



Herbal Medicine Use among Patients with Type 2 Diabetes in North Sudan

Badreldin A Mohamed Ali^{1*} and Mohamed Salih Mahfouz²

¹Department of Community Health Sciences, College of Applied Medical Sciences, King Saud University, P.O. Box 10219, 11433, Riyadh, Kingdom of Saudi Arabia.

²Department of Family and Community Medicine, Faculty of Medicine, Jazan University. PO Box 2531, Postal code 45142, Jazan, Saudi Arabia.

Authors' contributions

This work was carried out in collaboration between both authors. Author BAMA prepared the project proposal and designed the research paper. Author BAMA performed data analysis and wrote the draft manuscript. Author MSM provided significant input on the manuscript. Both authors read and approved the final version of the manuscript.

Original Research Article

Received 23rd November 2013
Accepted 9th February 2014
Published 19th February 2014

ABSTRACT

Aims: The aim of this study was to assess the prevalence, pattern and predictors of herbal medicine use among patients with type 2 diabetes.

Study Design: Observational cross-sectional study design.

Place and Duration of Study: This study was conducted in 2012 at primary health care centers (PHCCs) in Khartoum.

Methodology: Data for a cross-sectional study were collected via face-to-face interviews using structured questionnaires at primary health care centers (PHCCs) in Khartoum, Sudan.

Results: From a total of 600 patients who responded, 58% reported the use of herbal medicine. Significant factors associated with herbal medicine use were, gender ($P=0.006$), education ($P=0.001$), duration of diabetes ($P=0.005$) and family income ($P=0.019$). Gender ($P=0.001$), education, duration of diabetes and place of birth ($P=0.05$). The most commonly used herbs were fenugreek, black seed, cinnamon and olive. The proposed motivations for using herbal medicines were ease of access, low cost and reports of a positive experience by others. Family and friends were the main source of information for most patients. About 63.8% failed to inform their doctors about using herbs, and the main

*Corresponding author: Email: mm.mahfouz@gmail.com;

reasons given for this were fear of a negative response, doctor did not ask, and unnecessary to inform the doctor.

Conclusion: The prevalence of herbal medicine among diabetics is high. The herbs used are not investigated for safety and efficacy and this point to the urgent need for research in this area. In order to overcome a lack of knowledge among doctors about herbs, we propose the integration of herbal medicine into the current medical curriculum so that in future physicians will be better able to communicate with their patients.

Keywords: Herbal medicine; North Sudan; type 2 diabetes.

1. INTRODUCTION

The management of types two diabetes (T2D) is a global problem and as yet a successful treatment has not been discovered. There is a paucity of data on the epidemiology of diabetes in Sudan. The actual number people with diabetes is not known due to the absence of large-scale studies; however, some studies report that the prevalence of T2D has increased from 3.4% in 1996 to 10.4% in 2010, which is the highest in sub-Saharan Africa [1,2]. Studies have shown obesity to be an important risk factor for developing T2DM, along with other contributing factors of a sedentary lifestyle [2].

The prevalence of obesity in Sudan ranges from between 1.5% and 6.5%, which is the lowest in the Arabic-speaking countries [2,3]. Physical inactivity is the highest contributing factor (86.8%) in the Middle Eastern/North African regions [3,4]. Type 2 diabetes is the commonest cause of hospital admissions due to chronic diseases, constituting 70% of all hospital admissions, with 10% of deaths in hospitals being caused by T2D [1,5]. People with diabetes receive attention in general primary care clinics, but these are poorly equipped and even the minimum requirements for diabetic care are not available. There is an almost total lack of diabetes education. A few private clinics exist but their usefulness to the diabetes population is limited by their relatively high fees.

The majority of Sudanese diabetic patients lack the financial means to afford the increasingly expensive conventional treatments on a consistent and sustainable basis, and the government no longer supports the cost of conventional drugs, making it impossible for the majority of patients to secure such medication. This has prompted patients to seek other effective strategies to manage their symptoms. Herbal medicine is one available alternative for those patients.

Herbal medicine is defined by the WHO as herbs, herbal materials, herbal preparations and finished herbal products which contain parts of plants, or other plant materials, as active ingredients [6]. These plant materials include seeds, roots, leaves, fruit, bark and cloves. It is estimated that between 65% and 85% of the world population uses herbal medicine as their primary form of health care, and that more than 400 plant species are used in different forms for their hypoglycemic effects in treating diabetes, with tall claims of efficacy by patients and practitioners [7]. The aim of this study was to assess the prevalence, pattern and predictors of herbal medicine use among patients with type 2 diabetes in some selected primary health care centers (PHCCs) in Khartoum, Sudan.

