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Full Length Research Paper

Ethnopharmacological survey of medicinal plants used in the traditional treatment of diabetes mellitus in the North Western and South Western Algeria

Azzi Rachid[1]*, Djaziri Rabah[1], Lahfa Farid[1], Sekkal Fatima Zohra[2], Benmehdi Houcine[3,4] and Belkacem Nacéra[1]

[1]Laboratory Antifungal, Antibiotic, Physico-chemical, Synthesis and Biological Activity, Department of Biology, Faculty of Natural Sciences and Life Sciences of the Earth and the Universe, University Abou bekr Belkaid Tlemcen 1300, BP 119, Algeria.
[2]Department of Biotechnology, Faculty of natural science and life, University Abdelel Hamid Ibn Badiss –Mostaganem-27000, Algeria.
[3]Laboratory of LASNABIO, Department of Chemistry, University of Tlemcen 13000, Algeria.
[4]Laboratory of Plant Resource Development and Food Security in Semi Arid Areas, University of Bechar, South West of Algeria, BP 417, Algeria.

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In this study, the medicinal plants used in the treatment of diabetes mellitus were inventoried. The ethnopharmacological information was obtained from 470 patients suffering from diabetes mellitus in different areas in the North Western and South Western Algeria; 266 of them were of type 2 diabetes. The results indicated that only 28.30% of patients interviewed used medicinal plants as treatment alone or in association with the conventional treatment of diabetes. 60 medicinal plants belonging to 32 families were cited, of which the most cited were: *Trigonella foenum-graecum* (56 citations), *Rosmarinus officinalis* (27 citations), *Citrullus colocynthis* (22 citations), *Tetraclinis articulata* (21 citations), *Artemesia herba alba* (20 citations), *Origanum compactum* (16 citations) and *Punica granatum* (16 citations). The plants families' which contained the most commonly used species and their antidiabetic effects were: *Asteraceae* (8 species), *Lamiaceae* (8 species) and *Apiaceae* (4 species). Among these medicinal plants, five plants were known to be toxic: *Nerium oleander, C. colocynthis, Zygophyllum album, Nigella sativa* and *Peganum harmala.*

Key words: Ethnopharmacological survey, medicinal plants, traditional medicine, diabetes mellitus, Algeria.

INTRODUCTION

Diabetes mellitus is a metabolic disorder of multiple etiology characterized by chronic hyperglycemia with disturbances of carbohydrate, fat and protein metabolism resulting from defects in insulin secretion, insulin action, or both (WHO, 1999). Over 90% of patients with diabetes have type 2 diabetes, while the other percentage has type 1 diabetes.

According to the recent data from World Health Organization (WHO) and International Diabetes Federation (IDF), the number of people affected with diabetes worldwide has increased dramatically over recent years. Currently there are over 366 million diabetics worldwide and this is likely to increase to 552 million more by the year 2030 (Whiting et al., 2011; WHO, 2011). The disease becomes a real problem to public health in developing countries, where its prevalence is increasing steadily and adequate treatment is often expensive or unavailable (Djrolo et al., 1998). Alternative strategies to the current modern pharmacotherapy of diabetes mellitus are urgently needed (WHO, 2002).

For a long time, diabetics have been treated with medicinal plants based on traditional medicine information. Traditional herbal remedies have increased

*Corresponding author. E-mail: rachidbio@yahoo.fr.

in popularity everywhere in the world in recent years. There are several species of medicinal plants popularly used in the treatment of diabetes mellitus. World Health Organization (WHO) recommended that the use of traditional plant in connection with the management of diabetes mellitus should be assessed. In order to assess their effectiveness, safety may be evaluated to standardize their use (WHO, 1980).

Ethnopharmacological surveys indicate that more than 1200 plants are used worldwide in traditional medicine for their alleged hypoglycemic activity (Ivorra et al., 1989; Rahman and Zaman, 1989; Marles and Farnsworth, 1995; Roman-Ramos et al., 1995; Soumyanath, 2006).

A wide array of plant derived active principles representing numerous chemical compounds has demonstrated activity consistent with their possible use in the treatment of type 2 diabetes (Bailey and Day, 1989; Marles and Farnsworth, 1995).

Bnouham et al. (2006), presented the profiles of plants with hypoglycemic properties, reported in the literature from 1990 to 2000. The reports of the large number of plants described in this review (176 species belonging to 84 families) clearly demonstrated the importance of herbal plants in the treatment of diabetes.

