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Review Article

Use of Complementary and Alternative Medicine Among Type 2 Diabetes Mellitus Patients in South Asia: A Systematic Literature Review

Wajiha Rehman[1,3]*, Fatimatuzzahra'Abd. Aziz[1], Usman Abubakar[2]

[1]*Discipline of Clinical Pharmacy, School of Pharmaceutical Sciences, Universiti Sains Malaysia, 11800 Minden, Pinang, Malaysia*
[2]*Department of Clinical Pharmacy and Practice, College of Pharmacy, Qatar University, QU Health, Doha, Qatar*
[3]*Department of Health Informatics, College of Nursing and Health Science, Jazan University, Saudia Arabia*

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ABSTRACT

Complementary and alternative medicine (CAM) is becoming increasingly prominent as an adjunct to standard orthodox medicine among Type 2 diabetes mellitus patients globally. However, a comprehensive systematic review of Complementary and alternative medicine use among Type 2 diabetes mellitus patients and practice in South Asia is lacking. This study aimed to systematically review the prevalence, types, and factors associated with CAM use among Type 2 diabetes mellitus patients in South Asia. Three electronic databases, PubMed, Scopus, and Web of Science, were searched for studies published from 2000 to 2022. This study was registered on PROSPERO, number CRD42023445807. Fourteen studies from five South Asian countries were included. These studies revealed a wide range of complementary and alternative medicine usage from 9% to 76%. The prominence of a plethora of biologically-based practices, in addition to yoga, homeopathy, ayurveda, spiritual healing, highlighted the diversity of Complementary and alternative medicine options in Type 2 diabetes mellitus management in the region. The factors associated with the increased use of CAM include the ease of access and availability of the practices, cultural and societal norms, the socioeconomic conditions of the individuals, and their personal beliefs and values. The study identified a wide variation in the prevalence of complementary and alternative medicine use among type 2 diabetes mellitus patients. It underscores the need for healthcare providers to be knowledgeable about CAM, and open to discussing complementary and alternative medicine with their patients.

Keywords: Complementary and Alternative medicine, Prevalence, Type 2 Diabetes Mellitus, South Asia.

Introduction

Diabetes is a chronic metabolic disorder with devastating consequences to the heart, blood vessels, eyes, kidneys, and nerves.[1-3] The most common type, Type 2 diabetes mellitus (T2DM), is secondary to insulin resistance or insufficient insulin production by the pancreas. The prevalence of Type 2 diabetes mellitus has increased drastically over the last three decades in both developed and developing countries. South Asia remains one of the most severely affected regions globally, with a disproportionate share of Type 2 diabetes mellitus related morbidity and mortality.[4] Sufficient evidence has shown that healthcare access, education, and resource disparities can significantly impact Type 2 diabetes management, particularly in underserved communities or low-income populations such as South Asia.[1,4,5] Although the quest to find cures and manage diseases dates back to antiquity, the mainstream conventional (Western) medicine that evolved during the renaissance remained the most effective medical practice. Here, unbiased and rational scientific methods are followed in establishing the safety and efficacy of medical procedures, in contrast to nonscientific procedures of premedieval times.

*Corresponding author. Email: wrehman@student.usm.my
Tel: +00966561234430

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In this context, well-trained and legally licensed health professionals adopt scientifically validated, evidence-based standard care to diagnose, treat, or prevent Type 2 diabetes mellitus, often using pharmacological agents and other clinically accepted non-pharmacological therapies. Complementary and Alternative Medicine (CAM) is a diagnostic, therapeutic, or preventive practice that is used in collaboration with orthodox medicine to solve unfulfilled needs or broaden medical concepts.[6-8] CAM is the term for medical products and practices outside standard medical care. The term complementary medicine refers explicitly to practices used alongside standard care, whereas alternative medicine uses surrogate practices instead of standard medical treatment. People with Type 2 diabetes mellitus may use complementary therapies to augment the therapeutic outcomes of standard care. The major classes of CAM practices are mind-body therapies (MBT), biologically-based practices (BBP), manipulative and body-based practices (MBP), and energy-based healing (EBH). Mind-body therapy combines mental focus, breathing, and body movements to help relax the body and mind. CAM emphasizes the patient's preferences, and its worldwide prominence has been abundantly reported.[6-12]

According to the World Bank, the South Asian countries include India, Pakistan, Bangladesh, Nepal, Sri Lanka, Bhutan, and the Maldives.[13] Representing one of the world's most diverse regions, South Asia domesticates over 4,500 anthropologically identified groups exhibiting diverse religious beliefs, customs, and languages. Nearly two billion people, hundreds of languages, and the most significant concentrations of five of the twelve major global religions - Hindus, Muslims, Sikhs, Jains, and Zoroastrians live in South Asia.[14] Furthermore, the subregion has an abundant biodiversity of medicinal biomass coupled with a medico-cultural heritage, potentially impacting CAM practices.