2. MATERIALS AND METHODS

2.1 Study Population

This study was conducted at primary health care centers (PHCCs) in Khartoum. The total number of PHCCs is 125. The number of patients in daily attendance at each of those centers is approximately equal. Most of the patients attended for primary health care on an appointment basis. Patients between 30–70 years of age and who have had diabetes for at least one year were eligible to participate.

2.2 Sampling Methods

The sample size calculation was based on the assumption that 30% of the Sudanese population has used herbal medicine, with an estimated error of 5% within a 95% confidence level and 90% power, resulting in 529 patients. A decision was made a priori to increase the desired sample size in the selected PHCCs to ensure that ample patients had been entered into the study in the event that some patients were refused or missed their appointment. Thus, a sample of 600 patients was selected. Due to limited funding, we decided to select 15 PHCCs randomly.

2.3 Instrument and Data Collection

The study questions were adopted and modified from previously developed and validated studies on herbal medicine use [8]. The questionnaire was divided into four sections: demographic and health information, common medicinal herbs used, reasons for using herbal medicine, and characteristics of herb use. Interviews were conducted on different days and at different times of the week. The interview was conducted by medical students who were trained in questionnaire administration and interviewing skills. Participants who have used herbal medicine consistently in the last six months were regarded as herbal medicine users, and those who had never used it were considered as non-users. Patients who met the eligibility criteria were requested to participate in the study. In case of refusal or absence, the next patient on the list was approached. The sample was distributed equally between the PHCCs. Interviewees were approached while waiting to see the doctor.

2.4 Confidentiality

Participants were informed about the nature of the study prior to the commencement of the interview. Patients were also assured that any information they revealed would remain confidential and would be used strictly for research purposes only. All data obtained in the study were used in a manner that did not allow public disclosure of the subjects' identities. Each patient who participated in the study was paid 50,000 Sudanese pounds (US\$6.5).

2.5 Data Analysis

All questionnaires were cross-checked to ensure completeness, and the data was then entered into SPSS version 20 for analysis. Chi-square was used to assess the association between users and non-users for the demographic and health variables. Multiple logistic regression was used to identify factors predicting herbal medicine use. To the best of our knowledge, this is the first study to address the use of herbs in Sudan. The purpose of the

study was to examine the characteristics of herb use and to determine the factors associated with herb use.

3. RESULTS

3.1 Demographic Characteristics of Respondents

The study sample was composed of 600 patients. About 58% of the respondents were herbal medicine users. Of these herb users, the majority of the patients were married (80.2%), in the age group 41–50 years (49%), held primary and secondary school diplomas (82.2%), had a family income of between 400,000–1,200,000 SP (79.2%), and had been diabetic for more than five years (80.7%). Most patients have sugar-related complications, mainly eye disease (20.3%) and hypertension (23.8%). For non-herb users, the majority of the patients were married (76.5%), in the age group 41–<50 years (54.4%), held secondary and university diplomas (74.6%), had a family income of between 800,000–1,200,000 SP (77.0%), and had been diabetic for more than five years (69.8%). These patients also had sugar-related complications, with hypertension as the main related disease (24.8%). Statistically significant differences were observed between users and non-users for age ($P=0.045$), gender ($P=0.006$), education ($P=0.001$), duration of diabetes ($P=0.005$) and family income ($P=0.019$). Table 1.

3.2 Herbal Use and Characteristics of Herbal Use

Table 2 displays the types of herbs most frequently used among patients. Fourteen plant species were cited. The most frequently used were fenugreek (29.1%), black seed (21.6%), cinnamon (16.8%) and olive (15.7%). Several plant parts were used: leaves, seeds, roots, fruits and bark.

Table 3 presents the reasons cited by users and non-users for using or not using herbs. Herb users stated the following reasons: considered positive by others (81.3%), easy access (72.4%), low cost (75.0%), traditional belief of efficacy (48.3%), and conventional medicine is expensive (72.8%). For non-users, the reasons cited were: not safe (69.8%), bitter taste (54.0%), ineffective (23.4%), and a dislike of herbal medicine (19.4%).

