



ANTIDIABETIC MEDICINAL PLANTS IN MOROCCO: ETHNOBOTANICAL SURVEY OF THE POPULATION OF BÉNI MELLAL

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Abstract

The ethnobotanical study conducted in the city of Béni Mellal in 2017 has as main objective the evaluation of the city's potential in medicinal plants used specifically in the treatment of diabetes. For this purpose, the survey targeted 100 people of the local population and 33 plant taxa belonging to 22 families were identified for the treatment of diabetes.

These taxa belong mainly to the families of Lamiaceae (06), Fabaceae (03), Amaryllidaceae (02), Chenopodiaceae (02), Euphorbiaceae (02) and Oleaceae (02). The most important antidiabetic plants are: *Trigonella foenum-graecum* L. (11), *Olea europaea* L. (07), *Globularia alypum* L. (06), *Thymus satureioides* Coss (06), *Salvia officinalis* L (05) and *Aloe succotrina* Lamk (05). The leaves remain the most used organs; the decoction and infusion are the two most dominant modes of preparation.

Key words : Medicinal plants, ethnobotany, Béni Mellal, diabetes.

Introduction

The diabetes is a chronic multi-factorial disease that continues to grow in every country in the World. It is one of four priority non-transmissible diseases targeted by World leaders. It is a serious chronic metabolic disease that occurs when the pancreas does not produce enough insulin (a hormone that regulates blood sugar levels or blood glucose) or when the body is not able to use correctly the insulin it produces (OMS, 2016). A subject is considered to be diabetic when involved in any of the following situations: fasting blood glucose greater than or equal to 1.26 g / L (7 mmol / L) or symptoms of hyperglycemia and incidental finding at anytime of day of a blood glucose level, greater than or equal to 2 g / L (11.1 mmol / L) or a blood glucose level at the 2nd hour of an OGTT that is greater than or equal to 2 g / L (11.1 mmol / L) or hemoglobin A1c (HbA1c) greater than or equal to 6.5% (ADA, 2013; Goldenberg *et al.*, 2013; Wémeau *et al.*, 2014). Globally, the number of diabetes is estimated at 422 million in 2014, compared to 108 million in 1980. The global prevalence of diabetes has almost

doubled since 1980, passing from 4.7% to 8.5%. In 2012, the diabetes caused 1.5 million deaths (OMS, 2016). In Morocco, the number of diabetics is estimated between 1.5 and 2 million people aged 20 and over, 50% of whom are unaware of their disease (Ministère de la Santé au Maroc, 2015).

The ethnobotanical information collected in several regions of the World estimates that more than 1123 plant species, more than 725 genera belonging to 183 families, are used for their hypoglycemic and antihyperglycaemic properties (Bailey and Day, 1989; Marles and Farnsworth, 1995; Eddouks *et al.*, 2007).

Consequently, our study lies in the framework of classifying and recognizing the local flora of therapeutic interest used in traditional medicine for the treatment of diabetes in the city of Béni Mellal.

Material and Methods

Presentation of the study area

The city of Béni Mellal (Fig. 1) is located at the foot of the northern flank of the central High Atlas on the national road that connects the cities of Marrakech and Fez, about 200 km northeast of Marrakech and about

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200 km southeast of Casablanca. The capital of the Béni Mellal-Khénifra economic region, it is considered as a regional economic center according to its geographical location which makes it a place of exchange, its historical heritage and the richness of its irrigated agriculture. The climate of the region is semi-arid with temperate winters and very hot summers. It is characterized by:

1. Very high summer temperatures (average of the maximum 37.7°C) and low winter (average of the minimum 4.9°C).
2. Irregular average rainfall (550 mm/year) (Abhoer, 2016).

The population of the city of Béni Mellal would increase from 192 056 in 2014 to 233 473 inhabitants around 2030, representing an overall growth rate of 21.5% and an additional population of 2588 people on average per year (Direction Regional De Beni Mellal-Khenifra, 2017). Irrigated by the beautiful source of Ain Asserdoune, Béni Mellal forms a large task of greenery at the foot of the High Atlas.

Survey and sampling

Between 2016 and 2017, an ethnobotanical study was carried out in the intention of collecting information on the plants used to treat diabetes in the city of Béni Mellal. The precision of different ethnobotanical survey areas was performed by using a stratified random sampling (Gounot, 1969). The samples of 20 people are then formed for each of the 8 strata and are put together to constitute the overall sample (100 people). The ethnobotanical surveys were conducted using 100 questionnaire cards that were used to investigate the traditional healers, the

Table 1: The socio-demographic characteristics of the respondents (n = 100) in the city of Béni- Mellal.