Many ethnobotanical and ethnopharmacologically surveys on medicinal plants used by the local population have been performed in different parts of the world including Morocco (Ziyyat et al., 1997; Jouad et al., 2001; Bnouham et al., 2002; Eddouks et al., 2002; Tahraoui et al., 2007), Kingdom of Jordan (Lev and Amar, 2002; Wazaify et al., 2011), Israel, the Golan height and the West Bank region (Said et al., 2002), Eastern cape province in South Africa (Erasto et al., 2005; Mahop and Mayet, 2007), Nigeria (Abo et al., 2008; Gbolade, 2009; Jegede et al., 2011), Tanzania (Moshi and Mbwambo, 2002), Côte-d'Ivoire (N'guessan et al., 2009), Guinea (Baldé et al., 2006), Trinidad and Tobago (Mahabir and Gulliford, 1997), India (Grover et al., 2002; Chhetri et al., 2005; Mukherjee et al., 2006; Singh, 2011), China (Jia et al., 2003; Li et al., 2004), Malaysia (Husen et al., 2004), Canada (Leduc et al., 2006), Mexico (Hernandez-Galicia et al., 2002; Andrade-Cetto and Heinrich, 2005), etc.

In Algeria, many patients use medicinal plants as treatment for many ailments and serious diseases, such as diabetes and arterial hypertension, for several considerations: Historical, cultural and economic.

According to epidemiological data published by the National Institute of Public Health (INSP) (Algeria) in 2005, diabetes mellitus is the second chronic pathology after hypertension, in Algeria. Its prevalence is 12.29% with no significant differences by gender (11.93% for men and 12.54% for women) (TAHINA, 2007).

The number of people affected by diabetes in Algeria estimated by Ministry of Health and WHO in 2003, is more than 1.435 million. The risk for developing diabetes is closely linked to lifestyle changes, obesity and urbanization for population (Whiting et al., 2011).

Algeria is characterized by a climatic diversity which is favorable for growth and development of a flora rich in medicinal and aromatic plants; Mediterranean climate in the north (collectively known as the Tell), semi-arid climate in the Hauts Plateaux (high steppic plains) and arid across the Sahara.

Despite its wealth of medicinal plants, there are few studies on ethnobotanical and ethno pharmacological antidiabetic plants published in the literature.

This study aims at documenting plants used exclusively for the management of diabetes mellitus in targeted areas represented by four distinct provinces (called Wilaya: administrative division) located in the west of Algeria repartee in a trough north-south axis . We present the local and scientific names of the plants used for the treatment of diabetes, the parts of the plants used and the various methods of preparation.

METHODOLOGY

An ethnobotanical study was conducted from October 2009 to June 2011, using questionnaire. Ethnobotanic information was obtained from 470 patients suffering from type 1 or type 2 diabetes mellitus.

Interview was performed in hospital, pharmacy, and associations helping diabetics. All patients interviewed had been informed about the objective of the study.

Description of the study area

The study area is indicated in Figure 1, which represent the map of Algeria. To the north, it borders the Mediterranean Sea, to the west Morocco and to the south Mali.

The four provinces targeted are as follows: Tlemcen (34°52′58″ N, 01°19′00″ W), characterized by Mediterranean climate. Its population had 949,135 inhabitants at the 2008 censushttp://en.wikipedia.org/wiki/Tlemcen, with an area of 9,061 km^2. In the Tell and the Hauts Plateaux with a semi-arid climate, there are two provinces: Naâma (33° 16′ 0″ N, 0° 19′ 0″ W) with an area of 29,950 km^2. It had 209,470 inhabitants at the 2008 population census. El Bayadh (33°41′N, 01°01′E) with an area of 78,870 km^2. It had 262,187 inhabitants at the 2008 population census. In the Sahara, Adrar (27°52′ N, 0°17′ W), constitutes the South Western part of the Algerian Sahara where the climate is arid, it is the second-largest province of the country, with an area of 427,368 km². It had 402,197 inhabitants at the 2008 population census (ONS Algeria, 2008).

Interviews

The formulary of the survey questionnaire included the following parameters:

1. Informant: First name of the patients, age, sex, weight, address;
2. Information for diabetes: Type of diabetes, treatments (name of the drug used), complications;
2. Information for antidiabetic plants: Drug used parts and methods of preparation;
4. The results of their phytotherapy: Good, average or variable, compared with clinical.