Table 4 outlines the characteristics of herb use. About (31.9%) had experienced side-effects. One or more clinical manifestations of herbal medicine were observed, including gastrointestinal disorders (62.2%) (abdominal pain, diarrhea, vomiting), 36.4% reported skin irritation, and 1.0% stated dizziness. Regarding frequency of use, about 63.2% used herbs daily and 20.4% used them three times a week. Most of the patients (63.8%) did not inform their doctors they were using herbs. The reasons cited were that the doctor may feel upset (43.7%), doctor did not ask (26.6%), do not want doctor to know (21.5%), not necessary to inform their doctors (7.6%), and expressed a negative attitude when informed (4.2%). Four modes of plant procurement were mentioned. Purchase from a herbalist shop was the most frequent mode (59.2%), followed by obtaining from abroad (26.8%) and from family harvesting (14.0%). For source of information, about (47.1%) of the herb users were advised by a family member, followed by a friend (31.4%) or a herbalist (20.5%).

A stepwise multiple regression Table 5 showed that sex, education, duration of diabetes and place of birth are important predictors in the use of herbs. Females are more likely, by about

more than 100%, to use herbs as compared to males. Place of birth was a strong factor for using herbs: an approximately 1.5-fold increase in use was noted for those born in rural areas as compared to those born in urban areas. A significant relationship between education and herb use was observed. About a 60% decrease in herb use was demonstrated for university patients. The use of herbs increases with an increase in the duration of diabetes. Those who have been diabetic for more than 8 years were almost four times more likely to use herbs, as compared to those with up to 4 years of diagnosis.

Table 1. Socioeconomic characteristics, medical and family history

Variable	Users N (%)	Non-users N (%)	P- value
Marital status			
Married	279 (80.2)	193 (76.5)	0.291
Not married	69 (19.8)	59 (23.5)	
Age (years)			
< 40	41 (11.9)	40 (15.9)	0.045
41 – 50	171 (49.0)	137 (54.4)	
> 50	136 (39.1)	75 (29.8)	
Gender			
Male	142 (40.8)	85 (24.4)	0.006
Female	206 (59.2)	167 (75.6)	
Place of birth			
Rural	117 (33.6)	101 (29.0)	0.104
Urban	231 (66.4)	151 (71.0)	
Education level			
Illiterate	27 (07.9)	13 (05.0)	0.001
Primary and intermediate	184 (53.0)	54 (21.4)	
Secondary	102 (29.2)	123 (48.8)	
Graduate and above	35 (09.9)	65 (25.8)	
Duration of diabetes (years)			
1 – 4	67 (19.3)	76 (30.2)	0.005
5 – 8	169 (48.5)	114 (45.2)	
> 8	112 (32.2)	62 (24.6)	
Family income			
Less than 400,000	18 (0.50)	8 (03.2)	0.019
400,000 – less than 800,000	143 (38.6)	74 (29.4)	
800,000 – 1,200,000	141 (40.6)	120 (47.6)	
> 1,200,000	55 (15.8)	50 (19.8)	
Related health diseases			
Heart disease	14 (04.0)	3 (1.0)	
Eye disease	71 (20.3)	39 (15.6)	
Stroke	3 (01.0)	-	
Neuropathy	12 (03.5)	-	
Kidney disease	50 (14.4)	31 (12.3)	
Thrombosis	10 (03.0)	-	
Hypertension	83 (23.8)	63 (24.8)	

Table 2. Common medicinal herbs used by diabetic patients

Herb (scientific name)	Common English name	Part used	%
<i>Camellia Sinensis</i> (L.) Kuntze	Green tea	leaves	7.3
<i>Pimpinella anisum</i> L.	Aniseed	seeds	14.1
<i>Zingiber officinale</i> Rosc.	Ginger	root	14.7
<i>Matricaria Chamomilla</i> L.	Chamomile	leaves	10.4
<i>Salvia fructicosa</i> mill	Sage	leaves	8.3
<i>Trigonella foenum-graecum</i> L.	Fenugreek	seeds	29.1
<i>Nigella sativa</i> L.	Black seed	seeds	21.6
<i>Lupinus albus</i> L.	White lupin	fruit	8.4
<i>Olea europaea</i> L	Olive	fruit, leaves	15.7
<i>Cinnamomum Zeylanicum</i>	Cinnamon	bark	16.8
<i>Punica granatum</i>	Pomegranate	fruit coat	3.2
<i>Artemisia judaica</i>	Wormwood	seeds	7.1
<i>Allium sativum</i>	Garlic	cloves	11.3
<i>Coriandrum sativum</i>	Coriander	seeds, leaves	8.2

