A Questionnaire-Based Study on Use of Plants in Diabetic Patients

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ABSTRACT

Objective: Among patients diagnosed with diabetes mellitus, we aimed to investigate the rates of use of medicinal plants, detailed information on use and purchase, socio-demographic characteristics associated with the tendency to use plants, and the status of reporting to health care professionals.

Methods: The study was conducted in family health centers where patients diagnosed with diabetes mellitus visited. A questionnaire form of objective questions was filled for patients. The questionnaire included socio-demographic characteristics (age, gender, education) of the patients, disease condition, medicines used, and whether or not they used plants. If so, more information was obtained on the plants that are the name, used part, preparation method, frequency of administration, the place from which the plants was obtained, the person who advised the product, the knowledge of the physician and his/her attitude about herbals.

Results: 100 people (66% women, 34% men) participated in the study between the ages of 24-80, 13% of them have Type 1 and 87% have Type 2 diabetes. Only 11% of patients use plants. Eight plants have been identified. The most commonly used plant (36.36%) is cinnamon. Among the usage of the plants, decoction is placed on the top, with 78%. 62.5% of the patients obtain the plants from herbal shops. Friends or relatives are the primary sources of information regarding medicinal plant use (73%).

Conclusion: By increasing the knowledge of physicians about plants, it has been seen that patients can share their usage of plants more easily with physicians.

Keywords: Diabetic patients, medicinal plant, traditional medicine, Türkiye

1. INTRODUCTION

Diabetes is a severe, chronic disease that develops when the pancreas produces insufficient insulin or when the body is unable to use the insulin that it does produce adequately. Diabetes is a major public health issue, with both the number of cases and the prevalence of diabetes continuously rising over the last several decades. Diabetes can lead to complications in many parts of the body, including heart attack, stroke, kidney failure, leg amputation, eyesight loss, and nerve damage (1). The most common type of diabetes is type 2 diabetes which accounts for more than 90% of all diabetes globally. In 2021, diabetes was estimated to affect 537 million adults. Diabetes was the cause of more than 6.7 million deaths (2).

The burden of disease is gradually increasing today as the elderly population rises, and alternative treatment approaches for diseases are gaining importance. Over the last decade, there has been an increasing interest in the use of traditional medicine around the world (3). According to World Health Organization data, nearly 4 billion people worldwide attempt to solve their health problems with herbal drugs in the first place (4). Today, complementary and alternative medicine (CAM) is favored as a supportive treatment to decrease the side effects of medications used to treat chronic diseases and interactions that may occur when multiple drugs are used. In Europe, between 20 to 65% of the general population uses complementary and alternative medicine and herbal medicines are one of the most popular CAM methods among patients with chronic diseases (5, 6).

Medicinal plants have been used since ancient times in the treatment of diabetes. In the Egyptian Papyruses, the works of Hippocrates, and Chinese medicine and Ayurveda texts, plants were mentioned for diabetic treatment. Metformin, which has been used successfully in the treatment of diabetes for the last fifty years, is obtained from *Galega officinalis* L. (7). More than 1200 organisms (such as marine algae, fungi, plants) have been utilized ethnopharmacologically

or experimentally to treat symptoms of diabetes. Fabaceae, Asteraceae, and Lamiaceae are the most frequently cited plant families for diabetes. In antidiabetic activity studies conducted on plants traditionally used against diabetes, the effect was found in 81% of the studied plants, while this rate dropped to 47% in activity studies on randomly selected plants (8). The possible mechanisms of action of plants in diabetes include inhibition of α-glucosidase and α-amylase, the effects on glucose uptake and glucose transporters, the enhancement of insulin secretion and of pancreatic β-cell proliferation, the inhibition of protein tyrosine phosphatase 1B activity and antioxidant activity (9). According to the studies, *Momordica charantia*, *Lagerstroemia speciosa*, *Trigonella foenum-graecum*, *Gymnema sylvestre* are an example of a hypoglycemic effective plant; *Panax quinquefolius*, *Lagerstroemia speciosa*, *Cinnamomum cassia* for those with increased insulin sensitivity; and *Plantago ovata*, *Amorphophallus konjac*, *Trigonella foenum-graecum* for those that inhibit carbohydrate absorption (10).

The objective of this study is to determine the use of medicinal plants in diabetic patients, including detailed usage, plant supply, source of usage information, socio-demographic features, and notifying the physician about herbal uses. In addition, it will help to raise health professionals' awareness by making determinations about the usage of plants in diabetic patients.

