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Assessment of Knowledge and Attitude regarding Traditional Herbal Medicine among Diabetes Patients

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Abstract

The general population widely use herbal remedies for blood glucose control. This study examines diabetes patients' knowledge and attitudes towards traditional herbal medicine in Klang Valley. The survey had 391 responses: 58.8% female, 41.2% male. About 91% used herbs, mainly olive oil/leaves (42.2%), cinnamon (17.4%), and garlic (13.8%). Herbs were used primarily for supplementary benefits (47.3%) and affordability/accessibility (19.7%). Despite widespread use, 84.7% of patients admitted to using herbs with their diabetic medicines. Most participants have moderate knowledge and attitudes towards herbal therapy for diabetes. Diabetic Education for the public should include instruction on safe usage of herbal remedies.

Keywords: Traditional herbal medicine, Diabetes, Knowledge, Attitude

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1.0 Introduction

Diabetes mellitus persists in increasing worldwide and remains a significant public health issue owing to its chronic metabolic complications (Li et al., 2025). As patients progressively pursue complementary strategies to enhance glycaemic management, traditional herbal medicine has emerged as a commonly utilised adjunct to standard diabetes therapies, especially in culturally diverse regions such as Malaysia (Wan et al., 2025). Although many individuals regard herbal remedies as natural, readily available, and

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beneficial, the evidence supporting their safety and efficacy varies significantly, with recent studies showing inconsistent outcomes and potential effects on glycaemic control (Lema et al., 2024). More significantly, a limited understanding of herb–drug interactions and inconsistent patient education may impact treatment results and influence overall disease management (Aje et al., 2024). Therefore, evaluating patients' knowledge and perceptions regarding the use of traditional herbal medicine is essential for enhancing safe and integrated diabetes management.

2.0 literiture review

Diabetes mellitus, a chronic metabolic disorder characterised by hyperglycaemia resulting from defects in insulin secretion, insulin action, or both, has reached epidemic proportions globally, affecting an estimated 537 million adults in 2021 (Amaeze et al., 2018). This pervasive condition often leads to severe microvascular and macrovascular complications, resulting in effective management strategies to mitigate adverse health outcomes (Triyono et al., 2021). Its escalating prevalence, projected to affect over 5.4% of the global population by 2025, underscores the urgent need for comprehensive approaches to its management (Vishwakarma et al., 2024). This rise in prevalence highlights a significant public health challenge, prompting an exploration into diverse therapeutic avenues beyond conventional pharmacotherapy. Amidst this escalating health crisis, traditional herbal medicine has emerged as a significant complementary and alternative therapy, with a considerable number of patients integrating it into their diabetes management regimens (Kasole et al., 2019). This integration is often driven by cultural beliefs, perceived efficacy, and accessibility, despite varying levels of scientific evidence supporting their use (Kasole et al., 2019). However, the extent of knowledge and attitudes among diabetes patients regarding the use of traditional herbal medicine, especially in conjunction with conventional treatments, remains underexplored (Kassim et al., 2020; Sriraman et al., 2023). This study aims to assess the knowledge and attitudes of diabetes patients regarding the use of traditional herbal medicine, providing insights into their healthcare-seeking behaviours and potential implications for integrated diabetes care (Atwine & Hjelm, 2017).

3.0 Methodology

3.1 Study Design

This research utilized a cross-sectional study design, selected for its simplicity, time efficiency, and cost-effectiveness, making it particularly suitable for addressing the research question. The study was conducted in a central area of the Klang Valley. Data was collected through a self-administered online questionnaire created using Google Forms. The survey link, accompanied by a digital consent form, was circulated through popular online platforms including Facebook, WhatsApp, and other social media channels to reach eligible participants. The questionnaire, which included a validated instrument by Kamel et al. (2017), was structured into four main sections: demographic data, knowledge of diabetes, and perceptions and beliefs regarding herbal remedies in diabetes management. The data collection phase extended from March 2020 through February 2022. Ethical approval for this study was obtained from the Research Ethics Committee of Universiti Teknologi MARA (REC/12/2020 (UG/MR/244)).

