Herbal medicine use and its impact on glycemic control among diabetes patients at governmental hospitals in Debre Berhan, Ethiopia: A cross-sectional study

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ABSTRACT

Background: Diabetes mellitus (DM) is a major health concern worldwide. Diabetes patients are increasingly using herbal medicine (HM) without seeking advice from their healthcare providers. However, its impact on glycemic control is not documented in Ethiopia. Thus, this study aimed to assess herbal medicine use and its effect on glycemic control among diabetes patients at governmental hospitals in Debre Berhan town, Ethiopia.
Methods: A cross-sectional study involving 430 diabetic patients was conducted at two different hospitals in Debre Berhan town from January 1 to March 30, 2024. Data were gathered using a guided self-administered questionnaire to collect data including glycemic control assessed via hemoglobin A1c (HbA1c) levels. Data was analyzed using SPSS version 25. Logistic regression model was used to assess the predictors of herbal medicine usage, while an independent samples *t*-test was conducted to compare the mean HbA1c levels between herbal medicine users and non-users among diabetes patients.
Results: Of the 430 participants, 72.6 % were diagnosed with type 2 diabetes. The study revealed 48.1 % (95 % CI: 43.3–53) participants used herbal medicine. *Moringa stenopetala* (33.5 %), *Trigonella foenumgraecum* (27.4 %), and *Thymus schimperi* (17.9 %) were the predominant herbs utilized by diabetic patients. The use of herbal medicine was associated with the patients' diabetic knowledge (AOR: 1.59; 95 % CI: 1.01–2.49), occupation (AOR: 3.7; 95 % CI: 1.36–10.23), income (AOR: 3.58; 95 % CI: 1.22–10.55), and family history of diabetes (AOR: 1.9; 95 % CI: 1.19–3.18). Glycemic status was not controlled for 86 % of herbal users compared to 66.8 % of non-users. Participants who used herbal medicine had significantly higher mean HbA1c by a mean difference of 0.41 (95%CI: 0.04–0.78).
Conclusions: Herbal medicine use was common among diabetes patients in this study. Poor knowledge about diabetes, a family history of diabetes, lower income, and a farming occupation were identified as strong predictors of HM use. Patients who used herbal medicine had significantly higher mean HbA1c levels compared to non-users. Healthcare providers should engage patients in discussions about herbal medicine use, emphasizing the potential risks to glycemic management. Future research should explore specific herbs used, their mechanisms of action, and strategies to integrate herbal medicine safely into diabetes management protocols.

1. Background

Diabetes mellitus (DM) is a chronic condition that occurs when the pancreas can no longer make insulin, or the body cannot effectively use insulin [1]. As of 2021, there were 529 million people worldwide living with diabetes of all ages, equating to a global age-standardized prevalence of 6.1 % [2]. It is growing most rapidly in low- and middle-income countries [3]. The prevalence of diabetes in Ethiopia is rising

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significantly, with an overall rate of 6.5 % [4]. Diabetes mellitus is known to be a significant contributor to early mortality and disability due to a range of microvascular and macrovascular complications [3].

While numerous anti-diabetic medications exist, managing diabetes continues to pose a significant challenge, necessitating a lifelong commitment to treatment regimens dictated by the condition. Due to the persistent nature of diabetes and the lifelong need for treatment, many patients seek alternative management strategies such as traditional herbal remedies [5–14]. Various factors have been identified that influence the effectiveness of standard diabetes treatments, such as adherence to prescribed regimens and adopting a healthy lifestyle that includes regular exercise, healthy eating habits, and maintaining an ideal body weight [15].

The World Health Organization (WHO) defines traditional medicine as "health practices, approaches, knowledge and beliefs incorporating plant, animal and mineral based medicines, spiritual therapies, manual techniques and exercises, applied singularly or in combination to treat, diagnose and prevent illnesses and maintain well-being''. Herbal medicine is the most widely utilized traditional medical practice in both the general population and people with chronic disease [16]. Patients with diabetes may prefer to use herbal remedies over modern medicine for a number of reasons including; dissatisfaction with the conventional treatment, treatment related adverse effects and the perceived suitability of herbal remedies with patients' values and spiritual beliefs [10, 12,13,17].