2. METHODS

2.1. Ethical Considerations

Patients diagnosed with diabetes mellitus (DM) who visited the family health center (in İstanbul) were informed about the study. Only individuals who agreed to participate and signed a consent form were included. Informed consent was obtained from all patients. All principles of the Helsinki declaration were followed throughout the study. The study was considered ethically appropriate by the Istanbul University Istanbul Faculty of Medicine, Clinical Research Ethics Committee (09.12.2016/21).

2.2. Study Design and Sampling

This survey-based study was conducted with 100 patients diagnosed with DM between February and May 2017. A questionnaire form with objective questions was filled for patients who visited family health centers in Fatih district, İstanbul. Patients over 18 years of age with diabetes were included in this study.

2.3. Questionnaire

The questionnaire included the socio-demographical characteristics (age, gender, education) of the patients, disease condition, medicines used, whether or not they use plants. If so, more information was obtained on the plants that

are the name, used part, preparation method, frequency of administration, the place from which the plant was obtained, the person who advised the product, the knowledge of the physician and his/her attitude about herbals. The studies in the literature were investigated during survey design, and questions about diabetes were constructed for this study (11, 12).

2.4. Data Analysis

Data were analyzed using PAST software. Both chi-square analysis and Fisher's exact test was used to determine the statistical significance of differences between groups. Chi-square test was used for comparison of nonnumerical data. Fisher's exact test was used due to smaller sample sizes. A p value less than .05 was taken to indicate statistical significance.

Referred plants by the patients were bought from the local herbal market in the study district and the scientific name was identified as far as possible. The plants were identified by Assoc. Prof. Dr. Bahar Gürdal. A literature search on antidiabetic activities of identified plants was made.

3. RESULTS

100 patients aged between 24 and 80 years (average age 61.08 ± 9.85) participated in the study. Male/female ratio was 34/66. Forty-six patients (46%) had completed primary school, 8 patients (8%) intermediary school, 14 patients (14%) high school, 14 patients (14%) university and 18 patients (18%) had no education (Table 1).

Table 1. *Socio-demographic characteristics of the participants*

Variable	Frequency (%)	Plants User	
		Yes (%)	No (%)
Gender (p>0.05)			
female	66 (66%)	9 (13.6%)	57 (86.4%)
male	34 (34%)	3 (8.8%)	31 (91.2%)
Age (p>0.05)			
<40	2 (2%)	−	2 (100%)
40-50	9 (9%)	2 (22.2%)	7 (77.8%)
51-60	40 (40%)	2 (5%)	38 (95%)
>60	49 (49%)	7 (14%)	42 (86%)
Education (p>0.05)			
no education	18 (18%)	1 (5.5%)	17 (94.5%)
primary school	46 (46%)	7 (15%)	39 (85%)
intermediary school	8 (8%)	−	8 (100%)
high school	14 (14%)	2 (14%)	12 (86%)
university	14 (14%)	1 (7%)	13 (93%)

11% of female patients have Type 1 DM and 55% of them have Type 2 DM. This percentage for males is 2% Type 1 and 32% Type 2 diabetics. 44% of the patients have DM history in their family and 56% of them don't have. Duration of the diagnosis of DM and the duration of treatment were 0-3

years in 31%, 4-10 years in 46%, 11-20 years in 19% and more than 20 years in 4% patients. Only diabetes is diagnosed in 20% of patients. Besides DM, 23% of the patients have hypertension, 8% have hypertension and cardiac disease, 6% have hypertension and hyperlipidemia. Other 43% suffer from more than 2 diseases (osteoporosis, asthma, rheumatism, chronic obstructive pulmonary disease, gout, goiter, prostatitis, cancer, glaucoma) except DM.

Of the 100 patients surveyed, 11% said that they used plants and 89% did not use plants. Male/female ratio of the plant users was 3/9. As a result, the use of eight plants are documented, these are used in single or mixed by diabetic patients (Table 2). Plants are cinnamon (4 patients), olive leaves (one patient), pomegranate flower/lemon (one patient), cinnamon / olive leaves (3 patients), mint/ oregano (one patient) and cinnamon bark/ mahaleb/ black cumin (one patient).

