Prevalence, Awareness, Attitudes and Usefulness of Allopolyherbal Medications Among Type 2 Diabetics: A Community Based Cross-sectional Survey

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ABSTRACT

Objectives: The prevalence of herbal medicines is drastically increasing among patients with chronic diseases like diabetes mellitus due to its difficulty in adhering to therapeutic regimens and lifestyle changes, without considering its consequences of concomitant uses. The aim of this study was to explore the prevalence, attitude, awareness and consequences of simultaneous use of herbal medicines with allopathic anti-diabetic drugs. **Methods:** A community based cross-sectional study was conducted among Type 2 diabetes using pre-structured questionnaire consisting socio-demographic details and herbal use characteristics. Patients with type 1 diabetes, gestational diabetes and those rely only on anti-diabetic herbal products were excluded. Descriptive statistics and multivariate-logistic regression were employed to analyze data. **Results:** A total of 470 patients responded, 340 tried herbal plants along with allopathic drugs. The herbal users were mostly females (54.89%) and from rural background (62.55 %) (P= 0.011). The herbal use was higher among 40 to 55 age group, having a duration of diabetes less than one year (P=0.001). About 34 herbal plants identified, Guava (17.6%) and Bitter-gourd (12.9%) were most commonly used and families, friends, neighbors (32.60%) were their herbal information providers. About 67% of patients reported satisfactory with herbal use but only 35% patients informed their doctors about the concomitant use. Among herbal users, 25% of patients reported hypoglycemia and a negligible patient reported about such occurrence. **Conclusion:** This study identified high prevalence of herbal use with modern treatment. Hence, patients as well as health providers must be educated about potential risks and benefits of herbal treatment.

Key words: Concomitant, Herbal Medicine, Herb-Drug interactions, Hypoglycemia, Type 2 Diabetes mellitus.

INTRODUCTION

Diabetes mellitus (DM), a chronic progressive devastating disease that requires regular medications with adequate lifestyle modifications for achieving a target blood glucose level.[1] Uncontrolled diabetes has an increased risk for developing a serious health-related complication such as diabetic retinopathy, nephropathy, neuropathy and other vascular diseases.[2] As per the International Diabetes Federation (IDF), approximately 425 million adults were affected with diabetes and its prevalence is higher in low-middle income countries. Apart from an estimated rate, it found that a further 352 million will be at higher risk in the future.[3] About 8.8% of the Indian population is suffering from diabetes and its incidence prominently increases within the age group of 20 to 70 years.[4] Insulin and oral hypoglycemic agents established as the milestone in the management of diabetes mellitus.[5] However, even if such standard therapies are fully performed drawbacks like insulin resistance, side effects, and high expense tend patients to adopt alternative therapy like herbal remedies.[6]

The constituents present in the herbal plants like glycosides, alkaloids, terpenoids, flavonoids induce its anti-hyperglycemic effect by enhancing insulin output and inhibiting the intestinal absorption of glucose.[7] Hence, restore the function of pancreatic tissues.[8] Even though the use of herbal plants found to be effective, still there is no well-established scientific data about their safety and efficacy.[9] The concurrent use of anti-diabetic herbs and allopathic drugs can cause herb-drug interaction.[10]

However, it may result in hypoglycemia via additive/synergistic or antagonistic interactions.[11] Hence, further results in the failure of diabetes management.[12] Moreover, the lack of scientific findings on how such multiple bioactive components present in the herbal plants interact with pharmaceutical agents had raised the safety concerns regarding its concomitant administration.[13] This situation is further complicated by the lack of discussion about the concomitant use with the physician. Hence its use remains unknown, chances for avoiding such possible interactions becomes more difficult.[14]

Ernakulum is an area where the use of herbal medicines is highly prevalent and culturally accepted, but there is no data available about its use among diabetes patients. Thus our study mainly focused on explaining about the prevalence of herbal plants usage among diabetic patients in Ernakulum district, identifying the herbal plant products used, the source of motivation, pattern of herbal use, to investigate the attitude, awareness, consequences of simultaneous use of the herbal plants with allopathic drugs and to study the various socio-economic factors associated with the use of herbal plants.