3.2 Inclusion and Exclusion Criteria

Participants were included if they met the following criteria: diagnosed with diabetes by a healthcare professional, currently undergoing medical treatment, aged between 18 and 59 years, and able to understand basic English to complete the questionnaire. Individuals without internet access or low literacy levels, which might hinder their ability to respond independently, were excluded from participation.

3.3 Sample Size Calculation

Sample size estimation was conducted using the Raosoft Sample Size Calculator. According to the Malaysian Ministry of Health (2013), the diabetic population in Selangor was approximately 106,101 individuals. Assuming a 5% margin of error, a 95% confidence interval, and a 50% response distribution, the calculated minimum required sample size for representativeness was 383 participants.

3.4 Research Instrument

The study employed a structured English-language questionnaire titled "Knowledge, Attitude, and Beliefs Towards Traditional Herbal Medicine Use among Diabetics", which had undergone prior validation (Kamel et al., 2017). The questionnaire consisted of 21 items, grouped into five sections: demographic background, knowledge on the therapeutic use of herbal medicine, knowledge on its role in diabetes control, and assessment of participants' attitudes and beliefs regarding herbal interventions in diabetes care.

4.0 Findings

4.1 Demographic Data

Table 1 describes the attributes of the participants—three hundred ninety-one that completed the questionnaires. The results indicate that more than half of the patients were above 50 years of age (57.3%). Males constitute 41.2% of the population, and females comprise

58.8%. Secondary school is the predominant level of educational engagement, representing 62.1%. Individuals with type 2 diabetes comprised 72.6% of respondents, while those with type 1 diabetes constituted 24.4%.

Table 1. Demographic data of patients with diabetes in this study (n=391)

CHARACTERISTIC		Diabetes Patient Frequency	Percentages (%)
Age	18-29	22	5.6
	30-39	37	9.5
	40-49	108	27.6
	50 >	224	57.3
Gender	Males	161	41.2
	Females	230	58.8
Level of education	No formal education	13	3.3
	Primary School	68	17.4
	Secondary School	243	62.1
	University	67	17.1
Types of diabetes	Type I	107	24.4
	Type II	284	72.6

Table 1 shows the population characteristics of 356 diabetic patients that were recruited in this study. The result indicates that most of them were 50years and older (57%) and there were mostly females (59%). Most of the patients were diagnosed as type 11 DM (73%). Table 2 shows the association between sociodemographic characteristics and the usage of herbal products among the patients. The table shows that 91% of the total patient consumes herbal products to manage their blood sugar. Individuals aged 50 and older are more likely to use botanical products than those aged 18 to 29. In addition, females may be more inclined to utilise botanical products than male patients. The results suggest that individuals with type 2 diabetes are more likely to use botanicals than those with type 1 diabetes, and there is a correlation between the level of education and the number of herbal users, as evidenced by p>0.02.

Table 2: Association between demographic of the patient with diabetes and herbal user (n=391)

Characteristic		Herbal User		Not herbal user		P-Value
		N=356	%=91	N=35	%= 9	
Age	18-29	20	5.6%	2	5.7%	
	30-39	32	9%	5	14.3%	.444
	40-49	99	27.9%	9	25.7%	
	50>	205	57.5%	19	54.3%	
Gender	Male	144	40.45%	17	48.57%	.568
	Female	212	59.55%	18	51.43%	
Level Education	No education	6	1.69%	7	20.00%	
	Primary school	67	18.82%	1	2.86%	**.002**
	Secondary school	227	63.76%	16	45.72%	
	University	56	15.73%	11	31.42%	
Type of Diabetes	Type 1	100	28.09%	7	20.00%	.572
	Type 2	256	71.91%	28	80.00%	