Table 2. List of the plants and their used part

| Plant name	Latin name of plant	Used part
Black cumin	*Nigella sativa* L.	Seed
Cinnamon	*Cinnamomum cassia* (L.) J.Presl	Bark
Lemon	*Citrus limon* (L.) Osbeck	Fruit juice
Mahaleb	*Prunus mahaleb* L.	Seed
Mint	*Mentha × piperita* L.	Leaves
Olive	*Olea europaea* L.	Leaves
Oregano	*Origanum onites* L.	Leaves
Pomegranate	*Punica granatum* L.	Flower

The patients haven't provided plant samples which are used by them. The scientific (botanical) names of the cinnamon, oregano, and mint specified by the patients could not be exactly determined. Referred plants were purchased from herbal shops in the study district and identified as *Cinnamomum cassia* (L.) J.Presl, *Origanum onites* L., *Mentha × piperita* L. It is thought that patients also mentioned these plants. As the species used in other plants (olive, pomegranate, lemon, mahaleb, black cumin) are already known, no samples were obtained from them. The answer to the question 'Where do you obtain plants?' was from herbal shops (6 patients), friends/relatives (3 patients), nature/ own garden (1 patient), and pharmacy (1 patient) (Figure 1). Preparation methods are decoction (7 patients), infusion (one patient) and mixing with yogurt (one patient) (Figure 2). The answer to the question 'How long have you been using these plants for your DM?' was within 1-5 years (6 patients), more than 5 years (2 patients). Three patients could not state a clear period.

Friend or relative were the primary sources of information regarding medicinal plant use (73%). This is followed by the internet (18%) and television programs (9%) (Figure 3). Six patients didn't inform their physician about using plants beside those five patients informed. When asking 'How was your physician's approach to you about your plant usage?' 46% of patients reported that physicians didn't have
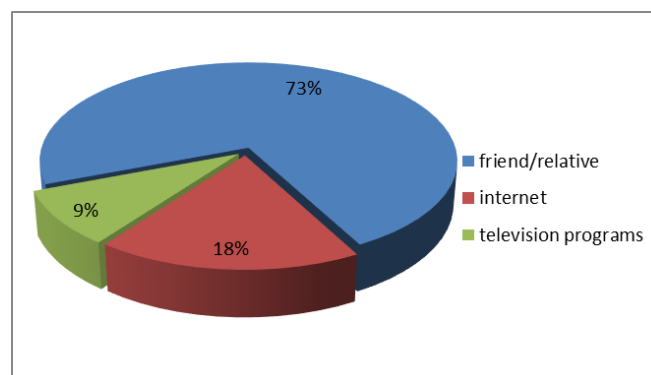
knowledge about herbal medicine; 18% of patients declared that physicians avoided commenting; 27% of the patients stated that physicians informed and motivated the utilization; 9% of the patients reported that physicians opposed herbal medicines (Table 3).
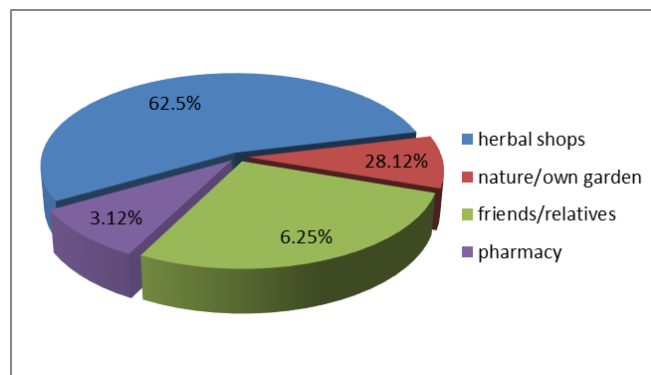
Figure 1. The way of obtaining plants
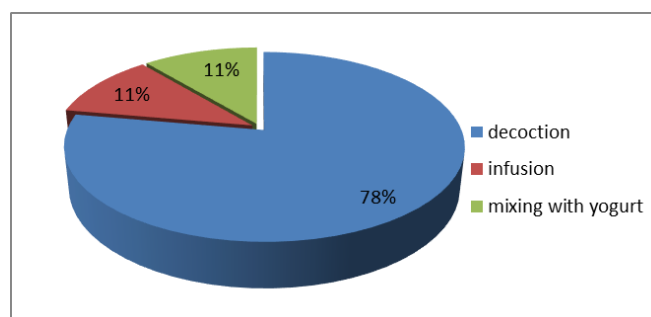
Figure 2. Preparation methods of plants used

Figure 3. The main source of information about medicinal plant use

Table 3. Physician's approach to plant usage

Variable		n (%)
Informing to physician	Yes	5 (45%)
	No	6 (55%)
Physician's approach about plant usage	Opposed	1 (9%)
	Avoided commenting	2 (18%)
	Informed and motivated the utilization	3 (27%)
	Not have knowledge	5 (46%)

4. DISCUSSION

Herbal medicines are sold and accessible at herbal stores and supermarkets as well as pharmacies. In most instances, these herbal medicines are made available to patients without a prescription, and possible adverse reactions, contraindications, and interactions with prescription medications and foods are rarely identified (13). Studies on the usage of herbal products are crucial for revealing the situation and increasing awareness among health professionals and patients. There are only a few studies on the use of plants by diabetic patients in Turkey, and this study will make a valuable contribution to this field.