METHODOLOGY

Study design and Study settings

This study employed a community-based cross-sectional epidemiological survey among type 2 diabetes patients living in a five major areas of

Ernakulam district. We choose subjects particularly from Kothamangalam, Muvattupuzha, Pattimattom, Angamali, and Piravom. Ernakulam is one of the developed districts in Kerala, possessing an appreciable forest area with an abundant variety of herbal plants. It is bounded by the beautiful coastline of Arabian sea stretching a length of 46.2 km on the western side and divided into hills, plains, and forests. The hill areas of the district lie on the western part include places like Kothamangalam, Muvattupuzha and referred as hilly taluks. The data collected from these areas between November 2017 to December 2018 having a total duration of 13 months.

Ethics, Privacy and Confidentiality

The study protocol was approved by the Institutional Human Ethical Committee of Nirmala College of Pharmacy, Muvattupuzha. The current study did not involve any biochemical sampling during the data collection. Before commencement of the interview, the participants were well-taught about the purpose of the study provided they could decline to answer any questions if felt inappropriate. The data collected were solely accessible to the investigators and assured that all provided information's would be used for only research purpose with strict confidentiality.

Subject recruitment and Study participants

We included patients who were at least 18 years of age diagnosed with T2DM for at least six months and had been on regular administration of both herbal plants and allopathic drugs for a minimum of two months (Users). Patients who had never used herbal and allopathic drugs together belong to the category of Non-users. Patients with type 1 diabetes, gestational diabetes, and known users of either antidiabetic herbal products alone or complementary alternative medicines including homeopathy, naturopathy were excluded from the study. By using a G* Power version 3.1.9.2, the sample size estimated with an assumption of 95% confidence interval, 5% of estimated error, 20.6 % of prevalence,[15] so that final sample size to be 470 was deemed appropriate for this study.

The Simple Random sampling technique was employed to recruit the study subjects. The survey carried out in such a way that, the selected areas given to five Pharm.D interns who were well trained in conducting the interview. It took an average of 30 minute to complete the face to face interview with the help of a validated questionnaire form. The participants were interviewed only once throughout the study. The survey was conducted once weekly and completed by one year with a total sample size of 470 patients, including both herbal users as well as non-herbal users.

Survey questionnaire and Data collection

The questionnaire used for data collection was validated by an expert panel under the Ethical Clearance Committee of our institution. The original version of the questionnaire was prepared in both English and vernacular language (Malayalam). A pilot study was conducted with a few selected diabetic patients to make sure that they could understand the questions and produce the required answers. Before the commencement of data collection, further modifications were made also included in the data collection form. The questionnaire divided into three sections: Socio-demographic Data, Disease-related and data related to Herbal use. Patients were asked to provide the following sociodemographic information including age, gender, education, employment status, area of living and comorbidities associated with it. Moreover, the details about the duration of diabetes, medication history of treatment and information regarding the secondary complications of diabetes were also collected. Subjects who responded affirmatively regarding the herbal use were then asked to indicate the type of herbal plant used, the frequency of its administration, source of information regarding the use, duration of its use with antidiabetic drug, benefits after the consumption of herbal drugs, the incidence of any side effect during the concomitant use, disclosure to the physicians about its co-consumption and assess patients satisfaction after the herbal use.

Statistical analysis

The data were analyzed statistically by using SPSS version 24 and G Power version 3.1.9.2. Categorical variables were expressed in both frequencies and percentage form. The numerical data (age) presented in both mean and standard deviation. Pearson's Chi-square test was used to compare the demographic characteristic of herbal medicine users and non-users. The multinomial logistic regression analysis was applied to determine the factors associated with herbal use. Where, the herbal use and sociodemographic characteristics were the dependent and independent variables respectively. Finally, the odds ratio and their respective 95% confidence interval were calculated. The Fisher exact test was employed to identify the significant relationship between hypoglycemic episodes and herbal use. P value <0.05 was considered as statistically significant.

RESULTS

A total of 470 diabetes patients had completed the questionnaire. Among them, 340(72.34%) patients tried herbal medicines for at least two months and further subjected to evaluate their herbal use patterns. Whereas, the remaining 130 patients (27.65%) relied only on allopathic antidiabetic drugs.