The questionnaire was basically addressed to two groups of diabetic: Those who knew and used the plants for medicinal purposes and those who did not.

Figure 1. Location of the study area: In the North West and South West of Algeria Tlemcen, Naâma, El Bayadh and Adrar.

A list of common names employed to designate medicinal plants was first established. Taxonomic identification of the plants and definite determination of their botanic names were conducted using the Flora of Algeria (Quézel and Santa, 1962-1963), Traditional medicine in Central Sahara: Pharmacopoeia of Tassili (Hammiche and Maiza, 2006), Medicinal plants in the Mediterranean area (González-Tejero et al., 2008).

The names of plant families were listed in alphabetic order. Families of flowering plants were classified on the basis of APG (Angiosperm Phylogeny Group) III 2009 system (APGIII, 2009).

RESULTS AND DISCUSSION

In this study, 470 diabetics in the western region of Algeria are questioned, 266 of them have type 2 diabetes (57% of the population surveyed), 272 (or 57.87%) of them are female and nearly 62% are living in urban areas. The frequency of diabetes in the study population increases with age classes. The age group most affected by diabetes is situated between 46 and 60 years (148 patients or 31.49% of diabetics surveyed).

Although more than 43% of people with diabetes questioned know medicinal plants, which can treat hyperglycemia, only 28.30 % (133 of the population questioned) of the population use them either as treatment alone or in association with the conventional treatment of diabetes.

The percentage of use of anti-diabetic medicinal plants registered in this study is lower than by the report those mentioned in the literature. In Morocco, studies in different regions amount to the large dependence of the local population on medicinal plants to treat diabetes. The frequency of use of the plants are estimated between 55 and 90% according to the study area: 67.5% (East of Morocco), 76% (Fez-Boublemane), 80% (region Tafilalet, South-east), 78% (South-east region Errachidia) (Ziyyat et al., 1997; Jouad et al., 2001; Eddouks et al., 2002; Tahraoui et al., 2007).

We observe that women used more frequently herbal medicine than men, 37.60% and 18.84% respectively. These observations are in line with results of the studies realized in many regions of Morocco, a neighboring country whose people share a common culture and traditions, have showed that generally, the use of medicinal plant is higher in women than men with a

percentage between 61 and 69% and 31 and 39%, respectively (Ziyyat et al., 1997; Eddouks et al., 2002). As suggested in this previous study, this could be explained by the relative frequency of illiteracy of women in our society, their attachment to traditional knowledge. Besides, most of women were housewives at the time of the survey (Jouad et al., 2001).

As regards to diabetes pathology, the interviewed patients suffered from type 1 or type 2 diabetes mellitus at 43 and 57%, respectively. Among the type 2 diabetic patients, 36.10% used phytotherapy. While only 17.16 % of type 1 diabetic patients frequently used medicinal plants, in addition to insulin treatment.

Generally, the use of hypoglycemic plants in treating diabetes mellitus is very dangerous, especially, type 2 diabetes mellitus. In this view, some medicinal plants have induced hypoglycemic accidents in type 1 diabetic patients as in bad controlled type 2 diabetic patients (Eddouks et al., 2002).

In all groups, the number of plant users was important and did not depend on age or socio-cultural level. In addition, the patients did not respect both the precision of doses and duration of the use. This could explain some accidental intoxication by medicinal plants. The inventory of the plants is summarized in Table 1, which contains the family, the scientific, vernacular and common name of the plant; its English and French name; the part of the plant and the preparation used and the frequency.

For 325 citations, a total of 60 medicinal plants belonging to 32 families were identified (Table 1), of which the most cited (over 10 citations) were: *T. foenum-graecum* (56 citations), *R. officinalis* (27 citations), *C. colocynthis* (22 citations), *Tetraclinis articulata* (21 citations), *A. herba alba* (20 citations), *Origanum compactum* (16 citations), *Punica granatum* (16 citations), *Z. gaetulum* (15 citations) and *Artemesia absinthium* (12 citations) (Figure 2). Of these plants, 51.67% grow in the wild, 40% are cultivated, and 8.33% are not indigenous to the area and are brought from other parts of Algeria or outside the country.