Characteristics	Numbers	(%)
The users of traditional medicine	30	30
The users of modern medicine	9	09
The users of traditional and modern medicine	61	61
Age		
18–33 years	11	0,11
33–45 years	24	0,24
45–60 years	36	0,36
>60 years	29	0,29
Sex		
Female	63	0,63
Male	37	0,37
Academic level		
Illiterate / Primary level	83	0,83
Secondary level	02	0,02
University level	15	0,15

herbalists and the users of medicinal plants. These questionnaires include precise questions about the informant, the non-vernacular of each species, the part used, the method of preparation and administration, the dose and the toxicity.

In this study, the identification of each plant was based on the name of the identified plants using competent informants of the region. The mentioned plants were collected and the determination of their taxonomy has been realized thanks to the botanical works: «Practical flora of Morocco. Manual plant determination, Vol 1 and 2» (Fennane *et al.*, 1999 et 2007),

«The traditional Moroccan pharmacopoeia, ancient Arab Medicine and popular knowledge (Bellakhdar, 1997) and «The medicinal plants of Morocco» (Sijelmassi, 1993).

Results and Discussion

Demographic characteristics of the respondents

Concerning the diabetes, this is the first study of its kind carried out in the city. The ethnobotanical survey was conducted among 100 informants, including the traditional healers, the herbalists and the users of medicinal plants. It should be noted that 63% of respondents are women and 37% are men (Table 1). This trend has been similarly shown by some earlier studies (Jouad *et al.*, 2001; El Beghdadi, 1991; Hamdani, 1984; Jaouad, 1992; Nabih, 1992; Ziyat *et al.*, 1997). This explains women's attachment to traditional knowledge (Hamdani, 1984; Jaouad, 1992; Nabih, 1992). Thus, during the moments of the survey, women were most often at home (Jouad *et al.*, 2001). As mothers, they are the ones who provide first aid for their children. Therefore, they have used these medicinal plants in other fields other than therapy (Benkhniguel *et al.*, 2011).

Also, it is important to note that the medication by the plants depends on the age. In fact, the age group between 50 and 70 years old represents the highest percentage (49%) of people taking medicinal plants, aging between 30 and 50 years old represents 26% and that having an age of less than 30 years old represents 23% (Table 1). This result is in line with other reports previously prepared in other regions of Morocco where the older people represent the majority in the use of medicinal plants (Abouri *et al.*, 2012 ; Mehdioui et Kahouadji, 2007).

Furthermore, we notice that 61% of people use herbal medicine, 30% use both herbal and modern medicine, but only 9% depend on modern medicine (Table 1). This indicates that herbal medicine has always been practiced in this region. It is a common

Table 2: Plants used to treat diabetes in the region of Béni Mellal.

Families and plant species	Vernacular name	Part used	Method of preparation	Administration mode	Frequency
Amaryllidaceae					
<i>Allium sativum</i> L.	Touma	Bulb	Cru	Oral	3
<i>Allium cepa</i> L.	Al Bassla	Bulb	Cru	Oral	3
Apiaceae					
<i>Carum carvi</i> L.	Lkarwya	Seed	Decoction/Maceration /Infusion/ Powder	Oral	2
Cactaceae					
<i>Opuntia ficus-indica</i> (L.) Mill.	Lhndia /karmous n'sara	Stem/flower / Racket	Decoction / Powder	Oral	2
Cucurbitaceae					
<i>Citrullus colocynthis</i> (L.) Schrader	Lhedja	Seed	Decoction / Powder	Oral	2
Chenopodiaceae					
<i>Atriplex halimus</i> L.	Legtef	Leaf	Decoction / Infusion	Oral	1
<i>Cucurbita pepo</i> L.	Gueraalmra	Fruit	Cooked	Oral	2
Cupressaceae					
<i>Tetraclinis articulate</i> Benth.	El-arar	Leaf / Aerial part	Maceration/Poudre	Oral	3
Euphorbiaceae					
<i>Euphorbia echinus</i> . Coss et Hook.	Ddaghmúss	Stem	Maceration	Oral	3
<i>Euphorbia resinifera</i> Berg**	Zaqoum	Leaf stems	Decoction	Oral	1
Fabaceae					
<i>Lupinus albus</i> L.	Termíss	Seed	Decoction /Powder	Oral	4
<i>Phaseolus vulgaris</i> L.	Loubiyaalkhadra	Fruit /Clove	Juice	Oral	3
<i>Trigonella foenum-graecum</i> L.	Lhelba	Seed	Decoction / Powder	Oral	11
Geraniaceae					
<i>Pelargonium roseum</i> Willd.	Laattercha	Leaf stems	Infusion	Oral	2
Globulariaceae					
<i>Globularia alypum</i> L.	Ainlarneb /Tasalra	Leaf	Decoction / Infusion	Oral	6
Juglandaceae					
<i>Juglans regia</i> L.	Siwak/Grgaa	Leaf /Écorce	Decoction / Infusion	Oral	2
Lamiaceae					
<i>Ajuga iva</i> (L.) Schreb	Chendgoura	Leaf stems	Decoction	Oral	4
<i>Lavandula dentata</i> L.	El-khzama	Leaf stems / inflorescence/ Aerial part	Decoction / Infusion	Oral	1
<i>Rosmarinus officinalis</i> L.	Yazir	Leaf stems	Infusion	Oral	1
<i>Salvia officinalis</i> L.	Salmia	Leaf	Decoction	Oral	5
<i>Thymus zygis</i> L.	Za'tar	Leaf stems	Decoction / Infusion	Oral	2
<i>Thymus satureioides</i> Coss. et Bal.	Z'itra	Leaf	Decoction / Infusion	Oral	6
Lauraceae					
<i>Cinnamomum cassia</i> Blum, <i>C. aromaticum</i> Ness.	L-Qarfa	Root	Decoction / Powder	Oral	1