Socio-demographic characteristics of the patients with diabetes

In a total of 470 patients, a major proportion of the study participants were females (54.89%). Moreover, the use of herbal plants was also predominantly higher 186 (54.7%) among them. A substantial proportion 139(40.8%) of herbal use was between 41 to 55 years, with a mean age of 54.62±9.45. The patients with at least six months duration of diabetes were more prone to use herbal medicines 119(35%). Most of the patients 210(62%) initiated herbal drugs after their allopathic therapy. In contrast to urban areas, the majority of the herbal medicine users had been residing in rural areas 224(65.8%) and having an average socioeconomic status 225(66.1%). A statistically significant association were observed between users and non-users for their area residents (*P*=0.011), educational level (*P*=0.00), occupational status (*P*=0.011) and duration of diabetes (*P*=0.00). However, in terms of gender, no statistically significant association was identified between users and non-users (*P*=0.489) as shown in Table 1.

Diseases related to characteristics of the patients with diabetes

Majority of the respondents were diagnosed by T2DM within six months 174(37%). As a therapeutic approach for controlling diabetes, more than half of the patients taken oral hypoglycemic agents from government hospitals 200(58.8%) and remaining from the private healthcare institutions 140(41.1%). For maintaining a target range, about 90% of patients were followed a specific diet pattern and had routinely monitor their blood sugar in every month (59.4%) as shown in Table 1.

A substantial number of patients 219(46.5%) were suffering from secondary complication related with diabetes including diabetic foot (18.2%) and other health related co-morbidities such as hypertension 172(36%), dyslipidemia 137(29%), respiratory disorders like asthma and chronic obstructive pulmonary diseases as depicted in Table 2.

Table 1: Socio-Demographic profile & clinical characteristics of Type 2 Diabetes patients(n=470)

Variables	Categories	Herbal users[3]		Non – users[2,4]		*p*[1] value
		n	%	*n*	%	
Age	Less than 41	35	10.2	39	30	
	41 to 55	139	40.8	39	30	<0.000
	56 to 65	118	34.7	32	24.6	
	Greater than 65	48	10.2	20	15.3	
Sex	Male	154	45.2	58	44.6	0.489
	Female	186	54.7	72	55.3	
Education status	Primary School	69	20.2	12	9.2	
	12th Pass	145	42.6	42	32.3	<0.000
	Graduate	115	33.8	52	40	
	Post Graduate	11	3.2	24	18.4	
Area of living	Rural Area	224	65.8	70	20.5	<0.011
	Urban Area	116	34.1	60	46.1	
Living status	Lower class	29	8.5	17	13.0	
	Middle class	225	66.1	70	53.8	<0.042
	Upper class	86	25.2	43	33.0	
Occupation	Employed	170	50	81	62.3	<0.011
	Unemployed	170	50	49	37.6	
Duration of diabetes	At least 6 months	119	35	55	42.3	
	<5	115	33.8	22	16.9	<0.000
	<10	49	14.4	35	26.9	
	>10	57	16.7	18	13.8	
Co-morbidities	Yes	164	48.2	55	42.3	-
	No	176	51.7	75	57.6	
Treatment	Oral Hypoglycemic	180	52.9	60	46.1	
	Insulin	95	27.9	45	34.6	-
	Oral + Insulin	85	19.1	25	19.2	
Frequency of measuring Blood sugar level	Every day	11	3.20	0	0	
	Every week	66	19.4	3	2.3	-
	Once in month	202	59.4	85	65.3	
	When doctor asked for	61	17.9	42	32.3	
Type of hospital	Govt	200	58.8	60	46.1	-
	Private	140	41.1	70	53.8	
Following specific diet	Yes	310	91.1	85	65.7	-
For controlling diabetes	No	30	8.8	45	34.6	

Values are presented as frequency number (%)

[1]Determined by Chi-square test.

[2]Non-users are patients taking only allopathic treatment,

[3] n = 340,

[4] n = 130

Association between socio-demographic characteristics and herbal uses among diabetes patients

Association between herbal use and socio-demographic characteristics were determined by multinomial logistic regression analysis. By regression, it was found that age and duration of diabetes are the important predictors in the use of herbs. The risk estimates of using herbal plants with allopathic drugs were higher among middle aged group between 41 to 55 years (OR: 26.46 (CI: 5.313:136.923) *P*=0.00).When compared to the youngest age group, the risk was least among age between 56 to 65 years (OR:3.533; CI:1.033: 12.089) *P*= 0.044). There is an inversely proportional relationship between herbal use and duration of diabetes. Therefore, the use of herbs was more in patients having an early stage diabetes (OR:3.9456 (CI: 1.359:11.461) *P*=0.012). Whereas, the risk ratio was minimal for longer duration ones was shown in Table 3.

