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Ethnobotanical Survey of Medicinal Plants Used For the Treatment of Diabetes in Western Anatolia, Turkey

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ABSTRACT In order to make an inventory of herbal remedies commonly used in the treatment of diabetes, in Western Anatolia, 48 traditional herbal healers were interviewed in 17 different areas of the Afyonkarahisar region. In this study, an ethnobotanical approach to diabetes treatment has been shown by using medicinal and herbal plants. Ethnobotanical data was collected by administering a semi-structured questionnaire to 48 resource people (28 women and 20 men) and interviewing them about use of medicinal plants between 2015 and 2016. Ethnobotanical plant species were identified after bringing to the laboratory. They have also been cured with medicinal plants as ethnobotanical practices have been undergoing a cure during the study carried out. The plants reported have been identified and are presented in a table with their vernacular name, useful parts and medicinal uses. In addition, use values (UV) were calculated. An ethnobotanical approach was exhibited to struggle with the diabetes ailment. A different approach to cure diabetes is presented.

INTRODUCTION

People started to benefit from the plants at the beginning of the 1800s. Using plants for food, paint, decoration and medical purpose has reached up today. With the ethnobotany culture, which has been acquired traditionally, treatment was sought for important diseases by using plants for centuries. WHO (World Health Organization) stated that twenty-five percent of the modern medicines originated from plants used traditionally and the herbal plants have led to the discovery of the seventy-five percent of the herbal medicines (WHO 2002; Malla et al. 2015). The World Health Organization (WHO) is seeking for healing by using medicines derived from about 21,000 plant species (Ghorbani 2006). Turkey has a rich diversity of plants due to its climate and phyto geographical position (Mediterranean Sea, Iran-Turan and Euro-Siberian). There are more than 11,000 taxon and about 1/3 of these taxon are endemic. 1,000 taxon of the plants are used medicinally, and additionally 350 plant species are used in foreign trade (Arı et al. 2015).

Medicinal plants were used throughout human history for various purposes (Arı et al. 2017). Turkey also has a great ethnobotanical culture. It has been intensively benefitted from medicinal plants from ancient times until today (Güler et al. 2015). Diabetes known as sugar disease among the people is the most common metabolic disease seen in all population and age groups and widespread around the whole world. The prevalence of diabetes has increased dramatically during the last 20 years. The number of the diabetics, which reached 135 million in 1995 in the world, is expected to be around 300 million in 2025. Statistical studies detected that possible the majority of this numerical growth is predicted to be seen especially in countries such as China, India and the USA. Turkey is also expected to be among the top 10 countries (Arı et al. 2015; Arituluk and Ezer 2012).

The wild and cultivated plants should be supported with the ethno botany culture acquired traditionally in the past in order to support the people seeking the treatment of diabetes with medical methods or to stop the progression of this disease. In a survey work carried out in a field research around Afyonkarahisar in central-west Anatolia it was observed that different herbal plants with different preparation were used in diabetes. Ethnobotanical approach is presented to overcome the diabetic problems.

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METHODOLOGY

Study Area

Afyonkarahisar is 1034 m above sea level. It is located at the 38° 45' north latitude and 30° 32' east longitude. The total area of Afyonkarahisar is 14,295 km^2 and it occupies 1.8 percent of Turkey's land. In the north Eskisehir, northwest Kütahya, east Konya, south Isparta, west Usak, southwest Denizli and Burdur are located (Ari et al. 2015). Despite the fact that Afyonkarahisar is located in the Aegean region, its climate is similar to that of the central Anatolia region. The hottest month is July with an average temperature of 22.3 °C, while the coldest month on average is January with a temperature of 0.2 °C. Only sixteen percent of the annual rainfall occurs in summer. The annual precipitation is 410-478 mm. A high plant diversity in Afyonkarahisar results from the richness of the mountains with different flora around it. Sultandaglari, Akdag, Emirdaglari, Kumalar Dagi, Ahir Dagi, Kizildag, Paþa Dagi, Kasim Dagi, Kirseli Dagi, Ilbulak, Asar Dagi and Eyer Dagi are some of these mountains, which contribute significantly to this plant diversity.

Data Collection

Plant materials were obtained from the studies conducted in Afyonkarahisar and its surrounding area in the years between 2015-2016. During this period, 28 plants taxa were collected. The plants were pressed in the field and prepared for identification. These specimens were initially identified with the help of the 'Flora Turkey and East Aegean Islands' and the studies related to Afyonkarahisar by Kargioglu et al. (2010) These plants are being kept in the Herbarium of Afyon Kocatepe University, Faculty of Arts and Science, Department of Molecular Biology and Genetics. The names of plant families were listed. Scientific names of plant species were identified according to the International Plant Name Index (IPNI: http:// www. ipni.org).

