8.38%) and skin diseases (6.84%), while 5.29% of the species are used as antiseptic, 5.07% to treat rheumatological disorders, 4.63% for hair care, 4.42% to treat cardiovascular diseases and 3, 53% facial treatments. Some plants are used to stimulate appetite (2.86%), others to treat neurological disorders (2.65%) and to treat burns (2.42%), Hepatic and haemostatic, ocular, auditory and anemic diseases are treated by less than 8% of the medicinal plants listed in the study area (Fig 9).Previous studies have shown that digestive diseases were the ailments most treated with medicinal plants (Daoudi *et al.* 2016, El Azzouzi & Zidan 2015,Salhi *et al.* 2010, Tahri *et al*. 2012).

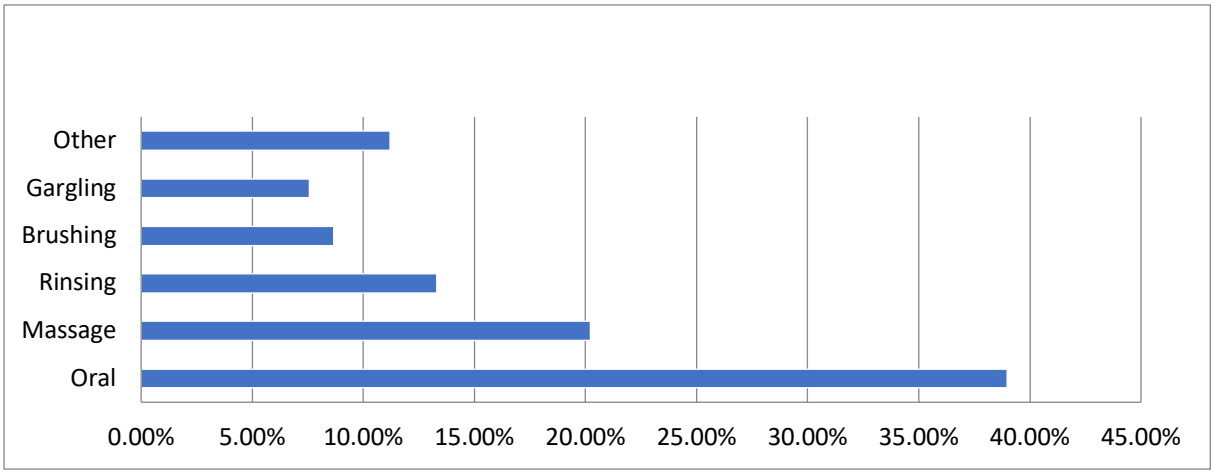

Figure 8. Percentage employment methods

Traditional knowledge acquisition modes

During our field survey, it was found that 39.81% of respondents based their choice of appropriate medicinal plants on the experience of their ancestors,who hold the traditional knowledge of treating diseases,while 32.14% consulted herbalists,24.2% were referred on their own experience, because of the presence of many medicinal plants in their environment, or by reading books on traditional Arab medicine, or from television and radio programmes, while a small minority acquire their traditional knowledge through a doctor.This knowledge in phytotherapy was acquired by the local populations over centuries and is transmitted from one generation to another, which will safeguard ancestral knowledge. Especially since accumulated experience with age constitutes the main source of information at local level about the use of plants in traditional medicine (Fig. 10).

The reasons for choosing this herbal medicine

Herbal medicine in this study was used for its low cost in most patients (54% of cases), and its effectiveness in 46% of cases. A study carried out in this area, in the Fès - Boulemane region in Morocco, had shown that phytotherapy is preferred by the local population for its low cost in most patients (54% of cases), and its effectiveness in 38% of cases (Jouad *et al* 2001).