The usage of herbal remedies and other complementary therapies among diabetes mellitus patients shows significant variation across different countries in the world, ranging widely from 8 % to 93 % with pooled prevalence of 51 % [18]. Previous studies have identified various factors associated with the use of HM [10,12,19–25].

The use of herbal medicine has variable impact on glycemic control among diabetes patients [5,26]. Animal experiments and clinical studies with the active ingredients of plants lack detailed and reliable information [27]. While traditional and complementary medicine therapies involving herbal products may hold potential for effectiveness, there is a lack of comprehensive studies on them. Additionally, it's important to recognize that herbal products can sometimes be ineffective or harmful.

In Ethiopia, herbal medicine has deep cultural and traditional roots, often viewed as natural and safer than pharmaceutical drugs [16,28]. The pooled estimate of herbal medicine use among patients with chronic disease in Ethiopia is found to be 56.94 % [29]. However, studies on use of HM among diabetes patients are scarce. This study encompasses both type 1 and type 2 diabetes patients. The present study also investigated additional factors that may influence herbal medicine use, including patients' knowledge about diabetes, which had not been addressed in previous research. The impact of herbal medicine use on glycemic control is not documented in Ethiopia. Therefore, this study aimed to investigate herbal medicine use and its impact on glycemic control among diabetes patients at governmental hospitals in Debre Berhan town, Ethiopia.

2. Methods

2.1. Study setting and design

An institutional-based cross-sectional study was conducted from January 1 to March 30, 2024, within the diabetic care services of two governmental hospitals located in Debre Berhan town. Debre Berhan is found in North Shewa zone, Northeast Ethiopia, 130 km away from Addis Ababa, Ethiopia. The town has two public hospitals, both of which offer diabetic outpatient follow-up clinics; one of these hospitals is a teaching hospital. The diabetic care clinics provide services for many diabetic patients.

2.2. Study participants, sampling and recruitment procedures

The study included all adult patients ≥18 years of age who were diagnosed with diabetes mellitus and had been receiving follow-up care for at least three months before recruitment. Patients not started diabetic medications, those with incomplete diabetes-specific information, or patients who could not complete the individual interviews were excluded. The sample size was calculated using the single population proportion formula with the assumption of 50 % as a proportion (p) of patients with herbal medicine use, at 95 % CI, margin of error (d) = 5 %, and a non-response rate of 5 %. Based on the considerations mentioned earlier, the initial sample size was set at 385. Subsequently, it was expanded to 430 patients in order to ensure the reliability of the data collected. Using a simple random sampling technique, patients were recruited during their visits for follow-up care or medication refills over a 3-month period.

2.3. Data collection tools and procedures

Several articles were reviewed to develop the data collection tool. An interviewer-guided self-administered questionnaire was prepared initially in English. The questionnaire was translated into the local language to facilitate understanding among participants. It was then back-translated into English to ensure accuracy and consistency. A pretest of the questionnaire was conducted two weeks before the actual data collection. This involved 5 % of the participants who were not included in the final analysis to identify any issues or ambiguities with the questionnaire. Data collection was conducted using the finalized questionnaire. The questionnaire consisted of two main sections: The first section focused on socio-demographic characteristics and clinical status related to diabetes mellitus including HgA1c level. The second section assessed the use of herbal medicine. Data collectors were trained adequately in the use of the data collection tool. Two trained health professionals were involved in data gathering and were supervised by the principal investigator to ensure data quality. Completed questionnaires were collected and checked daily for completeness and consistency. The principal investigator and data collectors verified the completeness and correctness of all questions.