Families which contain over two species of medicinal plants most used for their antidiabetic effects were: *Asteraceae* (8 species), *Lamiaceae* (8 species), Apiaceae (4 species), *Brassicaceae* (3 species), *Fabaceae* (3 species), *Rosaceas* (3 species), *Amaranthaceae* (3 species), *Lauraceae* (2 species), *Lythraceae* (2 species) and *Zygophyllaceae* (2 species). It is also interesting to compare the medicinal plants used in the management of diabetes mellitus in the Western regions of Algeria with that reported for the population of Morocco. So, the most plants identified in our study (95%), are cited at least once in various surveys in Morocco (Ziyyat et al., 1997; Jouad et al., 2001; Eddouks et al., 2002; Tahraoui et al., 2007), except three of them: *Atriplex halimus*, *Arctium lappa* and *Origanum majorana*. The geography and history of the two neighboring countries will make their populations share the same cultural values and customs.

Some of these plants have been experimentally studied and their hypoglycaemic activity demonstrated by studies on experimental animals, and on patients with diabetes, including *T. foenum-graecum* (Abdel-Barry et al., 1997; Eidi et al., 2007), *R. officinalis* (Erenmemisoglu et al., 1997; Al-Hader et al., 1994), *A. herba-alba* (Twaij and Al-Badr, 1988; Al-Khazraji et al., 1993), *C. colocynthis* (Abdel-Hassan et al., 2000 ; Fallah et al., 2009), *Allium cepa* (Kelkar et al., 2001; Ozougwu, 2011), *Allium sativum* (Jain et al., 1973; Eidi et al., 2006), *Marrubium vulgare* (Roman-Ramos et al., 1992; Herrera-Arellano et al., 2004), *Ficus carica* (Canal et al., 2000; Perez et al., 2000), *Punica granatum* (Jafri et al., 2000; Das et al., 2001), *Nigella sativa* (Al-Hader et al., 1993), *Ammi visnaga* (Jouad et al., 2002), *Z. gaetulum* (Skim et al., 1999; Jaouhari et al., 1999), *Berberis vulgaris* (Leng et al., 2004; Meliani et al., 2011), *Zingiber officinale* (Akhani et al., 2004; Ojewole, 2006), *Camellia sinensis* (Gornes et al., 1995; Sabu et al., 2002), *Aloe vera* (Yongchaiyudha et al., 1996; Okyar et al., 2001), *Retama raetam* (Maghrani et al., 2005), *Lepidium sativum* (Eddouks et al., 2005), *A. halimus* (Shani et al., 1972), *Olea europaea* (Al Jamal and Ibrahim, 2011), etc,

Although in many citations, more than one part of the plant is used, the parts of the plants most used for medicinal purposes are, in descending order as shown in graphical representation in Figure 3: leaves (37.84%), aerial parts (19%), seeds (13.51%), fruits and roots (9.46%) and flowers (5.41%).

Previous percentage analysis shows that leaves are the most frequent part of the plant used just like the report in many other ethonomedicinal studies (Neves et al., 2009; Macia et al., 2005).

In this study, decoctions or infusions of the leaves, the aerial parts and flowers are the main preparation methods. The plants used are fresh (raw, powder) or dried, essentially in the form of a decoction (45%), infusion in water (30%) and maceration (7.50%). Sometimes oils, juice and external use are used, as shown in graphical representation in Figure 4.

Decoction or infusion is almost the common method of preparation of medicinal plants to be used internally, however, without knowing neither the real differences between the two methods nor their effect on the final product. In very rare cases, other methods of preparation and use were recorded like direct applications in the form of powdered plant material or in the form of vapor inhalation (Aburjai et al., 2007; Al-Qura'n, 2009).

The local people recognize the toxic plants and are very careful when using plants such as *C. colocynthis* (Al-Yahya et al., 2000; Dehghani and Panjehshahin, 2006), *N. oleander* (Langford and Boor, 1996; Al-Yahya et al., 2000), *N. sativa* (Zaoui et al., 2002; Ali and Blunden, 2003), *Peganum harmala and Z. gaetulum* (Tahraoui et al., 2007; Eddouks et al., 2002). Toxicity of medicinal plants may be related to the mixtures of active compounds

Table 1. List of medicinal plants used in the treatment of diabetes mellitus he North Western and South Western Algeria.