Moroccan tradition that everyone has stored traditional remedies at home (Weniger, 1991).

The dependence of the local population towards medicinal plants used to treat diabetes was the result of a series of studies conducted in different Moroccan regions: eastern Morocco (67.5%), Fès-Boulemane

(76%), Tafilalet region (80%), and Errachidia region (78%) (Ziyyat *et al.*, 1997; Jouad *et al.*, 2001; Eddouks *et al.*, 2002; Tahraoui *et al.*, 2007).

Similarly, it should be mentioned that 83% of the patients included in this study were globally illiterate (Table 1). Most of them are parents or grandparents who have

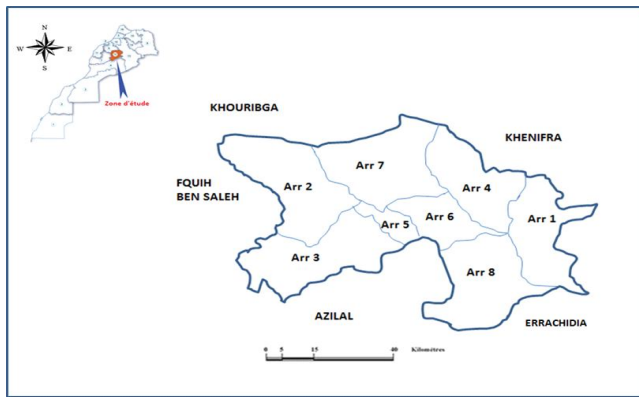


Fig. 1: Geographical location of the study area (ELAZZOUZI, 2015).

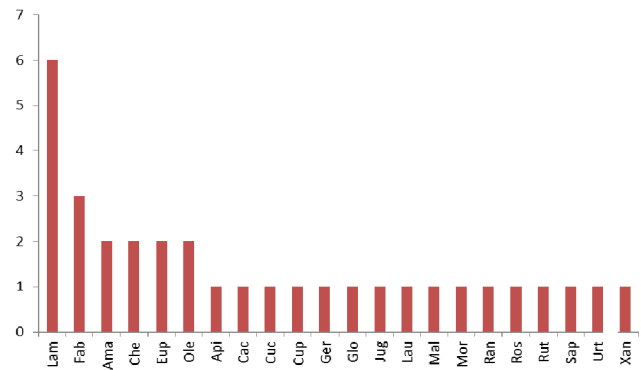


Fig. 2: Number of species per family.