2.4. Data processing and analysis

Epi-data version 3.1 was used for data entry and exported to SPSS version 25 software for analysis. Normality test, model fitness test and multi-colinearity test was done. We conducted a model fit assessment using the Hosmer-Lemeshow goodness-of-fit test to ensure the robustness and reliability of the logistic regression model. Descriptive statistics such as frequency and percentage were computed for categorical variables. Continuous variables were presented as mean ± standard deviation or median. To assess the association of different independent variables with the outcome variable, bivariate and multi-variable logistic regression analysis was carried out. All variables with p value of less than 0.25 in the bivariate analysis were included for multi-variable logistic regression analysis. Significant association was declared by odds ratio with 95 % confidence interval at p-value <0.05. An independent samples *t*-test was conducted to assess the difference in mean HbA1c levels between diabetic patients who use herbal medicine and those who do not.

3. Results

3.1. Socio demographic and clinical characteristics

The study comprised 430 diabetic patients. Over half of the participants (51.4 %) were male, with a mean age of 49.24 ± 15.29 years. The majority identified as Orthodox Christians (90.9 %) and reported being married (57.9 %). Additionally, most were permanent residents of urban

Table 1

Socio-demographic and clinical characteristics of study participants, Debre Berhan, Ethiopia (N = 430).

Variable	Categories	Frequency (n)	Percent (%)
Sex	Male	221	51.4
	Female	209	48.6
Age	<30	47	10.9
	30–45	134	31.2
	46–60	147	34.2
	>60	102	23.7
Marital status	Single	108	25.1
	Married	249	57.9
	Divorced	30	7
	Widowed	43	10
Religion	Orthodox	391	90.9
	Muslim	20	4.7
	Protestant	19	4.4
Residence	Urban	325	75.6
	Rural	105	24.4
Educational status	Unable to write and read	79	18.4
	1-8 grade	106	24.7
	9-12 grade	83	19.3
	College and above	162	37.7
Average monthly income	<1500 ETB	21	4.9
	1500-2500 ETB	53	12.3
	>2500 ETB	356	82.8
Occupation	Government employed	123	28.6
	Private employed	99	23
	Housewife	88	20.5
	Farmer	38	8.8
	Retired	82	19.1
Type of diabetes	Type 1	118	27.4
	Type 2	312	72.6
Duration of diabetes	<1 years	72	16.7
	1–5 years	205	47.7
	>5 years	153	35.6
Type of treatment	Insulin	141	32.8
	Oral tablets[a]	266	61.9
	Insulin and oral tablets	23	5.3
Family history of diabetes	Yes	119	27.7
	No	311	72.3
BMI(kg/m^2)	<18.5 (underweight)	59	13.7
	18.5–24.99(Normal)	198	46.0
	25–29.99 (overweight)	150	34.9
	>30 (Obese)	23	5.3
Diabetic knowledge	Poor	241	56.0
	Good	189	44.0
HbA1c level	<7 %	103	24
	≥7 %	327	76

Abbreviation: ETB, Ethiopian Birr; BMI, Body mass index.

[a] Oral tablets include: metformin, glibenclamide, and glimepiride.

areas (75.6 %). Among the respondents, 23.7 % were aged over 60 years, 28.6 % were government employed, and 8.8 % were involved in farming. A significant portion of patients (61.9 %) were on oral hypoglycaemic agents, with Metformin being the most commonly prescribed (92 %). The socio-demographic and clinical characteristics of study participants are summarized in Table 1.

3.2. Herbal medicine use and associated factors

The study revealed 48.1 % (95 % CI: 43.3–53) of participants used herbal medicine while 51.9 % were non-users. Sheferaw (*Moringa stenopetala*) (33.5 %), Abish (*Trigonella foenumgraecum*) (27.4 %), Tosign (*Thymus schimperi*) (17.9 %), and Tenadam (*Ruta chalepensis*) (12.6 %)

Table 2

Herbal medicine used to treat diabetes mellitus among participants, Debre Berhan, Ethiopia (N = 430).