4.2 Knowledge of patients with diabetes about the use of herbs

Table 3 presents the distribution of diabetic respondents' knowledge regarding specific herbs and their perceived role in glycaemic control. Among the participants, 42.2% identified olive oil or olive leaf as beneficial in lowering blood glucose levels. This was followed by awareness of the benefits of fibre-rich foods (25.3%), cinnamon (17.4%), garlic (13.8%), and almonds (1.3%). Regarding the perceived mechanisms, 53.5% believed that herbal treatments could directly reduce blood glucose levels, 31.7% recognised their potential to reduce insulin resistance, while 14.8% were uncertain about the exact mode of action. The majority of respondents (48.8%) reported acquiring information on herbal usage from fellow individuals with diabetes. Other sources included media outlets (43.5%), physicians (4.3%), and traditional healers (3.3%). Additionally, 93.1% of participants demonstrated awareness of both hypoglycemic and hyperglycemic symptoms, whereas 6.9% lacked such knowledge.

Table 3: Knowledge of patients with diabetes about the use of herbs to control diabetes (n=391)

Characteristic	Frequency (n)	Percentages (%)
Which herb do you know that can control diabetes?		
Olive oil or leaf	165	42.2
Cinnamon	68	17.4
Garlic	54	13.8

Fiber-rich food	99	25.3
Nuts	5	1.3
How do herbs control diabetes?		
By decreasing blood glucose	209	53.5
By decreasing insulin resistance	124	31.7
I do not know	58	14.8
Do you know if vitamins reduce diabetic complications?		
Yes	198	50.6
No	193	49.4
Where do you get the information regarding beneficial herbal uses for diabetes?		
Doctor	17	4.3
Media	170	43.5
Traditional healer	13	3.3
Other patients with diabetes	191	48.8
Are you aware of the symptoms of hypo/hyperglycemia?		
Yes	361	93.1
No	27	6.9

4.3 Attitude of patients with diabetes about the use of herbs

Table 4 indicates that the majority of respondents (91%) expressed a preference for herbal remedies over conventional medications. Among the primary motivations, 47.3% cited the perceived additional health benefits of herbs, while 23.5% reported using them to prevent diabetes-related complications. Economic factors also played a role, with 19.7% indicating affordability and ease of access as key reasons. A smaller proportion (0.8%) believed that herbs could enhance the effectiveness of their current treatments, and 8.7% reported various other personal reasons. Despite the widespread use of herbal remedies, 84.7% of respondents acknowledged concurrent use with prescribed antidiabetic medications, reflecting a pattern of integrative self-management. In terms of frequency, 63.7% reported using herbs on a daily basis, while 30.4% used them weekly, and 3.1% less frequently. Notably, more than half of the participants (54.7%) did not disclose their herbal use to their physicians, whereas 45.3% reported discussing it with their healthcare providers.

Table 4: Attitude of patients with diabetes regarding the use of herbs (n=391)

Characteristic	Frequency (n)	Percentages (%)
Do you prefer using herbal products to control diabetes?		
Yes	356	91
No	35	9
Why do you use herbal products?		
Belief in the benefits of herbs	185	47.3
They are inexpensive and readily available	77	19.7
Their effect in preventing diabetes complications	92	23.5
Because they increase drugs' effects of drugs.	3	0.8
Others	34	8.7
Do you use herbal products with medicine?		
Yes	331	84.7
No	60	15.3
Do you use herbal products on a regular basis?		
Yes	249	63.7
No	142	36.3
How often do you use herbal products?		
Daily	12	3.1
Weekly	119	30.4
Less frequently	260	66.5
Do you tell your doctor about using herbal products to control diabetes?		
Yes	177	45.3
No	214	54.7
Does your doctor usually ask if you are using the herbal product to control diabetes?		
Yes	179	45.8
No	212	54.2

5.0 Discussion

Effective diabetes care is significantly dependent on knowledge and attitude. This study aimed to assess the knowledge and attitudes of diabetic patients on herbal products to develop a diabetes education program. The study results indicate that 91% of diabetes patients in Malaysia's Klang Valley use herbal remedies to manage their disease. Herbal medicines are favoured for their natural attributes, ease of use, and little risk of adverse consequences (Azhar et al., 2022). Previous research has revealed that roughly 75% of the population in France and 42% in the United States have used herbal medicine at least once for diabetes management (Alqathama et al., 2020).