Table 3. Reasons for using or not using herbal medicine

Reasons for using herbal medicine (users)	N (%)
1- easy access	252 (72.4)
2- low cost	261 (75.0)
3- experience considered positive by others	283 (81.3)
4- traditional belief in the efficacy of herbal medicine	168 (48.3)
5- conventional medicine expensive	253 (72.8)
Reasons for not using herbal medicine (non-users)	
1- not safe	176 (69.8)
2- dislike herbal medicine	49 (19.4)
3- ineffective	59 (23.4)
4- bitter taste	136 (54.0)
5- no reason	86 (34.1)

Table 4. Characteristics of use of herbs

Characteristic Source of information	N	%
Family member	230	47.1
Friend	153	31.4
Herbal medicine retailers	100	20.5
Media	5	1.0
Source of herb		
Family harvest	48	14.0
Herbal shop	203	59.2
Abroad	92	26.8
Frequency of use Daily		
Twice a week	220	63.2
Three times a week	26	7.5
Other	71	20.4
Other	31	8.9
Did you experience any side-effects?		
Yes	111	31.9
No	237	68.1

Continued Table 4.....

Side-effect experienced		
Diarrhea	26	12.6
Vomiting	3	1.5
Fainting	2	1.0
Skin reaction	75	36.4
Abdominal pain	100	48.5
Discuss using herbs with your doctor?		
Yes	126	36.2
No	222	63.8
If No, reason why		
Fear of response, doctor may feel upset	167	43.7
Doctor did not ask	82	21.5
Do not want doctor to know	88	23.0
Not necessary to inform doctor	29	7.6
Past negative attitudes when informed	16	4.2

Table 5. Stepwise multiple logistic regression of predictors for herb use

Variable	Odds ratio	p-value	95% Confidence interval
Sex			
Male	1		
Female	2.12	0.001	1.86 – 4.33
Education			
Illiterate	1		
Primary & intermediate	1.10	0.243	0.83 – 2.15
Secondary	0.87	0.125	0.47 – 1.64
University & above	0.38	0.017	0.22 – 1.28
Duration of diabetes (years)			
1 – 4	1		
5 – 8	1.73	0.026	0.81 – 2.63
> 8	4.06	0.001	2.79 – 5.61
Place of birth			
Urban	1		
Rural	1.48	0.023	0.74 – 2.81

4. DISCUSSION

Sudan is a country with deep-rooted traditions. The use of herbal medicine is a common practice in the management of many diseases [9,10]. Patients' belief in their efficacy, easy accessibility, lower cost, experience of others and frustration with conventional therapy have encouraged diabetic patients to seek herbal medicine to manage their symptoms. It is therefore not surprising that about 58% use herbs.

The prevalence of herbal medicines observed in our study (52%, 95% CI (0.475-0.575)) is comparable to that reported elsewhere in the world (40% in the USA, 48.5% in Australia, 37.1% in the UK, 49% in France) and lower than similar studies in India (68%), Mexico (62%) and Korea (63.7%), but was higher than reported in Arab countries: 16.6% in Jordan, 17.4% in Saudi Arabia, and 21.3% in Morocco [9,10]. This may be related to the traditions and cultural characteristics of a given country.

Some of the plants documented in this study for the treatment of diabetes have been similarly used in other countries of the world [11,12,13,14]. This correspondence in the use of the same herbs in different cultures strongly suggests that these plants may be effective in the treatment of diabetes. This study revealed some similarities and dissimilarities in the plants used in treating diabetes mellitus in other Arab countries. The similarity is mainly because most of those herbs were obtained from Arab countries. In our study about 26% reported obtaining herbs from Arab countries, mainly Saudi Arabia, Syria and Jordan. The observed dissimilarity is due to the availability of herbs in certain countries compared to others; also, tradition and habits may play a role in patients' choices. The most frequently used herb is fenugreek (29.1%), and it is usually taken as powder, with the disadvantage of having a strong odor in the sweat. Clinical trials showed a reduction in fasting blood glucose level of 35.2% with the daily use of 100g of fenugreek seed powder [15]. For fenugreek, the most commonly reported adverse effects reported in clinical studies include transient diarrhea, flatulence and dizziness, with the possibility of hypoglycemia when used in addition to other hypoglycemic therapies [16]. The next most commonly used herb is black seed (21.6%). This comes from the Prophet Mohamed in the Hadith: "black seed is a cure for all ailments except death". The third most widely used plant is cinnamon, used by around 15.7%. Clinical trials show that cinnamon reduces serum glucose levels by up to 29% with the use of 6g per day [16].