Scientific name	English	Local name	Parts used	Frequency (n, %)
Moringa stenopetala	Moringa, cabbage-tree	Sheferaw	Leaves	144(33.5 %)
Trigonella foenumgraecum	Fenugreek	Abish	Seed	118(27.4 %)
Thymus schimperi	Lamiaceae	Tosign	Stem, leaf, Whole plant	77(17.9 %)
Ruta chalepensis	Rue	Tenadam	Leaf	54(12.6 %)
		Others[a]	Seed, leaf	74(17.2 %)

[a] Others include: Damakese (*Ocimum lamiifolium* Hochst.), Eret (*Aloe vera*), Nech shinkurt (*Allium sativum*), Tunjit (*Otostegia fruticosa*), Zinjibl (*Zingiber officinale Rosc.*), and Kosso (*Hagenia abyssinica*).

were the predominant herbs utilized by diabetic patients. Herbal medicines used to treat diabetes among participants are summarized in Table 2.

Multivariate analysis revealed that a family history of diabetes, knowledge about diabetes, income levels, and occupation were significant predictors of herbal medicine use. Table 3 summarizes the factors independently associated with herbal medicine use.

3.3. Effect of herbal medicine use on glycemic control

In general 327(76 %) of patients had poor glycemic control (HbA1c ≥ 7 %). Glycemic status was not controlled for 86 % of herb users compared to 66.8 % of non-users.

The mean HbA1c of study participants was 8.51 with (SD ± 1.95). Moreover, 43 % of patients had HbA1c levels above the mean. Patients who used herbal medicine had mean HbA1c of (8.73 ± 1.88) and those who did not use herbal medicine had mean HbA1c of 8.31 ± 2.00 (Table 4).

This study found that participants who used HM had significantly higher mean HbA1c by a mean difference of 0.41 (95 % CI: 0.04–0.78) as compared with patients who did not use herbal medicine (Table 3)

4. Discussion

The current study found that 48.1 % (95 % CI: 43.3–53) of diabetes patients utilized herbal medicine. This is consistent with findings from a recent global systematic review and meta-analysis, where the combined prevalence of complementary and alternative medicine (CAM) use among diabetes patients was 51 % with herbal medicine emerging as the most frequently chosen CAM modality [18]. However, this finding is relatively lower than the rates of 62 % [12] and 58.5 % [10] reported in earlier studies conducted in Ethiopia. This variation underscores the dynamic nature of herbal medicine utilization among diabetes patients over time within Ethiopia. Several factors may contribute to these discrepancies. Firstly, previous studies were conducted in different locations across Ethiopia, where local herbal medicine practices and availability may differ. Additionally, our study included participants with type 1 diabetes, whereas earlier research mainly focused on type 2 diabetes patients. Type 2 diabetes patients have historically shown higher herbal medicine use compared to those with type 1 diabetes [19, 30], potentially influencing the observed differences in herbal medicine prevalence between studies.

In multivariate analysis, it was found that a family history of diabetes, knowledge about diabetes, income levels, and occupation were identified as significant predictors of herbal medicine use.

In terms of the association between family history of DM and HM use, the present study was consistent with previous studies [10,12]. Patients with a family history of diabetes may perceive herbal remedies as effective due to anecdotal evidence within their families or

Table 3
Patient characteristics and factors associated with herbal medicine use, Debre Berhan, Ethiopia (N = 430).