Herbal use in diabetic patient's
Commonly used herbal plants by type 2 diabetes patients

Among herbal users, a total of 34 plants were identified. Predominantly, a significant proportion of patients consumed only one anti-diabetic herbal plant (71.4%) with modern medicine. Whereas, few patients tried a mixture of various herbal plants (19.4%) or different ayurvedic products (9.1%). Among the identified plants, most commonly used were Guava 60(17.6%) (*Psidium Guajava*), Bitter gourd 44(12.9%) (*Momordica charantia*), Mango 35(10.29%) (*Mangifera indica*), Indian gooseberry 24(7.5%) (*Phyllanthus charantia*) and Fenugreek 23(6.8%) (*Trigonella foenum graecum*) was shown in Table 4.

Awareness, attitude, beliefs and benefits of the diabetes patients towards the use of herbal plants

The recommendations from the family members, friends and neighbors 291(85.60%) encouraged patients to begin consuming the herbal

Table 2: Distribution of Co- morbid illness(n=470)

Co- morbid conditions[1]	No. of patients (n=470)	
	Users(n=340)	Non- users (n= 130)
Hypertension	125	47
Cholesterol	94	43
Stroke	10	0
Coronary artery disease	16	6
Rheumatoid arthritis	12	6
Varicose Vein	12	6
Myocardial infraction	18	4
Parkinsonism	14	3
Psychiatric diseases	8	0
Diabetic foot	65	21
Asthma	25	10
Chronic obstructive pulmonary disease	22	7

[1] Patients with more than one co-morbid condition

Table 3: Factors associated with herbal plants use (n= 340)

Variables	Categories	P[1]-value	Odds ratio (OR)	95% Confidence Interval (CL) for Odds ratio	
				Lower Bound	Upper Bound
Age	Less than 41	<0.000	13.64	3.796	49.018
	41 to 55	<0.000	26.46	5.113	136.923
	56 to 65	<0.044	3.533	1.033	12.089
	Greater than 65	-	-	-	-
Sex	Male	0.356	0.771	0.445	1.338
	Female	-	-	-	-
Education status	Primary School	0.143	0.255	0.041	1.589
	12th Pass	0.288	0.399	0.073	2.17
	Graduate	0.176	0.317	0.06	1.673
	Post Graduate	-	-	-	-
Duration of diabetes in years	<1	<0.012	3.946	1.359	11.461
	<5	0.204	1.852	0.715	4.798
	<10	0.3	0.584	0.211	1.616
	>10	-	-	-	-
Area of People living	Rural Area	0.576	0.857	0.5	1.47
	Urban Area	-	-	-	-
Living status	Lower class	0.83	0.904	0.362	2.258
	Middle class	0.592	1.18	0.644	2.16
	Upper class	-	-	-	-

Values are presented as odds ratio (OR) and confidence interval (CL)

[1]Determined by Multinomial logistic regression analysis.

Table 4: Prevalence of herbal use[1]