Interviews with Resource People

The people who may have an ethno-medicinal knowledge or experience were visited at least five times while they were in houses, fields, plateaus and farms at different seasons of the year. Information about usage of medicinal plants was obtained from these people using a model of a semi-structured ethnobotanical questionnaire (Appendix). Seventeen settlements were visited for field research. 48 of them became the informants. Data was collected from seven people between the ages of 35 and 50, nineteen people between the ages of 50-65, and twenty-two people over the age of 65. In conjunction with families, local names, used parts and preparation methods of the plants, ethnobotanical indices of plant species used for healing of local people were reported and presented in Table 1.

Data Analysis

The use value (UV) demonstrates the relative importance of plants known locally. It was calculated using the formula:

$Uv = \Sigma Ui / N.$

Where, Ui is the number of uses mentioned by each informant for a given species and N is the total number of informants (Vijayakumar et al. 2015). The UV of the plant taxa, which therapeutic use detected, in this research is given in Table 1.

RESULTS AND DISCUSSION

Diabetes Plants and Associated Knowledge

The researchers identified 28 species belonging to 17 families, which were believed to be useful for diabetes. The researchers also determined their ethno botanical uses by the locals (Table 1). Table 1 presents taxa's Latin name, family name, local name, used plant parts and their administration types. The UV of the plant taxa in this research is also given in Table 1. Additionally, IP is the number of informants who independently indicated the use of a species for the diabetes and Iu the total number of informants. The results indicated that 4 species belong to Rosaceae, three species belong to Lamiaceae and Asteraceae, and two and one species belong to other families and were used in treating diabetes by the locals. For diabetes purposes, fruits were being used for 8 different purposes and this was followed by other plant parts including leaves 7, aerial organs 7, tuber, root, seed, bough for 2 and flower 1.

Table 1: List of the diabetes plants used by local people in Afyonkarahisar, Turkey (n=48)

Plant species	*Families*	*Local names*	*Parts*	*Preparations*	ΣUi	*Uv*
Pistacia terebinthus L. subsp. *palaestina* (Boiss.) Engler	Anacardiaceae	Sakızlık	Aerial organs	Nuts	18	0.38
Rhus coriaria L.	Anacardiaceae	Mavru	Fruits	Infusion as tea	10	0.2
Ferulago trachycarpa Boiss.	Apiaceae	Çaksır	Root	Infusion as tea	7	0.15
Pastinaca sativa L. subsp. urens (Req. ex Godr.) Celak	Apiaceae	Yabani havuç	Tuber	Infusion as tea	6	0.13
Artemisia campestris L.	Asteraceae	Aci yavsan	Leaves	Capsule	13	0.27
Lactuca sativa L.	Asteraceae	Marul	Aerial organs	The plant's aerial organs are made of salad and rolls.	22	0.46
Anthemis aciphylla Boiss. var. *aciphylla*-**E**	Asteraceae	Dag papatyası	Flowers	Infusion as tea	11	0.23
Berberis crataegina D.C.	Berberidaceae	Karamik	Roots	Decoction as tea	19	0.4
Brassica oleracea L. var. *capitata* f. Alba	Brassicaceae	Lahana	Leaves	Decoction as tea	21	0.44
Eruca sativa Miller	Brassicaceae	Roka	Leaves	The leaves of the plant are consumed as part of a salad.	13	0.27
Juniperus oxycedrus L. subsp. *oxycedrus*	Cupressaceae	Gıli gili	Fruits	Infusion as tea	24	0.5
Diospyros kaki L. Fil.	Ebenaceae	Yer elması	Fruits	The fruit of the plant part (grape) is consumed directly.	20	0.42
Ceratonia siliqua L.	Fabaceae	Keçi buynuzu	Fruits	Boil the fruit of the plant part, crushed sieve is passed, the cold drink	4	0.08
Juglans regia L.	Juglandaceae	Ceviz	Fruits	Consumed directly.	15	0.31
Satureja cuneifolia Ten.	Lamiaceae	Kara kekik	Leaves	Infusion as tea	18	0.38
Tymus longicaulis C. Presl subsp. *longicaulis* var. *subisophyllus* (Borbas) Jalas.	Lamiaceae	Kaya kekik	Aerial organs	The plant's aerial organs are fried in oil and consumed	13	0.27
Thymus sipyleus Boiss. subsp. *sipyleus* var. *Sipyleus*-**E**	Lamiaceae	Sipil Kekik	Aerial organs	The plant's aerial organs are fried in oil and consumed	7	0.15
Myrtus communis L. subsp. *communis* L.	Myrtaceae	Gara murt	Fruits	Infusion as tea	7	0.15
Olea europaea L. var. *europaea* L.	Oleaceae	Sitin	Leaves	Decoction as tea	15	0.31
Punica granatum L.	Punicaceae	Eksi nar	Fruits	Molasses, Marmalade	22	0.46
Paliurus spina-christi Mill.	Rhamnaceae	Aslanpençesi	Seeds	Infusion as tea	20	0.42
Rhamnus rhodopeus Velen. subsp. *anatolicus* (Grub.) Browicz & ZieliDski-**E**	Rhamnaceae	Yalican çehri	Fruit	The fruits are directly consumed	18	0.38
Amygdalus orientalis Miller	Rosaceae	Aci payam	Seeds	Infusion as tea	10	0.21
Eriobotrya japonica (Thunb.) Lindl.	Rosaceae	Musmala	Leaves	Infusion as tea	9	0.2

Table 1: Contd...

