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

Zaouai Fouad* and Zidane Lahcen

Department of Biology, Faculty of Science, Laboratory of Nutrition, Health and Environment, BP. 133, Ibn Tofail University, Kenitra, Morocco.

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 satarioides* 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 any time 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 diabetics 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
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 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; Ziyyat 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 (Benkhnigue 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>
<thead>
<tr>
<th>Characteristics</th>
<th>Numbers</th>
<th>(%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>The users of traditional medicine</td>
<td>30</td>
<td>30</td>
</tr>
<tr>
<td>The users of modern medicine</td>
<td>9</td>
<td>09</td>
</tr>
<tr>
<td>The users of traditional and modern medicine</td>
<td>61</td>
<td>61</td>
</tr>
</tbody>
</table>

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

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; Eddoukset al., 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* (Benkhnigue 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.

**References**


sur plantes médicinales utilisées dans la province de Tata, Maroc ». *Journal International de recherche sur les plantes médicinales*, 1(7): 099-123.


Gounot, M. (1969). Méthodes d’étude quantitative de la taxonomie des plantes médicinales spontanées dans la région de la Commune d’Imi n’Tlit (Province d’Essaouira) – cas de la population riveraine de la forêt d’Amsittène:


Organisation Mondiale de la Santé (2016). Rapport Mondial sur le Diabète