Most patients using medicinal herbs relied upon the advice of family and relatives. Such information on the use of medicinal plants could be based upon culture/traditional knowledge. Diabetes is an inherited chronic disease, and it is reasonable to expect that a strong traditional knowledge of the use of herbs already exists (47.1%). Traditional transmission of oral knowledge, a characteristic feature of African societies, was clearly at play here. Most of the users (81.2%) were persuaded to use medicinal plants after hearing the positive experiences of others [17].

Many people today feel that they would like to be more in control of their own health care and perceive that herbal medicine allows this, as neither a prescription nor a physician visit is required for the use of this therapy. Most of the patients (63.8%) did not discuss their use of herbs with their physicians, a figure which is similar to that reported in a number of other studies [17,18,19,20]. The non-disclosure rate in this study falls within the range from other studies of 43–65% [21,22]. Reasons cited for non-disclosure were expectation of a negative reaction from the doctor (43.7%), the perception that there is no need to report such use (7.6%), past negative attitude (4.2%) and doctor did not ask (21.5%). Usually the number of visitors to PHCCs is large and, due to shorter office visits, time constraints may render the discussion and integration of herbal medicine into mainstream practice difficult. Previous studies have shown that physicians usually do not discuss herb use with their patients, which may be due to insufficient information about herbs, lack of information regarding standard dosage, lack of knowledge about the potential harm and efficacy of those plants, and the fact that such knowledge is not imparted during their medical training [22,23,24,25].

In Arabic countries, previous research showed that more than 75% of physicians were found to be accepting of herbal medicine use in their patients but exhibited poor knowledge of herbs, leading to a gap in communication. Even for those who have asked their patients about herb use, very few documented this information in the patients' charts [23,25].

Adverse effects from using herbs were reported in our study, and these may be attributed to many causes. There is no law regulating the sale and distribution of herbal medicines and

access to herbal medicines is unrestricted. Herbs are sold to customers upon the request of the customer or as recommended by the herbalist. Most herbalists learn about use of herbs through experience, and often they are not educated; they inherited their business from their families. Some herbalists rely upon books written in the Arabic language on herbal medicine by non-specialist authors in order to recommend herbal remedies to their customers. Those writers use the local plant names of their countries and communities, and one plant can be known by more than one name. For example, black seed is known in Sudan as both black kamoon and Baraka seed. Additionally, different plants may share the same common name. In Jordan, the Arabic name "Rijl el haameh" is used for *Paronychia argentea*, and also for the less-used plants *Verbena officinalis* and *Anchusa officinalis* [26]. About 30% of those who work in the herb business originate from West Africa. Some sell prepared extracts which are a mixture of various herbs. Most of the extracts used were prepared by decoction: this method uses the crude plant, and carries a high risk of bacteria or fungal contamination. The adverse effects of these extracts are not known. Plants are stored in unventilated shops with poor sanitary conditions, where they are liable to rodent attack and plant material attack by insects, while some herbalists apply insecticides to prevent attack by insects. Besides, those herbs are not inspected at the port of entry by any expert, nor are they authenticated by the Ministry of Commerce.

There is no consistency in the results reported in different countries for the association between sociodemographic variables and herb use [27,28,29,30]. This conflict might be due to differences in beliefs, values and cultural features of the country or community included in the study. The results of our bivariate analysis are in agreement with other studies in identifying an association between income, age, gender, diabetes duration, place of birth, and education with use of herbal medicine [27,28]. However, our multivariate result highlighted some differences. For example, age and income were found to be associated with herbal medicine use, but when an adjustment was made for the influence of other predictors, no significant effect was observed. Our results showed that education, gender, place of birth and duration of diabetes were the main predictors of herbal use. Attaining a higher level of education negatively influenced the decision to use herbs, contrary to other studies. The availability of scientific evidence-based information on the efficacy of herbs in the treatment of diabetes may be particularly significant in patients with a higher educational level; this may predispose an individual to access general knowledge, especially with greater exposure to the internet and other sources of information, and could be a factor in influencing the individual's decision to use specific medicinal plants. Income was not associated with herb use, due to the fact that the price of many herbs is very low. About 69.8% indicated that they had used herbs specifically because conventional treatments were too expensive. The duration of diabetes has previously been reported to affect herb use [27,28,30]: this may be due to the fact that individuals who have had diabetes for a long period of time have experienced difficulty in managing their illness using conventional medicine and seek alternatives to cope with those difficulties. Our result confirms the association shown in previous studies that women were more likely to be users of herbal medicine than men [12,28,29]. The reason for this difference is not known, although it may be related to cultural context: differing roles and health beliefs between the genders in Sudan may contribute to it. Diabetes in North Sudan is more common among females than males, a similar pattern to many African countries; besides, there is a high rate of illiteracy (65%) among diabetic women [31]. Patients from rural origins have a higher rate for herb use. Culture/traditional knowledge plays a role: people grow herbs on their farms, such as fenugreek, cinnamon and garlic, and they have information on the use of those herbs. Also rural people may not afford to buy conventional drugs due to their low income.