Plant species	*Families*	*Local names*	*Parts*	*Preparations*	*ΣUi*	*Uv*
Eriolobus trilobatus (Poiret) Roemer var. *trilobatus* (Poiret) Roemer	Rosaceae	Geyik elmusi	Leaves	Infusion as tea	10	0.21
Crataegus orientalis Pallas ex M.Bieb. var. *orientalis.*	Rosaceae	Ahlât	Bough	Decoction as tea	15	0.31
Solanum tuberosum L.	Solanaceae	Gumpir	Tuber	Tuber of the plant part eaten directly	18	0.38
Urtica dioica L.	Urticaceae	Yayla isirgani	Bough	Decoction as tea	14	0.29

Abbreviations: Uv: Use value- Ui: The number of uses mentioned by each informant for a given species. -E: Endemic

The researchers found that the most commonly used parts of the plants are fruit, leaf, aerial organ, tuber, root, seed, bough and flower. These findings were in agreement with previous studies conducted in different parts of the world, where the fruits are cited as commonly used parts of the medicinal plants (Morvin et al. 2014; Korkmaz et al. 2016; Mükemre et al. 2016). The calculated UV in this study ranges from 0.08 to 0.50, which demonstrates from the least relative importance with Ceratonia siliqua L. to the highest importance with Juniperus oxycedrus L. subsp. oxycedrus. The most common preparation method is infusion with the rate of thirty-six percent. The other preparation methods including direct consumption, syrup, mixture, aerial parts boiled, meal, capsule swallow, fruits and leaves eaten raw, oil extracted could be listed in Table 1.

Table 2: Percentile distribution according to taxa of families

Families	*Percentile distribution according to taxa of families (%)*
Rosaceae	24
Asteraceae	18
Lamiaceae	18
Anacardiaceae	12
Apiaceae	12
Brassicaceae	12
Rhamnaceae	12
Berberidaceae	5.9
Cupressaceae	5.9
Ebenaceae	5.9
Fabaceae	5.9
Juglandaceae	5.9
Myrtaceae	5.9
Oleaceae	5.9
Punicaceae	5.9
Solanaceae	5.9
Urticaceae	5.9

Table 3: Percentile distribution of plant organs used diabetes

Plant parts	*Percentile distribution of plant organs used diabetes (%)*
Fruits	28.6
Leaves	25
Aerial organs	25
Tuber	7.1
Roots	7.1
Seeds	7.1
Bough	7.1
Flowers	3.6

It was seen that some of these herbal plants, which were used for the diabetic problems by the people living around Afyonkarahisar, were also used by other researchers according to the literature reviews. In some in vivo studies their anti-diabetic effects were highlighted. For example, it was proven that the aqueous extract prepared from the pericarp of the *Punica granatum* showed significant anti-diabetic activity in diabetic rats (Arituluk and Ezer 2012; Aslan et al. 2003). It was reported that the essential oil of *Myrtus communis* showed significant diabetic activity in alloxan induced diabetic rats (Arituluk and Ezer 2012; Orhan et al. 2012). It was revealed that the methanol extract of the *Juniperus oxycedrus* ssp. *oxycedrus*'s fruits and leaves and the *Juglans regia*'s fruits showed anti-diabetic effects in streptozotocin induced diabetic rats (Orhan et al. 2012). The compounds such as oleuropein isolated from *Olea europaea*, mirisetol isolated from *Myrtus communis*, lectin isolated from *Urtica* sp., shikimik acid isolated from *Juniperus oxycedrus* ssp. *oxycedrus* were also reported to have anti-diabetic effects (Al-Azza-

wie and Alhamdani 2006). These results show that the plants used for diabetes in the research field could be helpful against diabetes and the used and information about the other herbal plants should be also considered.

CONCLUSION

In addition to the fact that this study supports the idea that the herbal plants used for diabetes could be useful against diabetes, it also reveals the importance and benefits of the ethnobotany culture gained by the people until today. It was proved by different researches conducted in Turkey or around the world that some of the plants given in Table 1 were useful against diabetes. Looking at the use format of some other plants, which were not found to be useful or which were not known to be good for diabetes is considered to shed light to the future studies in this regard. These plants, which are used by the people for the treatment of diabetes, may contribute to the development of new medicines against diabetes.

APPENDIX

Name and surname of the participant**,** age and sex of the participant, telephone and address of the participant, educational level of the participant, date of interview, place of residence of the participant, duration of residence of the participant, what is the local name of the plant used, for which diseases do you use the plant, which parts of the plant do you use (Root, stem, flower, leaves, fruit, etc.), how do you prepare the plant for use, how and when do you use the plant, approximately what dose do you use, how long does the convalescence period take, and did any complication occur from the plants you used.

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