Variable	Categories	Herbal medicine use (N = 430)		*p*-value	[a]AOR (95 % CI)
		Yes (n)	No (n)		
Age	<30	17	30		1
	30–45	54	80	0.978	1.01 (0.46–2.25)
	46–60	86	61	0.108	2.07 (0.85–5.02)
	>60	50	52	0.818	1.12 (0.40–3.15)
Marital status	Single	59	49		1
	Married	107	142	0.074	0.62 (0.37–1.05)
	Divorced	19	11	0.396	1.53 (0.57–4.09)
	Widowed	22	21	0.560	0.78 (0.33–1.81)
Educational status	Unable to write and read	37	42	0.353	0.68 (0.31–1.53)
	1-8 grade	54	52	0.531	1.23 (0.64–2.38)
	9-12 grade	48	35	0.075	1.75 (0.94–3.26)
	College and above	68	94		1
Average monthly income	<1500 ETB	16	5	0.021[a]	3.58 (1.22–10.55)
	1500-2500 ETB	23	30	0.097	0.57 (0.29–1.11)
	>2500 ETB	168	188		1
Occupation	Government employed	54	69		1
	Private employed	47	52	0.499	1.26 (0.65–2.44)
	Housewife	38	50	0.950	1.02 (0.49–2.14)
	Farmer	25	13	0.011[a]	3.72 (1.36–10.23)
	Retired	43	39	0.502	1.31 (0.59–2.92)
Type of diabetes	Type 1	46	72	0.206	1
	Type 2	161	151		1.48 (0.81–2.73)
Family history of diabetes	Yes	68	51	0.008[a]	1.95 (1.19–3.18)
	No	139	172		1
Diabetic knowledge	Poor	127	114	0.043[a]	1.59 (1.01–2.49)
	Good	80	109		1

Abbreviation: ETB, Ethiopian Birr; AOR, adjusted odd ratio; CI, Confidence Interval.

[a]Significant association (P < 0.05).

[a] The model was adjusted for age, marital status, educational status, average monthly income, occupation, type of diabetes, family history of diabetes, and patients' diabetic knowledge.

communities, potentially influencing their healthcare choices. The presence of family history of diabetes could also signify a more pronounced concern or awareness about the disease, leading patients to explore additional treatment options beyond conventional medicine.

In this study, poor knowledge about diabetes was identified as a strong predictor of herbal medicine use. Previous studies did not investigate the relationship between diabetic knowledge and herbal medicine use. Patients with inadequate knowledge about diabetes may turn to alternative therapies like herbal medicine as they seek solutions

they believe will complement or substitute for conventional treatments. Patients with limited understanding of diabetes may rely on cultural or traditional beliefs that endorse herbal medicine use. Enhancing patient education could potentially empower individuals to make more informed decisions about their healthcare. Recognizing the influence of patient knowledge levels on treatment decisions can guide healthcare professionals in tailoring education and counselling strategies that promote evidence-based practices while respecting patient preferences. Further investigation is necessary to better understand how knowledge about diabetes influences the adoption of herbal medicine and other alternative therapies.

In contrast to findings in other studies where higher income [31–34] was linked to herbal medicine use, our study revealed that lower income correlates with the use of herbal medicine among diabetes patients. This difference could be attributed to factors such as cultural and traditional beliefs, socioeconomic factors, and access to healthcare service. Individuals facing financial constraints may turn to herbal remedies as a cost-effective healthcare alternative. Lower-income individuals might face barriers to accessing healthcare services, leading them to explore alternative and possibly more affordable treatment options like herbal medicine. Although not exclusively among diabetes patients, one study demonstrated that low monthly income was linked to the use of CAM, encompassing patients with chronic diseases, including diabetes [35].

This study identified a correlation between being a farmer and using herbal medicine, consistent with findings from previous research [25]. While some studies have also observed associations between occupational status and herbal medicine use, others have not found such relationships. This may stem from factors specific to agricultural work, such as exposure to traditional knowledge about herbs or a cultural affinity towards natural remedies. Farmers often have close ties to the land and may rely on herbal treatments due to accessibility or historical practices within their communities. Farmers may also have limited access to conventional healthcare services due to their rural location or economic constraints, leading them to explore alternative therapies like herbal medicine more frequently.

Otherwise, age, gender, educational level, type of diabetes, duration of diabetes, type of diabetes treatment, and diabetes complications did not show a significant association with the use of herbal medicine in diabetic patients in the multivariable analysis.