These disparities may be associated with the current worldwide increase in the use of herbal remedies as adjunctive and alternative therapies by individuals with diabetes.

This research indicates that the primary objective of using herbs for diabetes treatment was to derive benefits from them. Herb-derived chemicals lower blood glucose via several mechanisms. Principal mechanisms encompass augmented insulin secretion through the proliferation of pancreatic cells within the Langerhans islets as secretagogues, activation of glucose catabolism pathways, inhibition of gluconeogenesis pathways, enhancement of glucose conduction and absorption, suppression of protein binding, and amplification of antioxidant capacity (Gholamine et al., 2024; Choudhury et al., 2018). Numerous diabetes patients consume herbal remedies with antidiabetic properties with their standard therapies, which may provide both advantages and risks for effective disease management. Gupta et al. (2017).

Majority of patients (84.7%) reported using herbal remedies with their diabetic medications. While several studies on herb-drug interactions emphasise their potential adverse effects, herbal constituents may also enhance or augment the efficacy of antidiabetic pharmaceutical agents or vice versa (Gupta et al., 2017). Numerous plants have been used as a source of potent antidiabetic medications for ages. In underprivileged nations, medicinal plants are used to manage diabetes, primarily to alleviate the economic strain of conventional pharmaceuticals on the populace. These medicinal plants include phytoconstituents, such as flavonoids, terpenoids, saponins, carotenoids, alkaloids, and glycosides, which act as anti-hyperglycemic agents (Frimpong et al., 2024; Salehi et al., 2019). The pharmaceutical industry has increasingly focused on using the phytochemical components of therapeutic plants, as shown by the literature. Steroids, alkaloids, phenolics, lignans, carbohydrates, and glycosides are examples of secondary metabolites from plants that possess antiallergic, anticancer, antibacterial, anti-inflammatory, antidiabetic, and antioxidant properties, all of which are beneficial to humans. Diverse biological features provide advantages to humans, including antiallergic, anticancer, antibacterial, anti-inflammatory, antidiabetic, and antioxidant attributes. Tran, Pham, and Le (2020).

Several novel phytochemical compounds have demonstrated superior antidiabetic efficacy compared to the oral hypoglycaemic agents. Traditional medicine has demonstrated efficacy in treating diabetes mellitus and holds a promising future (Tran et al., 2020). Beneficial interactions between herbs and pharmaceuticals may enhance the efficacy of an antidiabetic agent Gupta et al. (2017). This research indicates that just 50.6% of diabetes individuals recognise the essential function of vitamin consumption in mitigating diabetic complications. The present research indicates that after 24 months of vitamin E medication, individuals with diabetes are less prone to develop late complications such as retinopathy, foot ulcers, and cardiovascular difficulties. Furthermore, it has been hypothesised that vitamins C and D may provide antidiabetic advantages by influencing insulin secretion or sensitivity, hence offering hypoglycemic effects, anti-inflammatory properties, hypolipidemic effects, and immunomodulatory functions (Karla et al., 2021; Puvvada et al., 2020). The extended use of antioxidant therapy offers enduring benefits by slowing disease progression (Yedjou et al., 2023; Jain & Jain, 2012). A prior poll indicated that just 35.5% of individuals recognise the significance of vitamin consumption in mitigating diabetes problems. Kamel et al. (2017)

A majority of individuals (54.7%) reported that they had never disclosed their use of herbal products to their physicians. Prior research indicates that insufficient disclosure stems from doctors not inquiring about patients' herbal use as often as necessary, or from apprehension over potential adverse reactions (Alqathama et al., 2020). A deficiency in clear communication between patients and healthcare providers may result in plant toxicity owing to improper use, anticipated and unanticipated adverse effects, and herb-drug interactions with hypoglycemic medications (Foley et al., 2019). Simultaneously, only 45.3% of them were asked by their physicians about their habitual use of herbs. During the assessment of a patient's medical history, it is customary to enquire about any drugs they are taking; however, herbal items are seldom considered. Consequently, it is advisable to encourage treating physicians to routinely inquire about the use of herbal products and to foster transparent communication between doctors and patients.