Scientific Name	English Name	Plant parts used	n%
Psidium guajava	Guava	Leaf	60(17.64)
Phyllanthus emblica	Indian Gooseberry	Fruit	44(12.94)
Momordica charantia	Bitter Gourd	Fruit	24(7.05)
Passiflora edulis	Passion fruit	Leaf	23(6.76)
Mangifera indica	Mango	Leaf	35(10.29)
Abelmoschus esculentus	Lady's Finger (Okra water)	Fruit	14(4.11)
Moringa oleifera	Drumstick	Leaf	20(5.88)
Trigonella foenum-graecum	Fenugreek	Seed	23(6.76)
Azadirachta indica	Neem	Leaf	17(5.00)
Allium sativum	Garlic	Fruit	19(5.58)
Aloe barbadensis	Aloe vera	Leaf	07(2.05)
Artocarpus heterophyllus	Jack Fruit	Leaf & unripe fruit	13(3.82)
Cinnamomum verum	Cinnamon	Bark	11(3.23)
Ocimum basilicum	Basil Leaves	Leaf	16(4.70)
Coccinia grandis	Ivy Gourd	Fruit	15(4.41)
Hibiscus rosa-sinensis	Hibiscus	Leaf	11(3.23)
Myristica fragrans	Nutmeg	Leaf	07(2.05)
Syzygium cumini	Jamun seeds	Seed	06(1.76)
Glycyrrhiza glabra	Liquorice	Bark	09(2.64)
Bacopa monnieri	Brahmi (Water Hyssopo)	Leaf	10(2.94)
Quercus	Oak Plant	Bark	08(2.35)
-	Apple cider vinegar	-	06(1.76)
Ficus benghalensis	Banyan tree bark	Bark	04(1.17)
Musa paradisiaca	Banana	Fruit	05(2.05)
Senna alexandrina	Senna	Leaf	06(1.76)
Carica papaya	Papaya	Leaf	02(0.58)
Allium cepa	Onion	Fruit	02(0.58)
Andrographis paniculata	Chirata(Swertia Chiratta)	Leaf	17(5.00)

[1]Patients used different herbal plants combinations

products. About 175(51%) patients depend on herbal plants available at their home and consumed it daily 276(81%) along with allopathic medicines. A large number of diabetes patients consumed herbal plants as a morning regimen 158(46.5%) for an at least 1 year with conventional therapy 205(60.30%).

The ease of accessibility (44.4%), low cost (29.14%), positive experience from the previous herbal users and traditional belief in the efficacy were some of the reasons that trigger patients to opt for the concomitant therapy. In spite of its beneficial aspects, certain factors limit the use of these traditional therapies due to its ineffectiveness (38.6%), safety issues and dislike towards the herbal medicines.

Majority of the diabetic patients 228(67%) found to be satisfied with the concomitant use of herbal plants. Besides, patients reported further benefits from herbal therapy such as reduction in their blood sugar level 319(67.9%) and relief from the diabetic symptoms 285(60.6). Frequent urination 83(17.7%) during the night (nocturia) were also reduced in some patients after concomitant therapy.

Awareness and attitude of diabetes patients towards physicians

The important fact that resides is, a larger proportion of herbal users 218(64.1%) did not disclose their use with respective doctors. Because, they feared of disapproval action by the physician 125(57.3%). However, such concurrent use developed hypoglycemia among 82(25%) patients and whose frequency of episodes increases with using more than one herbal plants(P=0.000) as shown in Table 5. But a negligible fraction informed to the physician about their hypoglycemic occurrence. Details of herbal use among diabetic patients summarized in Table 6.

DISCUSSION

The complementary alternative therapy (CAM) considered as a notable therapeutic option around the world due to its inconsequential toxicity and better effectivity. Ayurveda considered as one of the oldest systems of medicine and widely accepted treatment for various diseases like diabetes in many places of India. The development of various irreversible

Table 5: Pattern of herbal use in diabetes patients (n= 340)

Characteristics	n	%
Initiation of herbal use[1]		
After using Anti-diabetic treatment	210	61.7
Before using Anti-diabetic treatment	130	38.2
Reason for starting Herbal use[1]		
Easy access	150	44.4
Low cost	100	29.1
Positive experience from the previous herbal users	70	20.5
Traditional belief in the efficacy of herbal medicine	70	20.5
Dissatisfaction from conventional medicines	50	14.7
Reason for not using Herbal medicines[1,4]		
Not safe	50	38.4
Dislike towards herbal medicines	35	26.9
Ineffective	17	13.0
Herbal medicine use:		
Use of one herbal plant	243	71.4
Combination of herbal plants	66	19.4
Ayurvedic products	31	9.10
Information about herbal medicines obtained from[1]		
Magazines	79	23.2
Internets	111	32.6
TV	32	9.40
Friends, Neighbors, Relatives	291	85.6
Doctors, Nurses, Pharmacists	27	7.90
Source of Procurement[1]		
Available in Home	175	51.5
Purchase the marketed products	30	8.80
Purchase the raw material and prepare at home	154	45.3
Duration of usage of herbal plants with prescribed synthetic drugs		
Less than 6 months	139	40.9
6 months to 1 year	158	46.5
1 to 5 year	42	12.4
Greater than 5 year	1	0.3
Frequency of using herbal plants		
Daily	276	81.2
Weekly	17	14.7
Alternative Days	50	14.7
Regimen of using Herbal plants[1]		
Morning	205	60.3
Evening	175	51.5
Concomitant[2]	51	15.0
Others[3]	87	25.6
Benefits after using herbal and synthetic drug together[1]		
Reduction in sugar level	319	93.8
Symptomatic Relief	285	83.8
Reduction in polyuria	83	24.4
Level of confidence after using herbal and synthetic together		
Very confident	69	20.3
Confident	228	67.1
Doubtful	42	12.4
Not confident	0	0.00
Information shared with your doctors about the use of herbal and synthetic together		
Yes	122	35.9
No	218	64.1
If no, reason why[1,5]		
Fear of response from doctor	125	57.3
Do not want doctor to inform	50	23.0
Doctor did not ask	35	16.0
Side effect (hypoglycemia) after herbal use		
Yes	85	25.0
No	255	75.0