In our study, the number of patients who used plants for diabetes was 11%. There was no relationship between medicinal plants use with gender, age, and education. In the related surveys which were done in Turkey, different use ratios were reported. Ceylan et al. (14) determined that 41% of diabetic patients used at least one of CAM practice in Ankara. Sex, age, marital status, occupation, and monthly income level were not found to be significant factors ($p > 0.05$). Duration of diabetes in the patients, educational status, birthplace, and family type were found to be significant factors in using CAM ($p < 0.05$). The most preferred practice was the use of herbal medicine (88.1%), followed by acupuncture and meditation practices (5.3%). Öztürk et al. (12) investigated the use of herbal products in type 2 DM patients in Istanbul and reported 52.1% of patients used herbal products. There was no correlation between herbal products usage, its frequency, the type of product, and the advisor and gender, marital status, or educational status. In another study about herbal medicine use among DM patients in Northern Cyprus, they reported 32% of patients used herbal medicine (11). All of the patients declared that the plants they used had a positive effect on them. Soner et al. (15) investigated the uses of herbal medicine in a population of Turkish hospital patients. 48.8% of the participants used herbal medicines and the majority of patients used them to stay healthy. Although there was no linear relationship between age groups and HM usage, there was a clear linear relationship between educational level, monthly family income, and HM use.

There are several studies on herbal medicine usage among diabetic patients in different countries. According to interviews with type 2 diabetes patients, 58% of them reported the use of herbal medicine in North Sudan (16). Gender, education, diabetes duration, and family income were all significant characteristics associated with herbal medicine use. Black seed, cinnamon, olive, and fenugreek were the most commonly used plants. The first three plants were also recorded in our study. As in our study, family and friends were the primary sources of information about medicinal plant use. The majority of patients (63.8%) did not notify their physicians about utilizing herbs. This rate is 55% in our study. Ali-Shtayeh et al. (17) evaluated the CAM uses of Palestinian diabetic patients. 51.9% of the patients used herbs. No statistically significant association was found between plant uses and gender, age, marital status, educational level, presence of other chronic diseases, presence of other diabetic family members, diabetes type or duration of diabetes. All plants except mahaleb and mint, which were mentioned in our study, were also reported in that study. The primary sources of plant recommendations were the same to those found in our study. Due to the widespread use of bush medicine in Trinidad and Tobago, Mahabir and Gulliford (18) investigated the use of bush medicine by diabetic patients there. In the Caribbean, herbal remedies derived from medicinal plants are referred to as "bush medicines." of patients 42% stated using bush medicines and 58% of bush medicine users reported using it for diabetes. In the survey, 103 plants were identified. There were no significant differences between bush medicine use with age and gender. Al-Asadi and Salih (19) assessed the prevalence of herbal remedy use among diabetes patients in Nassyria (Iraq). Only 17.3% of respondents utilized herbal remedy. As in our study, the rate of medicinal plant use was found to be low. Cinnamon and black cumin were the two most commonly used plants. These two plants were found in our results as well. Other plants used were identified as aloe, fenugreek, wormwood, bitter apple, Syrian rue, and garlic. Patients with a higher degree of education were shown to be more frequent plant users. Only 5.9% of plant users disclosed their usage to their physician. This ratio was 45% in our study. Plant uses were mainly recommended to patients by their friends. In Oriental Morocco, uses of herbal medicines among diabetic patients were evaluated (20). Plant usage was reported to be 54.8% in diabetic patients. *Salvia officinalis* L., *Trigonella foenum-graecum* L., *Olea europaea* L., *Artemisia herba-alba* Asso, and *Origanum vulgare* L. were the most commonly used plants. 60% of plant usage has been recorded as a mixture of plants (more than one plants combined). Diabetic patients used single or mixed plants in our study as well. The source on plant use coincides with our study as friends/family and media. In Jordan, the usage of herbal medicine by diabetes patients evaluated and 16.6% of the participants stated that they used plants (21). Plants used by diabetic patients were determined to be green tea, aniseed, ginger, chamomile, sage, fenugreek, blackseed, white lupin, germander, garlic, cinnamon, and olive leaves. Three plants overlap with our study. In Kanpur division (India), Dixit and Tiwari (22) interviewed with 44 healers to determine anti-diabetic plants. Thirty-five species used by healers for the treatment of diabetes have been identified. The most often used plants were *Aloe vera* L., *Syzygium cumini* L., *Momordica charantia* L., *Phyllanthus emblica* L., *Ocimum sanctum* L., *Trigonella foenum-graceum* L., *Catharanthus roseus* (L.) G.Don, *Carica papaya* L., *Allium sativum* L., *Cassia fistula* L., *Allium cepa* L., and *Tecoma stans* (L.) Juss. ex Kunth.