The strength of our study lies in the focus on the use of herbal medicines rather than on CAM use in general. The study was limited: we conducted the study at public health facilities and we excluded private institutions.

5. CONCLUSION

Our findings have revealed that the use of herbal medicines is quite popular among diabetic patients, even those who live in the capital and have better access to orthodox medical care and specialized medical practitioners. There is an urgent need for educational intervention with regard to herbal medicine in terms of the training of physicians. We propose an integration of herbal medicine into the current medical curriculum so that in future physicians will be better able to communicate with their patients on health care modality.

ACKNOWLEDGEMENTS

We are indebted to study participants who took active part of the survey. Also we would like to extend our appreciation to the Research Center, College of Applied medical sciences and Deanship of Scientific Research at King Saud University for funding this research.

ETHICAL APPROVAL

Ethical issues (including plagiarism, Informed Consent, misconduct, data fabrication and/or falsification, double publication and/or submission, redundancy) have been completely observed by the authors.

COMPETING INTERESTS

The authors have no conflict of interest to declare.

REFERENCES

1. Awad MA, Nada HA. Diabetes mellitus in Sudan: The size of the problem and the possibilities of efficient care. *Pract Diab Int.* 2006;18(9):324–327.
2. Vivian CT, Geoffrey KM, Chung EH. Type 2 diabetes mellitus and obesity in sub-Saharan Africa. *Diabetes Metab Res Rev.* 2010;26(6):433–435.
3. Mohammad B, Ismail L. Obesity in Arab-speaking countries. *J of Obesity;* 686430. doi:10.1155/2011/686430. 2011.
4. Mohammad B, Ismail L. Type 2 diabetes in Arab-speaking countries. *Int J Endocrinol;* 2012:902873. Doi:10.1155/2012/902873. 2012.
5. Elrayah-Eliadarous H, Yassin K, Eltom M, Abdelrahman S, Wahlström R, Ostenson CG. Direct costs for care and glycaemic control in patients with type 2 diabetes in Sudan. *Exp Clin Endocrinol Diabetes.* 2010;118(4):220–225.
6. World Health Organization. National policy on traditional medicine and regulations of herbal medicines—report of a WHO global survey. WHO. Available: <http://www.who.int/medicines/area/traditional/en/indexhtml>. 2005.
7. Malviya N, Jain S, Malvia S. Antidiabetic potential of medicinal plants. *Acta Polomiac Pharma Drug Res.* 2010;67(2):113–118.