In this research, 42.2% of diabetes patients recognised that olive oil or leaves may assist in managing their disease. Research indicated that the majority of diabetes patients in Malaysia used olive oil or leaves for managing their disease. The research indicated that olive oil intake was associated with a reduced incidence of type 2 diabetes and enhanced glucose metabolism (Schwingshackl et al., 2017). When incorporated into a nutritious diet, olive oil has been linked to the prevention and management of type 2 diabetes. Olive oil is rich in biophenols, including oleuropein and its derivatives, which are associated with several antidiabetic mechanisms owing to their immunomodulatory, antiproliferative, antioxidative, and anabolic characteristics. (Alkhatib, Tsang, & Tuomilehto, 2018). Oleic acid, the primary constituent of olive oil, has been shown to reduce insulin resistance and may aid in the management of type 2 diabetes. Guasch-Ferré et al. (2015). Olive leaf extract (OLE) enhances insulin sensitivity and pancreatic cell secretory function in overweight individuals after an oral glucose challenge (Alshali, 2020).

Additionally, several respondents favoured the usage of cinnamon for diabetes management. Cinnamon has been shown to have effects on various metabolic syndrome processes, including enhancing insulin signalling and glucose transport, altering carbohydrate metabolism, and influencing glucose absorption in individuals with diabetes (Singletary, 2019). Several additional respondents favoured fibre-rich foods for diabetic management. Fibre-rich foods are crucial for diabetes management, as they improve glycaemic control, blood lipid levels, body weight, and inflammation, while reducing the risk of early mortality. These benefits were not confined to any one fibre type or diabetes classification, and they were observed across the entire range of dietary options. Conversely, those transitioning from low to moderate or high intakes had more pronounced enhancements in glycaemic control (Reynolds et al., 2020).

6.0 Conclusion& Recommendations

Ultimately, the data and analysis indicate that most respondents had a moderate degree of knowledge and attitude about the use of herbal medicine for diabetes management. Given that more than half of the study population consumed herbal remedies and there are

beneficial uses of herbal remedies in managing diabetes , it is important to incorporate education for the proper use of medicinal plants in diabetic management in this country. The target audience should include the whole community rather than only those diagnosed with diabetes.

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Paper Contribution to Related Field of Study
This paper contributes to the growing body of knowledge on integrative and complementary approaches in diabetes management by providing empirical evidence on the knowledge and attitudes of diabetic patients toward traditional herbal medicine. By focusing on a Malaysian urban population, the study highlights the widespread use of herbal remedies and the need for enhanced public health education regarding their safe and informed usage. The findings support the inclusion of herbal medicine awareness in public health curricula and clinical practice guidelines, particularly in multicultural societies where traditional remedies are commonly used alongside conventional treatments

References

Alkhatib, A., Tsang, C., & Tuomilehto, J. (2018). Olive oil nutraceuticals in the prevention and management of diabetes: From molecules to lifestyle. International Journal of Molecular Sciences, 19(7), 2024. https://doi.org/10.3390/ijms19072024

Alqathama, A., Alluhiabi, G., Baghdadi, H., Aljahani, L., Khan, O., Jabal, S., et al. (2020). Herbal medicine from the perspective of type II diabetic patients and physicians: What is the relationship? BMC Complementary Medicine and Therapies, 20, 65. https://doi.org/10.1186/s12906-020-2854-4

Aje, A. A., et al. (2024). Factors associated with disease knowledge and attitude among ambulatory diabetes patients in tertiary healthcare facilities in Nigeria. BMC Endocrine Disorders. https://doi.org/10.1186/s12902-024-01696-0

Alshali, K. Z. (2020). Review of herb supplement use in type 2 diabetes. Archives of Pharmacy Practice, 11(2), 42–49.