Family (APGIII)	*Scientific name*	Popular name	French name	English name	Used parts	Preparation	Citations (Frequency)
Amaranthaceae	*Atriplex halimus L.*	El gtaf	Atriplex	Sea- orache	Leaves	Decoc	1 (0.31%)
	Allium sativum L.	Toum	Ail	Garlic	Bulb	Raw	1 (0.31%)
	Allium cepa L.	Elbesla	Onion	Onion	Bulb	Raw	4 (1.23%)
Apiaceae	*Ammi visnaga Lam.*	Bachnikha	Khella, Ammi	Picktooth	Fruits	Decoc	2 (0.62%)
	Apium graveolens L.	Krafess	Céleri	Celery	Seeds, Aerial part	Decoc, Raw	1 (0.31%)
	Petroselinum crispum (Mill.) Fuss	Maâdnous	Persil	Parsley	Seeds, Aerial part	Decoc, Raw	1 (0.31%)
	Ammoides pusilla (Brot.) Breistr.	Nûnkha	Ptychotis	False Parsley	Aerial part	Infu	3 (0.92%)
Apocynaceae	*Nerium oleander L*	Defla	Laurier rose	Oleander, Rose-bay	Leaves	Decoc, infu, macera	9 (2.77%)
Asteraceae	*Anacyclus pyrethrum (L.) Link*	Tagandass	Pyrèthre	Pillitory of Spain	Roots	Decoc	1 (0.31%)
	Matricaria chamomilla L.	Babounidj	Camomille sauvage	Camomilee	Roots, Leaves, flowers	Infu	1 (0.31%)
	Artemisia absinthium L.	Chiba	Absinthe	Wormwood	Aerial part	Infu	12 (3.69%)
	Artemisia herba-alba Asso	Chih	Armoise blanche	White mugwort	Tige, Aerial part, roots	Powd, decoc, infu	20 (6.15%)
	Helianthus annuus L.	Nouarat chamess	Tournesol	Common sunflower	Roots	Powd	1 (0.31%)
	Taraxacum officinale F.H. Wigg.	Garnina	Pissenlit officinal	Common Dandelion	Leaves, roots	Decoc, Powd	1 (0.31%)
	Dittrichia viscosa (L.) Greuter	Magramâne	Aunée visqueuse	Rock Flea - bane	Leaves, roots	Decoc	1 (0.31%)
	Arctium lappa L.	Arkitoun	Bardane	Burdock	Roots, Leaves, flowers	Decoc, infu	2 (0.62%)
Berberidaceae	*Berberis vulgaris L.*	Elghris	L'épine-vinette	Barberry	Leaves, roots	Decoc, infu	2 (0.62%)
Brassicaceae	*Lepidium sativum L.*	Hab err-chad	Resson alenoise	Gardencress	Seeds	Decoc	2 (0.62%)
	Raphanus sativus L.	Jirjir, fidjel	Radis	Radish	Seeds	Infu	1 (0.31%)
	Brassica oleracea L.	Kroumb	Chou	Wild cabbage	Aerial part	Decoc, Juice	1 (0.31%)
Cactaceae	*Opuntia ficus-indica (L.) Mill.*	Hindiya	Figuier de Barbarie	Barbary fig,	Flowers	Decoc	1 (0.31%)
Capparaceae	*Capparis spinosa L.*	Kebbar	Câprier	Caper	Aerial part, fruits	Decoc	1 (0.31%)
Cucurbitaceae	*Citrullus colocynthis (L.) Schrad.*	Handal, lahdedj	Coloquinte	Colocynth	Fruits	External use, macera	22 (6.77%)
Cupressaceae	*Tetraclinis articulata (Vahl) Mast.*	Araâr	Thuya	Berber thuya, Arar	Leaves	Macera	21 (6.46%)
Fabaceae	*Lupinus albus L.*	Termas mur	Lupin blanc	white lupin	Seeds	Decoc	1 (0.31%)
	Trigonella foenum-graecum L.	Halba	Fenugrec	Fenugreek	Seeds	Decoc, macera, powd	56 (17.23%)
	Retama raetam (Forssk.) Webb	R'tum	Retam	Common retama	Leaves	Decoc	1 (0.31%)
Gentianaceae	*Centaurium erythraea Rafn*	Merrâret lehnech	Petite centaurée	Earth- gall	Aerial part	Infu	1 (0.31%)
Geraniaceae	*Geranium robertianum L.*	Laatarcha	Géranium Robert	Robert Geranium	Leaves, flowers	Infu	1 (0.31%)

Table 1. Contd.