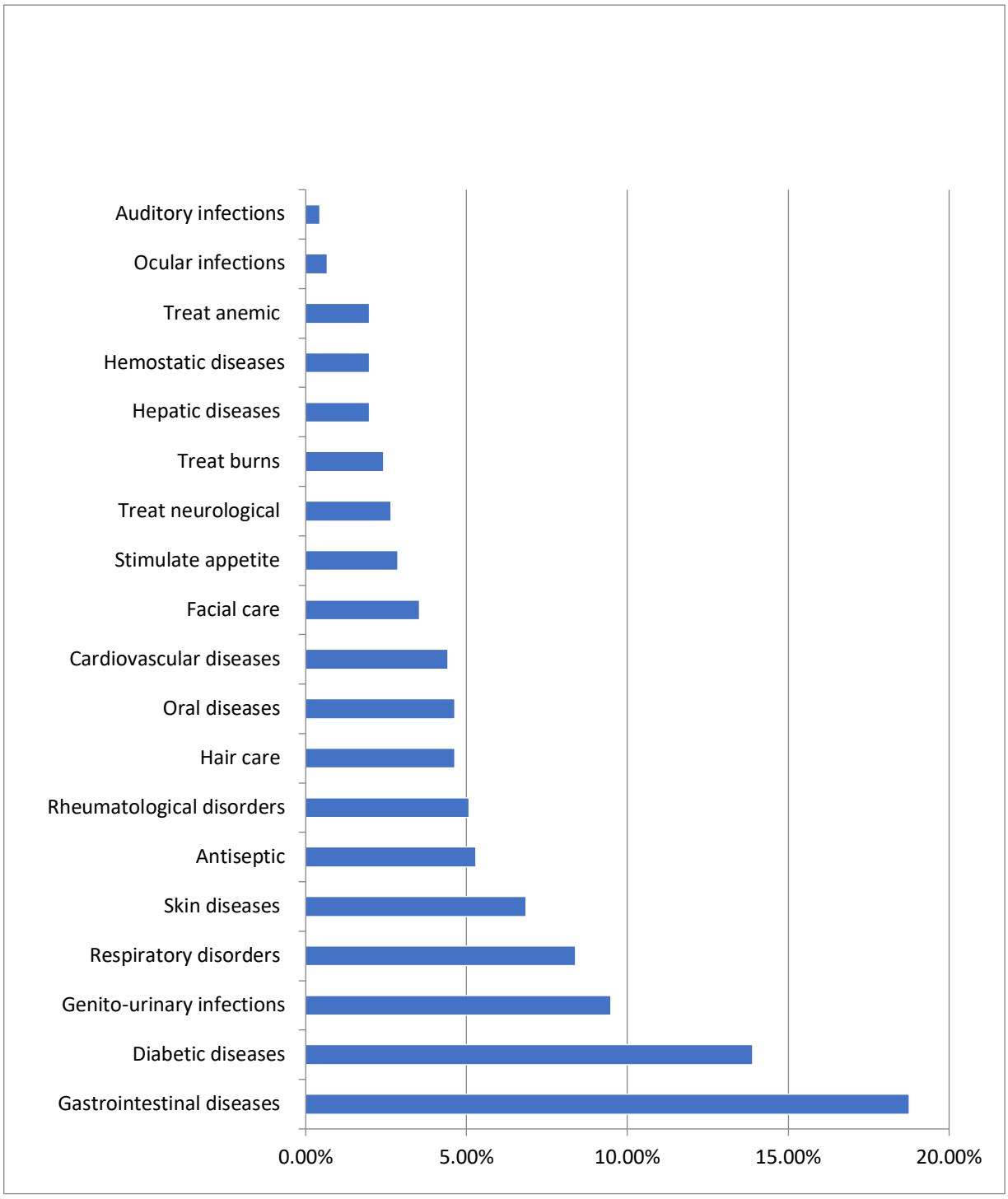

Figure 9. Distribution percentage of medicinal plants uses depending on treated diseases group

The results of care

According to the ethnobotanical survey conducted in the Central High Atlas, we observed that 66.24% of people believed that medicinal plants help healing diseases, while 26.31% said that medicinal plants help only in improving health status, however, only 7.45% of the local population believed that medicinal plants can cause toxicities or may have side effects, if the user of these plants has not complied with the recommended dose and the technique of use (Fig. 11). Similar studies conducted in the Tafilalat region of south-eastern Morocco, indicated that 63% of people interviewed declared that modern medicine is the best (Eddouks *et al*. 2002). While in Guinea (in Black Africa), 85% of those participants were satisfied with the results of the use of medicinal plants (Baldé et al 2006).