Amaeze, O., Aderemi-Williams, R. I., Ayo-Vaughan, M. A., Ogundemuren, D. A., Ogunmola, D. S., & Anyika, E. N. (2018). Herbal medicine use among Type 2 diabetes mellitus patients in Nigeria: Understanding the magnitude and predictors of use. International Journal of Clinical Pharmacy, 40(3), 580. https://doi.org/10.1007/s11096-018-0648-2

Atwine, F., & Hjelm, K. (2017). Health professionals' knowledge and attitudes to healthcare-seeking practices and complementary alternative medicine usage in Ugandans with diabetes: A cross-sectional survey. Pan African Medical Journal, 28. https://doi.org/10.11604/pamj.2017.28.256.11615

Azhar, M. N., Ibrahim, F. S., & Muniandy, N. D. (2022). Antidiabetic effect of Piper sarmentosum: A systematic review. Malaysian Journal of Medicine and Health Sciences, 18(Suppl. 15), 341–348.

Foley, H., Steel, A., Cramer, H., Wardle, J., & Adams, J. (2019). Disclosure of complementary medicine use to medical providers: A systematic review and meta-analysis. Scientific Reports, 9, 1573. https://doi.org/10.1038/s41598-018-38279-8

Frimpong, E. K., Thembane, N., Hlatshwayo, S., Ngcobo, M., & Gqaleni, N. (2024). Indigenous medicinal plants used in the management of diabetes in Africa: 5 years (2019–2024) in perspective. Plants, 13, 1898. https://doi.org/10.3390/plants13141898

Gharaibeh, B., & Tawalbeh, L. I. (2017). Beliefs and practices of patients with diabetes toward the use of herbal therapy. AIMS Public Health, 4(6), 650–661. https://doi.org/10.3934/publichealth.2017.6.650

Gholamine, B., Malviya, J., Rudiansyah, M., Abid, M. K., Alawadi, A. H., et al. (2024). Herbal therapy in diabetes mellitus: A review. Advances in Life Sciences, 11(1), 40–48.

Guasch-Ferré, M., Hruby, A., Salas-Salvadó, J., Martínez-González, M. A., Sun, Q., Willett, W. C., et al. (2015). Olive oil consumption and risk of type 2 diabetes in US women. American Journal of Clinical Nutrition, 102(2), 479–486. https://doi.org/10.3945/ajcn.115.109165

Gupta, R. C., Chang, D., Nammi, S., Bensoussan, A., Bilinski, K., & Roufogalis, B. D. (2017). Interactions between antidiabetic drugs and herbs: An overview of mechanisms of action and clinical implications. Journal of Ayurveda and Integrative Medicine, 9, 59.

Jain, A. B., & Jain, V. A. (2012). Vitamin E: Its beneficial role in diabetes mellitus (DM) and its complications. Journal of Clinical and Diagnostic Research, 6(10), 1624–1628.

Kalra, S., & Aggarwal, S. (2021). Vitamin D and diabetes. Journal of the Pakistan Medical Association, 71, 383–384.

Kamel, F. O., Magadmi, R. M., Hagras, M. M., Magadmi, B., & AlAhmad, R. A. (2017). Knowledge, attitude, and beliefs toward traditional herbal medicine use among diabetics in Jeddah, Saudi Arabia. Complementary Therapies in Clinical Practice, 29, 207–212. https://doi.org/10.1016/j.ctcp.2017.10.007

Kasole, R., Martin, H., & Kimiywe, J. (2019). Traditional medicine and its role in the management of diabetes mellitus: Patients' and herbalists' perspectives. Evidence-Based Complementary and Alternative Medicine, 2019, 1–9. https://doi.org/10.1155/2019/2835691