Lamiaceae	*Ajuga iva (L.) Schreb.*	Chendgoura	Ivette, petit if	Herb ivy	Aerial part	Decoc	3 (0.92%)
	Lavandula stoechas L.	Halhal	Lavande	French lavender	Leaves	Decoc, infu	4 (1.23%)
	Marrubium vulgare L.	Marrîwa	Marrube blanc	Cmmon white	Aerial part	Decoc	2 (0.62%)
	Mentha pulegium L.	Fliou	Pouliot	Penny royal	Aerial part	Infu	8 (2.46%)
	Origanum compactum Benth.	Zâtar	Origan	Oregano	Leaves	Infu	16 (4.92%)
	Origanum majorana L.	Bardakouche	Marjolaine	Marjoram	Leaves, flowers	Infu	2 (0.62%)
	Rosmarinus officinalis L.	Yazir, barakella	Romarin	Common Rosemary	Aerial part, Leaves	Decoc, infu	27 (8.31%)
	Salvia officinalis L.	Mrimra, salmiya	Sauge	Garden sage	Leaves	Infu	2 (0.62%)
Lauraceae	*Cinnamomum cassia Lour.*	El Korfa	Cannelle	Cinnamon	Aerial part	Decoc	3 (0.92%)
	Laurus nobilis L.	Rand	Laurier	Laurel	Leaves	Infu	1 (0.31%)
Lythraceae	*Lawsonia inermis L.*	Hanna	Henné	Alcanna	Leaves	Decoc	5 (1.54%)
	Punica granatum L.	Rommane	Grenadier	Pomegranate	Pericarp	Decoc, Powd	16 (4.92%)
Moraceae	*Ficus carica L.*	Karmouss	Figuier	Fig	Leaves, Fruits	Decoc, Raw	5 (1.54%)
Myrtaceae	*Eucalyptus globulus Labill.*	Kalitouss	Eucalyptus	Eucalyptus	Leaves, Fruits	Decoc	2 (0.62%)
Oleaceae	*Olea europaea L.*	Zitoun, Zebouj	Olivier	Olive	Leaves, Fruits	Decoc, infu, oil	6 (1.85%)
Pedaliaceae	*Sesamum indicum L.*	Jenjlen	Sésame	Sesame	Seeds	Infu	1 (0.31%)
Plantaginaceae	*Globularia alypum L*	Aïn larneb, tasselgha	Globulaire	Alypo globe daisy	Leaves	Decoc, infu	2 (0.62%)
Ranunculaceae	*Nigella sativa L.*	Sanouj, El haba Sawda	Nigelle	Black cumin, Black seed	Seeds	Decoc, Powd	6 (1.85%)
Rhamnaceae	*Ziziphus lotus (L.) Lam.*	Sadra	Jujubier	Ziziphus	Leaves	Decoc	2 (0.62%)
Rosaceas	*Crataegus laevigata (Poir.) DC.*	Zaârour, Ain Bagra	Aubépine	Hawthorn	Fruits	Decoc	3 (0.92%)
	Eriobotrya japonica (Thunb.) Lindl	Lmzah	Néflier	Loquat	Leaves	Decoc	1 (0.31%)
	Prunus dulcis (Mill.) D.A.Webb	Louz mur	Amandier	Almond	Seeds	Decoc, infu	2 (0.62%)
Salicaceas	*Populus nigra L.*	Safsaf	Peuplier noir	Black poplar	Leaves	Decoc	1 (0.31%)
Solanaceae	*Capsicum frutescens L.*	Felfel har	Chili pepper	Piment de cayenne	Seeds	Raw	2 (0.62%)
Theaceae	*Camellia sinensis (L.) Kuntze*	Tay	thé vert	Tea	Leaves	Infu, decoc	3 (0.92%)
Urticaceae	*Urtica dioica L.*	Harriga	Ortie	Stinging nettle	Aerial part	Infu	3 (0.92%)
Verbenaceae	*Aloysia citriodora Palau*	Louiza	Verveine	Lemon verbena	Leaves	Decoc, infu	2 (0.62%)
Xanthorrhoeaceae	*Aloe vera (L.) Burm.f.*	Morw sbar, Siber	Aloès	Aloe	Leaves	Infu	5 (1.54%)
Zingiberaceae	*Zingiber officinale Roscoe*	Zenjabil,Skingebir	Gingembre	Ginger	Rhizome	Macera	2 (0.62%)
Zygophyllaceae	*Zygophyllum album L.*	Aggaya	Not found	Not found	Leaves	Infu	15 (4.62%)
	Peganum harmala L.	Harmel	Harmel	Harmal wild rue	Seeds	Macera	1 (0.31%)

Decoc, Decoction; Macera, maceration; infu, infusion; Powd, powder.