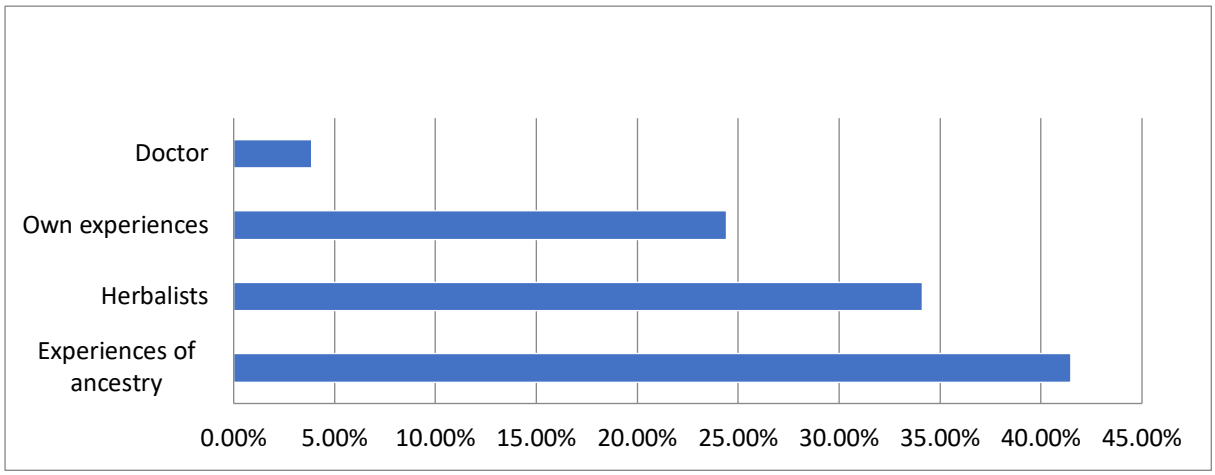

Figure 10. The reasons for choosing this herbal medicine

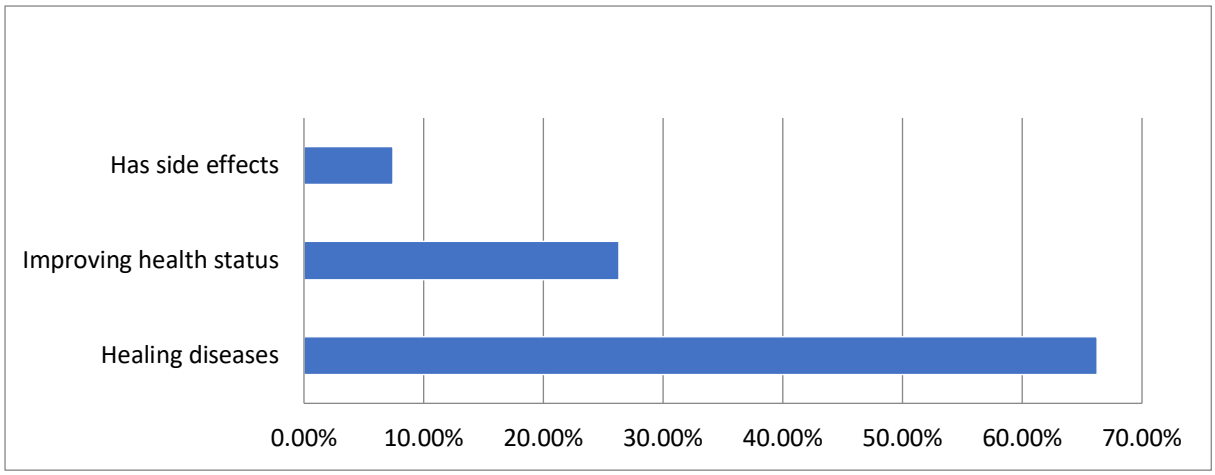

Figure 11. Results of care as a percentage

Conclusions

This study made it possible to determine the attachment of the population of the Central High Atlas of Morocco to the traditional heritage, and to collect information on the therapeutic uses practiced in this study area. Thus, the series of ethnobotanical and ethnopharmacological surveys revealed the region's wealth of medicinal plants, which constitute a very rich reservoir of biodiversity.

In this region, older women have a greater knowledge of phytotherapy and play an essential role in the conservation of therapeutic traditions based on medicinal plants and pass it on to their descendants.

From an ethnobotanical and pharmacological point of view, foliage is the most widely used part and decoction is the most widely used galenical form. Similarly, of all the diseases treated, gastrointestinal disorders and diabetes are the most frequently cited.

In addition, this study showed that the local populations of the Central High Atlas use 218 belonging to 73 families for the prevention and treatment of diseases. This region is the source of a very large number of medicinal plants for the whole of Morocco. This wealth of plants for therapeutic use is accompanied by the knowledge and practices of phytotherapy acquired by the inhabitants of the Atlas over the centuries.

Moreover, these results constitute a source of information that contributes to the knowledge of the medicinal flora and to the preservation of a local popular know-how that is tending to disappear. It will also be a database for the valorisation of medicinal plants in order to discover new active principles that can be used in pharmacology.

Declarations

List of abbreviations: Not applicable

Ethics approval and consent to participate: The study was approved by University Research Degree

Committee of Kumaun University Nainital. All participants provided oral prior informed consent and signed in the questionnaire as their consent.

Consent for publication: Not applicable

Availability of data and materials: Not applicable

Competing interests: The authors declare no competing interest.

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Authors' contributions: SB: Carried out field survey in High Atlas Central, compiled the literature sources, analyzed the data collected, interpreted the results and wrote the manuscript. JD: Made a substantial contribution to data analysis and wrote the first draft of the manuscript. NB: provide help for data analysis and writing of the manuscript. LZ: Designed the research and identified the plant species. All the authors participated in writing and giving feedback on the manuscript and approved the final version of the manuscript.

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