8. Quandt SA, Verhoef MJ, Arcury TA, et al. Development of an international questionnaire to measure use of complementary and alternative medicine (I-CAM-Q) *Journal of Alternative and Complementary Medicine*. 2009;15(4):331–339. [PubMed]
9. Hopkins A, Stepp JR. Distribution of Herbal Remedy Knowledge in Tabi, Yucatan, Mexico. *Econ Bot*. 2012;66(3):249–254.
10. Bell RA, Suerken CK, Grzwacz JG, Lang W, Quandt SA, Arcury TA. Complementary and alternative medicine use among adults with diabetes in the United States. *Altern Ther Health M*. 2006;12(5):16–22.
11. Zohreh B. Herbal medicines in diabetes. *Iranian J of Diabetes and Obesity*. 2012;3(2):88–95.
12. Norah AA. Herbal medicine in the treatment of diabetes mellitus. *Saudi Med J*. 2002;23(11):1327–1331.
13. Abeer JK, David LW. The use of complementary and alternative medicine by patients with diabetes mellitus in Bahrain: a cross-sectional study. *BMC Complement Altern Med*. 2010;10:35. doi: 10.1186/1472-6882-10-35.
14. Mayyada W, Fatma UF, Mohamed E, Kamel A. Complementary and alternative medicine use among Jordanian patients with diabetes. *Complementary Therapies in Clinical Practice*. 2011;17(2):71–75.
15. Kimberly L, Melissa C. Complementary and alternative medicine for the treatment of diabetes. *J of Pharmacy Practice*. 2009;22(6):546–552.
16. Posadzki P, Watson LK, Ernst E. Adverse effects of herbal medicines: an overview of systematic reviews. *Clin Med*. 2013;13(1):7–12. Review.
17. Baldé NM, Youla A, Baldé MD, Kaké A, Diallo MM, Baldé MA, Maugendre D. Herbal medicine and treatment of diabetes in Africa: An example from Guinea. *Diabetes Metab*. 2006;32(2):171–175.
18. Ibrahim AO, Kazeem AO, Mercy A. Herbal medicine use among urban residence in Lagos, Nigeria. *BMC Complement Altern Med*. 2011;11:117. doi:10.1186/1472-6882-11-117.
19. Özlem K, Sevgi K, Hatice M, Özlem U, Dilek B, Elif Ü. Complementary and alternative medicine use among people with diabetes in Turkey. *Western J of Nursing Research*, 2012;34(7):902–916.
20. Ogbera AO, Dada O, Adeleye F, Jewo PI. Complementary and alternative medicine use in diabetes mellitus. *West African J of Medicine*. 2010;29(3):158–162.
21. Robison A, McGrail MR. Disclosure of CAM use to medical practitioners: A review of qualitative and quantitative studies. *Complement Ther Med*. 2004;2(3):90–98.
22. Awodele O, Agbaje EO, Abiola O, Awodele DF, Dolapo DC. Doctors' attitudes towards the use of herbal medicine in Lagos, Nigeria. *J of Herbal Medicine*. 2012;2(1):16–22.
23. Abdullah Al-Rowais N, Al Bedah AM, Khalil MK, El Olemy AT, Khalil AA, Alrasheid MH, Al Khashan H, Al Yousef M, Abdel Razak Ba Fart A. Knowledge and attitudes of primary health care physicians towards complementary and alternative medicine in the Riyadh region, Saudi Arabia. *Forsch Komplementmed*. 2012;19(1):7–12
24. Mildren SP, Stokols D. Physicians' attitudes and practices regarding complementary and alternative medicine. *Behav Med*. 2004;30(2):73–82.
25. Alachkar A, Jaddouh A, Elsheikh MS, Bilia AR, Vincieri FF. Traditional medicine in Syria: Folk medicine in Aleppo governorate. *Nat Prod Commun*. 2011;6(1):79-84.
26. Barakat EA, Fatma UF. Herbal medicine in Jordan with special emphasis on commonly used herbs. *J Ethnopharmacol*. 2003;89(2-3):193–197.
27. Al-Windi A. Predictors of herbal medicine use in Swedish health practice. *Pharmacoepidemiol Drug Saf*. 2004;13(7):489–496.

28. Kuo GM, Hawley ST, Weiss LT, Balkrishnan R, Volk RJ. Factors associated with herbal use among urban multiethnic primary care patients: A cross-sectional survey. *BMC Complement Altern Med.* 2004;4:18. doi: 10.1186/1472-6882-4-18.
29. Vickers KA, Jolly KB, Greenfield SM. Herbal medicine: Women's views, knowledge and interaction with doctors: a qualitative study. *BMC Complement Altern Med.* 2006;6:40–48. doi: 10.1186/1472-6882-6-40.
30. Süleyman C, Ömer A, Abdullah T, Türker T, Cengi ZH, Mahir G. Complementary and alternative medicine among Turkish diabetes patients. *Complement Ther Med.* 2009;17(2):78–83.
31. Levitt NS. Diabetes in Africa: Epidemiology, management and healthcare challenges. *Heart.* 2008;94(11):1376–1382.

© 2014 Ali and Mahfouz; This is an Open Access article distributed under the terms of the Creative Commons Attribution License (<http://creativecommons.org/licenses/by/3.0>), which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

Peer-review history:

The peer review history for this paper can be accessed here:
<http://www.sciencedomain.org/review-history.php?iid=437&id=32&aid=3751>