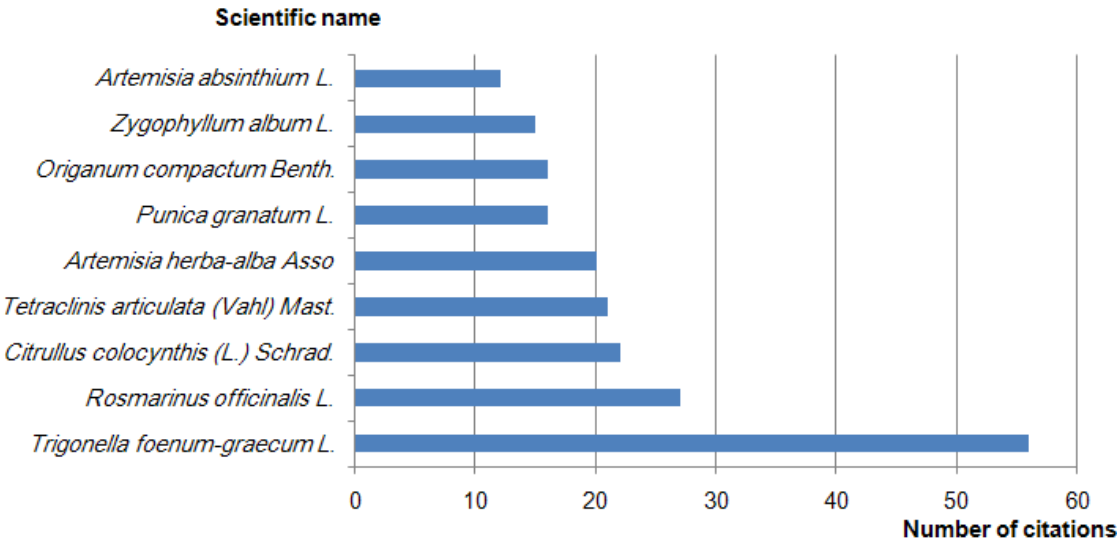

Figure 2. Number of citations of use of more popular plants (frequency of 10 or more) to treat diabetes in the North Western and South Western Algeria.

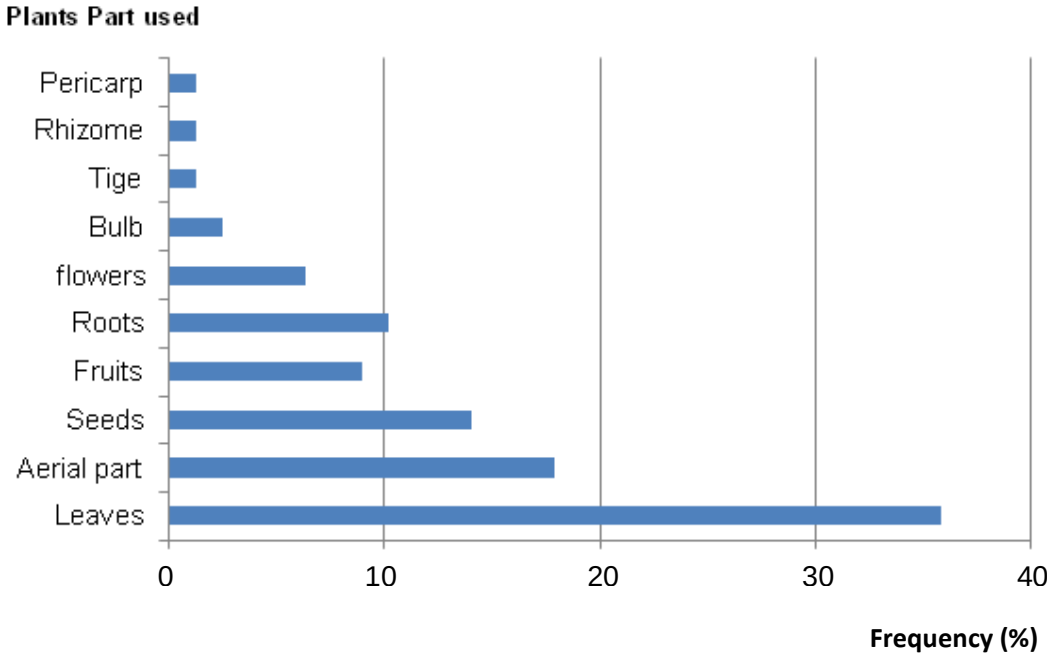

Figure 3. Frequency of plant parts used for the preparation of remedies.