In our study, 76 % of all diabetic patients had poor glycemic control, defined as having HbA1c levels ≥7 %. Glycemic status was not controlled for 86 % of herb users compared to 66.8 % of non-users. This finding coincides with a previous study done in Kuwait [5]. This could be because many herbal users did not consistently use herbs daily and often used them irregularly, sometimes as the sole treatment without the concurrent use of antidiabetic medications prescribed by their physicians. Some herbs might interact with diabetes medications or affect insulin sensitivity, potentially contributing to poorer glycemic control. Herb users might have different dietary or lifestyle habits that could influence their glycemic status. Users of herbs might rely more on alternative treatments or have different health beliefs that impact their diabetes management. The observed association warrants further investigation into specific herbs used by patients, their dosage, frequency, and potential interactions with standard diabetes treatments.

4.1. Limitation of the study

Since the study is cross-sectional and relies on self-reported data, there is a possibility of under-reporting. Additionally, this design offers only a snapshot at a single point in time and may not reflect the long-term effects of herbal medicine use on glycemic control. The limited sample size for Type 1 diabetes in our study makes it difficult to perform robust subgroup analyses. Future research with a larger sample size of Type 1 diabetes patients is needed to address this issue. The study does not fully account for other variables that could influence glycemic control. Despite these limitations, this study carries significant

Table 4

Effect of herbal medicine use on glycemic control of study participants, Debre Berhan, Ethiopia 2024 (N = 430).

Variable		Frequency	Mean HbA1c	Mean difference	95 % CI of mean HbA1c	p value	Std. Deviation	Mean ± Std.
Herbal medicine	Users	207	8.73	0.42	0.04-0.78	0.029	1.88	8.73 ± 1.88
	Non users	223	8.31				2.00	8.31 ± 2.00

Abbreviation: HbA1c, Hemoglobin A1c; CI, Confidence Interval; Std., Standard deviation.

implications for advancing the rational and evidence-based use of herbal medicine and underscores its impact.

5. Conclusions

This study assessed the usage of herbal medicine and its effect on glycemic control. Herbal medicine use was common among diabetes patients. Diabetic knowledge, a family history of DM, income and occupation were identified to be strong predictors of herbal medicine use. Herbal medicine use was associated with poor glycemic control. While herbal medicines offer potential benefits; they also carry potential adverse effects. Healthcare providers should engage patients in discussions about herbal medicine use, emphasizing the potential risks to glycemic management. Educating patients is essential in enhancing diabetic patients' understanding of the benefits, side effects of herbs, and their proper usage. Future research should explore specific herbs used, their mechanisms of action, and strategies to integrate herbal medicine safely into diabetes management protocols.

Ethics approval and consent to participate

The study was carried out in accordance with the Declaration of Helsinki and received approval from the Institutional Review Board of Asrat Woldeyes Health Science Campus, Debre Berhan University, under reference number IRB-192. Written informed consent was obtained from all participants prior to the study. The information gathered from participants was kept anonymous.

Consent for publication

Not applicable.

Availability of data and materials

The materials and data of this study are available from the corresponding author upon reasonable request.

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CRediT authorship contribution statement

Girma Deshimo Lema: Writing – review & editing, Writing – original draft, Visualization, Validation, Supervision, Software, Resources, Project administration, Methodology, Investigation, Formal analysis, Data curation, Conceptualization. **Enguday Demeke Gebeyaw:** Writing – review & editing, Methodology, Investigation, Formal analysis, Conceptualization. **Zena Admasu Yferu:** Writing – review & editing, Visualization, Validation, Supervision, Software, Resources. **Seife Feleke Mulatu:** Writing – review & editing, Visualization, Validation, Supervision, Software, Resources. **Asrat Berihun Dagnaw:** Writing – review & editing, Visualization, Validation, Supervision, Software, Resources. **Getachew Bizuneh Aydagnuhm:** Writing – review & editing, Visualization, Validation, Supervision, Software, Resources. **Esubalew Amanu Ayicheh:** Writing – review & editing, Visualization, Validation, Supervision, Software, Resources.

Abbreviations

AOR	Adjusted odds ratio
CI	Confidence interval
CAM	Complementary and alternative medicine
DM	Diabetes mellitus
HbA1c	Hemoglobin A1c
HM	Herbal medicine
OR	Odds ratio
SPSS	Statistical package for the social sciences

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.metop.2024.100311.

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