(Lam: Lamiaceae, Fab: Fabaceae, Ama : Amaryllidaceae, Che : Chenopodiaceae, Eup: Euphorbiaceae, Ole: Oleaceae, Api: Apiaceae, Cac: Cactaceae, Cuc: Cucurbitaceae, Cup: Cupressaceae, Ger: Geraniaceae, Glo: Globulariaceae, Jug: Juglandaceae, lau: Lauraceae, Mal : Malvaceae, Mor: Moraceae, Ran: Ranunculaceae, Ros: Rosaceae, Rut: Rosaceae, Sap: Sapotaceae, Urt: Urticaceae ,Xan: Xanthorrhoeaceae

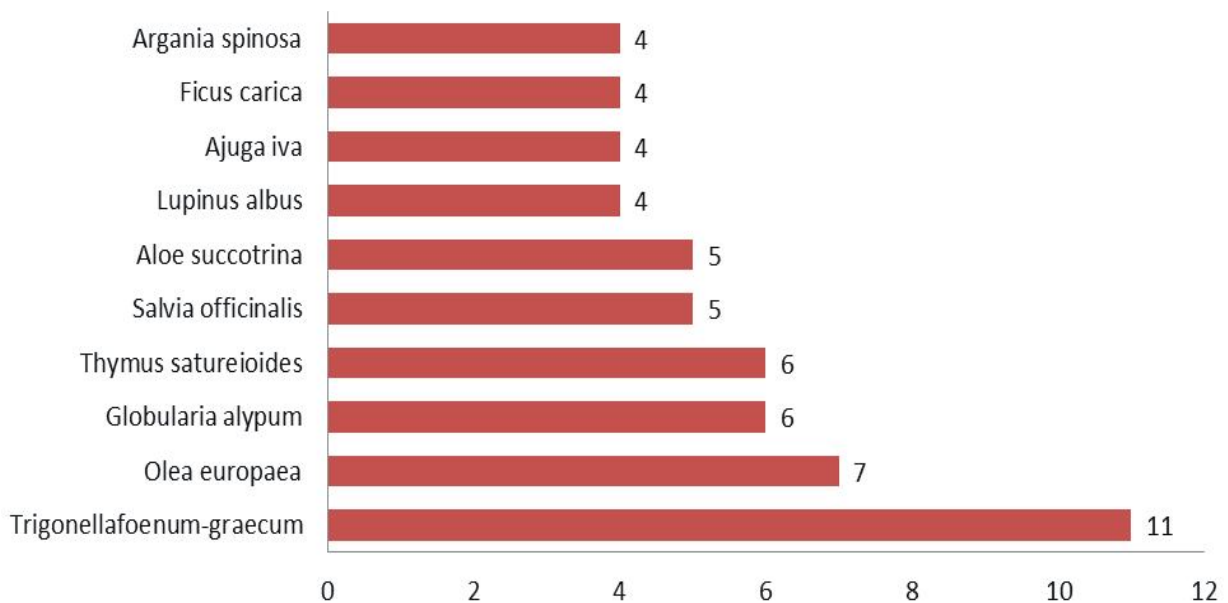


Fig. 3: The most commonly used antidiabetic plants in Béni-Mellal.

sufficient traditional knowledge about the use of medicinal plants in the treatment of diabetes. This finding is completely compatible with other ethnobotanical studies conducted in Morocco (Eddouks *et al.*, 2002; Ziyat *et al.*, 1997).

Medicinal plants used by the population

A total of 33 plant species were identified during this study. They belong to 22 families of which the Lamiaceae is the most represented with 06 species (18.18%) namely: *Ajuga iva* L. Schreb, *Lavandula dentata* L., *Rosmarinus officinalis* L., *Salvia officinalis* L., *Thymus*

zygis L. and *Thymus satureioides*. The Fabaceae were represented by 03 species (9.09%), followed by Amaryllidaceae, Chenopodiaceae, Euphorbiaceae and Oleaceae with 02 species of each (6.06%). 16 families were represented by one species of each (3.03%) (Fig. 2).

Most of the surveyed families are represented by one or two species, which shows that the *antidiabetic medicinal plants* are not concentrated in only a few families and genera. This is in agreement with other ethnobotanical studies conducted in Morocco and the

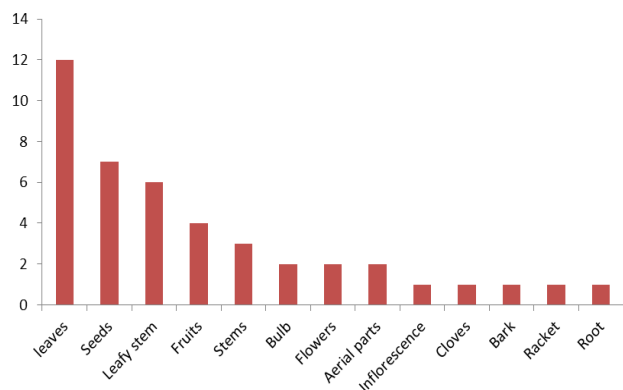


Fig. 4: Parts of used plant (%).