Values are presented as frequency number (%)

[1]Multiple response given by patients

[2]Herbal and allopathic drugs simultaneously at a time

[3]Example: Solution forms: people take when they feel thirsty,

[4] n=130,

[5] n=218

Table 6: Association between hypoglycemic episodes with herbal use (n= 340)

Herbal use characteristics	P- value[1]
Use of more than one herbal plants with synthetic drug	<0.000
Simultaneous use of herbal plants with synthetic drug	0.2

[1]Determined by fisher exact test.

complications necessitates patients to approach different alternative therapy for optimal management. The current study aimed at exploring the prevalence, attitude, effectiveness, and consequences of simultaneous use of herbal medicines with allopathic antidiabetic drugs.[17]

The prevalence of herbal medicines in the current study was about 72.3%. However, a similar survey conducted in Kerala reported that the use of an alternative system of therapies with modern medicine was 29.5%, among this herbal plant use was about 65.4% which is in line with the findings of the current study.[18] Whereas in Jammu, the use of herbal medicines was about 39.28%[6] which was comparatively lower than the present study. Based on the observation, this survey showed a high prevalence of herbal use when compared to other studies. The current study conducted in one district of Kerala: Ernakulam has a high literacy rate and well adapted modern medical facilities that even available to rural areas. Patient's prefer herbal plants with modern medicines probably due to their cultural beliefs, lower cost, the belief of patients in the effectiveness of herbal plants, recommendations from previous users and cumbersomeness with available conventional therapies. The rich floral diversity of the region can also be an added motivating reason. Therefore, it is not surprising that about 72.3% of herbal users were present in this district.

The use of herbal-plants higher among females (54.7%) that was consistent with a similar study conducted in a tertiary care hospital in Jammu.[6] The females get easily influenced by the cultural, religious, social-beliefs and a majority of them were unemployed. Hence, they spent more time in their houses. Patients from rural-background (65.9%) were more likely to use herbal plants which are comparable to similar studies in India.[6] The traditional home remedies regarded as a readily available, hugely accepted safe affordable system of medicine in rural populations and strong traditional knowledge about its use led to higher consumption. The percentage of herbal usage was higher in age between 40-55(29.6 %), which was consistent with the study conducted in Ethiopia[9] and Jammu.[6] The fear of further diabetic complications, worsening of existing co-morbidities encouraged these patients to try out concomitant treatment to get a quick and safe control in their glycemic level. The more likely users of herbal medicines were those in the early stage of diabetes (35%) and without any co-morbidities (51.76%). They believe that using all these known treatments from the beginning itself can control diabetes and avoid health complications in the future. Besides, the presence of other disease makes them unsure about the safe use of herbs. Moreover, patients may go for combined therapy because they were afraid of the side effects associated with modern therapy.