Kassim, R., Ithnain, N., Panting, A. J., Amirudin, N., & Krishnan, M. (2020). Exploring the knowledge on herbal medicine usage in disease management among people with type 2 diabetes mellitus in Negeri Sembilan, Malaysia. Malaysian Journal of Social Sciences and Humanities, 5(12), 272–281. https://doi.org/10.47405/mjssh.v5i12.555

Lema, G. D., Gebeyaw, E. D., et al. (2024). Herbal medicine use and its impact on glycaemic control among diabetes patients at governmental hospitals in Debre Berhan, Ethiopia: A cross-sectional study. Metabolites Open, 100311. https://doi.org/10.1016/j.metop.2024.100311

Li, E., Maunder, A., Liu, J., Pandey, C., Cave, A., O'Fee, A., & Ee, C. (2025). The efficacy and safety of herbal medicines for glycaemic control and insulin resistance in individuals with type 2 diabetes: An umbrella review. BMC Complementary Medicine and Therapies, 25, 341. https://doi.org/10.1186/s12906-025-05059-7

Puvvada, R. C. (2020). Association of vitamin C status in diabetes mellitus: Prevalence and predictors of vitamin C deficiency. Future Journal of Pharmaceutical Sciences, 6, 30.

Reynolds, A. N., Akerman, A. P., & Mann, J. (2020). Dietary fibre and whole grains in diabetes management: Systematic review and meta-analyses. PLoS Medicine, 17(3), e1003053. https://doi.org/10.1371/journal.pmed.1003053

Salehi, B., Ata, A., Anil, N. V., Sharopov, F., Ramírez-Alarcón, K., Ruiz-Ortega, A., et al. (2019). Antidiabetic potential of medicinal plants and their active components. Biomolecules, 9, 551. https://doi.org/10.3390/biom9100551

Schwingshackl, L., Lampousi, A. M., Portillo, M. P., Romaguera, D., Hoffmann, G., & Boeing, H. (2017). Olive oil in the prevention and management of type 2 diabetes mellitus: A systematic review and meta-analysis of cohort studies and intervention trials. Nutrition & Diabetes, 7(4), e262.

Singletary, K. C. (2019). Update of potential health benefits. Nutrition Today, 54(1), 42–52.

Sriraman, S., Sreejith, D., Andrew, E., Okello, I., & Willcox, M. (2023). Use of herbal medicines for the management of type 2 diabetes: A systematic review of qualitative studies. Complementary Therapies in Clinical Practice, 53, 101808. https://doi.org/10.1016/j.ctcp.2023.101808

Tran, N., Pham, B., & Le, L. (2020). Bioactive compounds in antidiabetic plants: From herbal medicine to modern drug discovery. Biology, 9(9), 1–31.

Triyono, A., Zulkarnain, Z., Astana, W., Ardiyanto, D., Novianto, F., Fitriani, U. A., Nisa, U., & Saryanto, S. (2021). Factors associated with the attitude of herb utilization among diabetes mellitus patients. IOP Conference Series: Earth and Environmental Science, 913(1), 012094. https://doi.org/10.1088/1755-1315/913/1/012094

Vishwakarma, P. K., Moharana, A., Behra, S. R., Choudhury, P., Jayronia, S., & Tripathi, S. M. (2024). Diabetes management: Herbal remedies and emerging therapies. Current Nutraceuticals, 5. https://doi.org/10.2174/0126659786283493240415155919

Wan, A. G. T., et al. (2025). Herbal and dietary supplement use among patients with type 2 diabetes mellitus (T2DM) from a rural region in Malaysia. Malaysian Journal of Pharmacy, 11(1), 48–58. https://doi.org/10.52494/maljpharmv11109

Yedjou, C. G., Grigsby, J., Mbemi, A., Nelson, D., Mildort, B., Latinwo, L., & Tchounwou, P. B. (2023). The management of diabetes mellitus using medicinal plants and vitamins. International Journal of Molecular Sciences, 24, 9085. https://doi.org/10.3390/ijms24109085