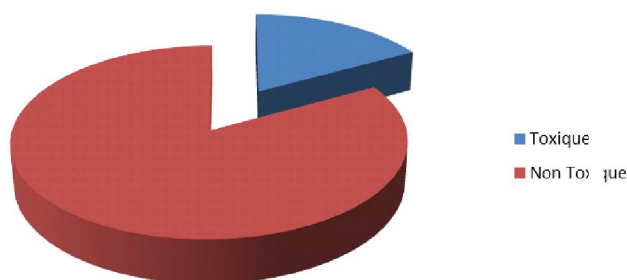


Fig. 6: Distribution of percentages of medicinal plants toxic and non-toxic.

Mediterranean region (Raja *et al.*, 1997; Ugulu *et al.*, 2009).

The plants are classified into alphabetical order according to family, genus, and species (Table 2). The most important antidiabetic plants are: *Trigonella foenum-graecum* L., *Olea europaea* L., *Globularia alypum* L., *Thymus satureioides*, *Salvia officinalis* L. and *Aloe succotrina* Lamk. (Fig. 3).

The hypoglycaemic activity of the mentioned certain plants has been demonstrated experimentally, such as: *Trigonella foenum-graecum* (Amin-Riyad *et al.*, 1988; Raghuram *et al.*, 1994), *Allium sativum* (Chang and Johnson, 1980), *Allium cepa* (Alaoui *et al.*, 1992), *Rosmarinus officinalis* (Erenmemisoglu *et al.*, 1997), *Nigella sativa* (Asdadi, 1993; Al Hader *et al.*, 1993; Ettaib *et al.*, 1994; Labhal *et al.*, 1999) and *Opuntia ficus-indica* (Enigbokan *et al.*, 1996).

Because of their great availability throughout the year, the leaves are often the most used organs (12 species, 36.36%) for the preparation of the plant-based medicines (Amri *et al.*, 2012; Shah *et al.*, 2006).

The other used parts are seeds (21.21%), leafy stems (18.18%), fruits (12.12%) and stems (9.09%). (6.06%) for bulbs, flowers and aerial parts, while (3.03%) for bark, root, inflorescence, snowshoe and clove (Fig. 4).

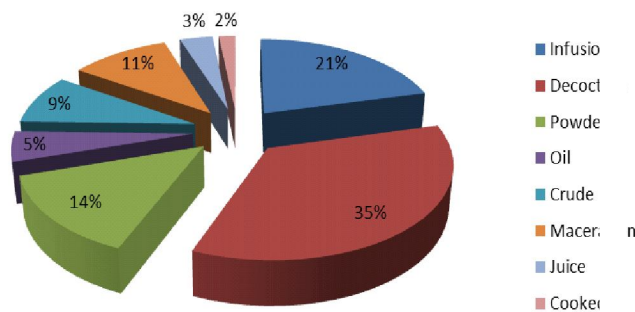


Fig. 5: Percentage of administration types.

The results of the survey indicate that the plants are used in the forms of decoction and infusion, with a frequency of 60.6% and 36.36%. (Fig. 5).

These two forms were also the most used herbal preparations in other regions of Morocco and in the World (Ziyyat *et al.*, 1997; Eddouksetal., 2002; El-Hilaly *et al.*, 2003; Kadir *et al.*, 2012; Tahraoui *et al.*, 2007; Nowbandegani *et al.*, 2015; Afolayan *et al.*, 2014; Urso *et al.*, 2016). The powder-based preparations, maceration and the raw form are also employed, but at varying frequencies, (24.24%), (18.18%) and (15.15%). We recall that the other methods of preparation are rarely used by the population of Béni Mellal (Fig. 4) and that the oral route is the main route of administration.

It should be noted that the toxic activity of several plants mentioned in our research has been proven and affirmed by numerous studies: *Salvia officinalis* L., *Euphorbia resinifera*, *Citrullus colocynthis* L., *Globularia alypum* L., *Aloe succotrina* (Benkhniqie *et al.*, 2014). *Citrullus colocynthis* (Al-Yahya *et al.*, 2000; Dehghani et Panjehshahin, 2006), *Nigella sativa* (Zaoui *et al.*, 2002; Ali et Blunden, 2003). (Fig. 6).

Conclusion

We see by what precedes in Morocco, the traditional medicines are still in practice and really constitute a rich medicinal heritage. It is a question of a repertoire to be expanded and successful plants to be identified with a view to subject them to detailed analysis experimentally and clinically in order to explore their pharmacological antidiabetic potential.

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