Certain plants documented in the present study for the management of diabetes were also identified in other studies conducted in different countries. Hence, the same herbs in a different culture strongly indicate that, despite its unproven efficacy and toxicity, patients hugely believe that these plants can be effective in reducing blood glucose level. One of the most frequently used herbs was Bitter gourd (karela), usually taken as a juice of fruit about 50 -100 ml per day. The Triterpenoids present in it activates AMP-activated protein kinase which can repair damaged β-cells, hence stimulate insulin levels and improve its sensitivity.[19] Lady's finger also known as Okra Water, prepared by soaking okra pods in

water for overnight. Okra has a similar hypoglycemic mechanism of alpha-glucosidase inhibitor. The glucosides called isoquercitrin and quercetin-3-O-beta-glucopyranosyl-(1"→6")- selectively inhibit intestinal maltase and sucrase.[18] Fenugreek administered either as a tea or its powder sprinkled over yogurt. Its antidiabetic action similar to glimepiride by promoting insulin secretion by the closure of K^+-ATP channels, a crucial initial step in insulin secretion.[19]

Majority of patients trust on non-scientific sources (family, friends, and relatives) for gathering information about medicinal herbs and make their health-based decisions based on the recommendations from the laymen. In contrast, the least source for herbal information from health care professionals. Diabetes is an inherited disease. So, there is a transmission of traditional knowledge on the potential use of medicinal of herbs from generation to generation happening here. Besides, the positive experience from users persuaded other patients to go for herbal therapy. Another important matter taken into consideration is that many patients do not disclose their herbal use to respective doctors (64.10%). However, such similar observation was reported in previous studies also.[6,9,18] In fact, these patients feared of discouraging reaction from their respective doctors. The lack of knowledge about the efficacy and potential harm of traditional medicines is also a contributing factor for attributing a communication gap between physician and patient.

The current study reveals the motive behind the continuous use of anti-diabetic herbs in conjunction with modern medicines were the patients reported a significant reduction in blood sugar level (93.3%), symptomatic relief (83.80%) and reduced polyuria (24.4%) when compared with non-users. However, contrary to the patient's beliefs, concurrent therapy is not significantly safe. Because there will be a chance for herb-drug interaction that lead to side effect such as hypoglycemia. As expected, the present study reported hypoglycemia among 25% of regular concomitant users. Furthermore, the simultaneous users of various anti-diabetic herbal plants (19.4%) had experienced more episodes of hypoglycemia. As a consequence, such co-administration with modern treatment can cause a synergistic effect and that lead to hypoglycemia.

Despite impressive advances in health sciences and medical care, it became clear that there is an increasing demand for herbal plants among diabetes patients. Although, these plants have shown a varying degree of anti-hyperglycemic effect few of them not considered to be safer. Thus, more researches needed to elucidates its toxicity before the consumption.

RECOMMENDATIONS AND LIMITATIONS

Our study has several limitations. The survey was conducted only in one district of Kerala so that the obtained data not generalizable to other regions. The benefits of simultaneous use of herbal drugs with allopathy were not quantitatively assessed. We recommend that future studies can be focused on multi centers and concentrating on the efficacy and safety of herbal drugs when used with conventional therapy. However, in a country like India, the practice of CAM therapy is part of indigenous culture. Thus, we recommend a culturally appropriate health treatment policy for an overall improvement of health care modality.

CONCLUSION

In summary, Physicians should have comprehensive knowledge regarding the safety and efficacy of herbal medicines. Hence, they can make a safe choice and avoid potential interactions with conventional therapy. In the current study, the use of anti-diabetic herbal plants along with conventional allopathic therapy was higher among diabetes patients. It is also notable that there is a negligible rate of disclosure to the health care providers. Majority of patients satisfied by the concurrent use of herbal drugs with conventional therapy. Whereas, one-fourth of the patient's

experiences hypoglycemia and minimal patients reported revealing poor physician-patient rapport. By the current study and many more previous studies, it can be concluded that the herbal plants hold a definite promise in the management of diabetes mellitus. In a diverse country like India, the challenge before us is how best to allocate these available sources of herbal medicines with modern medicine by the possible conformation of its efficacy and safety for a making better diabetes care for the future generation.

DISCLAIMER

The abstract of this research was presented as oral presentation at the 7th Epidemiology and Public Health Conference on June 17-19, 2019 in Dubai, UAE.

CONFLICT OF INTEREST

The author declare no conflict of interest.

ABBREVIATIONS

DM: Diabetes mellitus; **IDF:** International Diabetes Federation; **CAM:** Complementary alternative therapy.

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