In our study, eight plants used by diabetic patients were determined. *In vitro* and *in vivo* studies have shown that some of them have anti-diabetic properties. *Nigella sativa* seeds contain essential and fixed oils, alkaloids, proteins, and saponin. The main fatty acids are linoleic acid, palmitic

acid, and oleic acid. The major compounds of its essential oil are thymoquinone, trans-anethole, p-cymene, and α-pinene (23, 24). Different mechanisms of antidiabetic effect of *Nigella sativa* have been shown such as it reduces appetite, glucose absorption in intestine, blood glucose level, hepatic gluconeogenesis, triglycerides, cholesterol, body weight and simulates glucose induced secretion of insulin from beta-cells in pancreas. Its *in vivo* antihyperglycemic effects have been attributed to insulinotropic and insulin-like properties (25, 26). Major compounds of *Cinnamomum cassia* are determined as cinnamaldehyde, coumarin and essential oils. Because o-hydro-xyphenylacetaldehyde (o-HPA), a coumarin metabolite, is hepatotoxic, long-term intake of *C. cassia* may pose a health risk (27, 28). Kumar et al. (29) investigated antidiabetic activity of *C. cassia* on streptozotocin-induced diabetic rats. They prepared de-coumarinated water-soluble polyphenol-rich extracts of *C. cassia* and compared with a standard aqueous cinnamon extract. When compared to an aqueous cinnamon extract, polyphenol-rich *C. cassia* extracts significantly improved blood sugar, serum insulin, lipid profile, and liver antioxidant enzymes. Another study evaluated blood glucose and plasma insulin levels in rats given extracts from *Cinnamomum cassia* and *C. zeylanicum* (30). The *C. cassia* extract was found to be superior to the *C. zeylanicum* extract. Plasma insulin levels were raised. Extracts showed that insulin stimulatory effect. Al-Baidhani et al. (31) investigated the activity of herbal prescriptions which are used for diabetes. Therefore α-amylase and α-glucosidase inhibitory activities were studied. Prescriptions included mix plants. Prescription, which contains extracts of *Prunus mahaleb* L. and *Prunus dulcis* (Mill.) D.A.Webb, was shown to be the most effective α-amylase and α-glucosidase inhibitor. Ethanol extract of olive leaves was investigated in streptozotocin-induced diabetic rats. The antidiabetic activity of olive leaves was found to be more effective than that of glibenclamide (32). In another study, the antidiabetic effect of olive leaves was shown *in vivo* (33). As a result, improvement in glucose levels and in levels of inflammatory and metabolic markers was demonstrated. Huang et al. (34) evaluated *in vivo* antidiabetic activity of *Punica granatum*. Its flower extract showed that it inhibited the glucose loading-induced increase of plasma glucose levels, enhanced cardiac PPAR-g mRNA expression, and restored the down-regulated cardiac glucose transporter (GLUT)-4 mRNA. Additionally, gallic acid is found to be mostly responsible for this activity. Bagri et al. (35) studied the antidiabetic effect of *Punica granatum* flowers on streptozotocin-induced diabetic rats and aqueous extract was used. It showed benefits in the control of diabetes, abnormalities in lipid profiles, and oxidative stress through the activation of pancreatic antioxidant enzymes.

Plants used by the public have the potential to become drugs if they are supported by *in vitro*/*in vivo* activity studies and their effects are proven by clinical studies. Medicinal plants can help prevent diabetes and its complications, as well as improve treatment and quality of life. The important point is that when using plants in chronic diseases, the side effects, and interactions should be evaluated by the physician, and the importance of patient-physician cooperation.

5. CONCLUSION

Both in our study and in other studies, friends and relatives were indicated as the first source of recommending herbal products. There may be caused potential interactions and side effects. Prescription drugs are used in diabetes and also other chronic diseases. Therefore, accurate assessment of drug-herb interactions is critical. This requires the physician to be aware of the usage of herbal products. These studies provide important contributions to the determination of the use of herbal products by the patients. It contributes to raising awareness in both patients and physicians.

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