that they contain; their interactions with other herbs and drugs, contaminants, adulterants; or their inherent toxicity. Plants have complex mixtures of terpenes, alkaloids, saponins and other chemicals, increasing the risk of adverse reactions to any one of them or to the additive or synergistic effects of chemical interactions (Saad et al., 2006).

Toxicity is a relative term and will vary on the part of the plant being extracted or eaten and the amounts taken. However, it is critical that the crude extract and individual compounds are tested for toxicity, although most tests currently only measure acute toxicity. These tests do not provide information about adverse responses that might result from long-term exposure to the species.

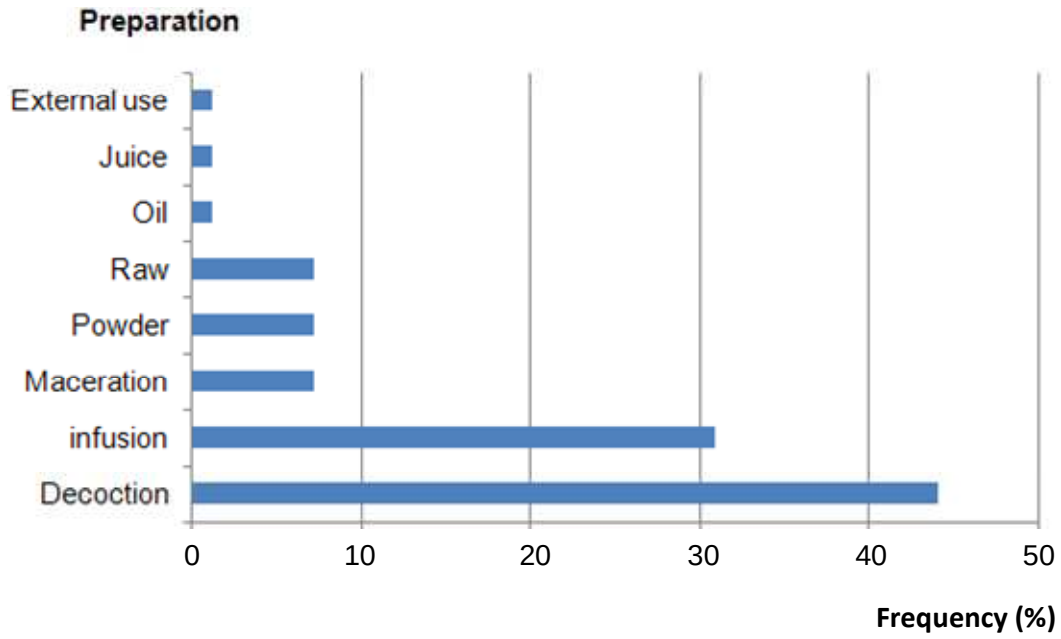

Figure 4. Frequency of methods of preparation of plants drug.

Knowledge about whether compounds taken in low amounts over time could result in the accumulation of a toxic dose is important because diabetes is a chronic condition and a patient might need to take a daily supply of a medication over a long period (Soumyanath, 2006).

Beginning toxicological and clinical studies is urgently needed. Many plants could be dangerous because they contain beneficial and toxic substances together. Thus, because the traditional preparations are complex mixtures of unknown substances, it is considered urgent to begin toxicological studies, principally with the plants most extensively used by the population, and to determine which plants are innocuous.

Further systematic studies into the chemical constituent, pharmacological actions, and toxicity of the plant materials will be needed to prove their medicinal worth. In addition, the cellular and molecular mechanisms of the recorded plants still need to be determined in animal models and detailed information on their usage; duration and dosage must be investigated before prescription in human healthcare.

Conclusion

The identified medicinal plants may be shown to have therapeutic value once they have been experimentally and clinically tested. Awaiting such investigations, serious efforts must be made in order to sensitize the local population to the dangers of anarchic usage of phytotherapy, especially the use of toxic plants and hypoglycaemic medicinal herbs in the treatment of type 1 and bad controlled type 2 diabetes mellitus.

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