At a global glance, there is a growing trend among patients to leverage CAM.[10,15] Compared to nations with lower GDP per capita, wealthier

nations with higher healthcare spending appear to have incorporated CAM therapies more thoroughly into their medical care systems. For instance, full integration of CAM practices has been reported in up to 50% of Norwegian hospitals.[16] However, CAM use is more pronounced in developing countries, where a prevalence of up to 70% is not uncommon.[17,18] Moreover, the world market for CAM has been estimated at $102 billion in 2021 and is expected to increase at a compound annual growth rate (CAGR) of 15.6% from 2022 to 2031, reaching $437.9 billion. The widespread availability and affordability make CAM particularly prevalent in Low and middle-income countries (LMICs) such as South Asia, where access to essential medicines is grossly inadequate to meet the health systems directed Sustainable Development Goals of the United Nations.[19]

Given the high prevalence of Type 2 diabetes mellitus in the South Asia region and the limited access to healthcare resources,[5] understanding the use of CAM is crucial for healthcare providers and policymakers in downsizing the burden of Type 2 diabetes mellitus in the region. In line with this goal, a systematic review of CAM use would provide valuable insights into the prevalence, patterns, and reasons for CAM use in this population.[12] There is a paucity of comprehensive, up-to-date systematic reviews investigating the prevalence of CAM use among Type 2 diabetes mellitus patients in South Asia. This review fills a critical gap and aims to synthesize the prevalence, types, and factors determining the use of Complementary and alternative medicine (CAM) among Type 2 patients in South Asia. The use of a systematic approach, grounded in a well-defined protocol, enhances the credibility and reliability of the review findings and supports evidence-informed decision-making in this area.

Materials and Methods

Study design and protocol

This study was conducted by the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines.[20] The PRISMA checklist is provided as a Supplemental file (Additional file 1). The study protocol was registered on PROSPERO with the following reference: ID CRD42023445807. A systematic review methodology was selected for its structured, transparent approach in synthesizing existing evidence. This aligns closely with the aim of this review. Also, a predefined systematic review protocol was developed to guide the review process, including the research questions, eligibility criteria, database selection, and data extraction procedures.

Eligibility criteria

This study targeted published studies investigating CAM use among patients with Type 2 diabetes mellitus from 2000 to 2022 in the South Asian Region. The study participants were adults aged 18 years and older residing in South Asian countries, including India, Pakistan, Bangladesh, Nepal, Sri Lanka, Bhutan, and the Maldives. The research encompassed diverse settings such as hospitals, clinics, communities, or homes, and all studies were published in English. All the studies were cross-sectional studies. Exclusion criteria comprised studies published before 2000, those not in English, qualitative research types, and investigations related to chronic diseases, including studies conducted on Type 1 and gestational diabetic patients.

Information sources

Electronic databases, including Web of Science, PubMed, and Scopus, were searched to identify eligible studies published between January 2000 and September 2022. Additionally, bibliographies were reviewed to identify further pertinent publications, ensuring alignment with predefined inclusion and exclusion criteria.

Search strategy

The search employed keywords such as complementary, alternative, traditional, medicine, therapy, Type 2 diabetes mellitus, and prevalence. Boolean operators such as "AND" and "OR" were used to enhance search sensitivity and specificity. Search limits included language (English), dates (1st January 2000 to 20th September 2022), species (Humans), and age (all adults >18 years). To further refine the results, the names of South Asian countries (India, Pakistan, Bangladesh, Sri Lanka, Nepal, Bhutan, and Maldives) as defined by the World Bank were included.

Data selection process

After retrieving 799 records, rigorous screening was applied to determine their relevance. All records from electronic databases were imported into EndNote, where duplicate entries were removed. The titles and abstracts of the non-duplicate articles were meticulously screened by two independent reviewers (WR, UA) based on eligibility criteria. The full text of the studies that fulfilled the eligibility criteria was reviewed by two reviewers (WR, UA). Disagreement between the reviewers was resolved through consensus.

Data collection process

The data from the selected studies were collected using a pre-designed data collection form. Two independent reviewers (WR, UA) conducted the data collection. Any disagreements between the reviewers was resolved through consensus.

Data items

The following information were extracted from the selected studies: first author's name and year of publication, the country involved, study settings, study design, number of participants, sampling method, sample size, data collection method, the prevalence of Complementary and alternative medicine (CAM) use, types of Complementary and alternative medicine (CAM) used, and factors associated with CAM use.

Study risk of bias assessment

In evaluating bias risk in clinical studies, Joanna Briggs Institute (JBI) Critical Appraisal Tools were utilized and tailored for various study types, such as prevalence, cohort, cross-sectional, and case-control studies.[21] These tools cover essential aspects of study quality, including selection, comparability, and exposure. Two reviewers (WR, FZ) independently assessed each included study's quality using the critical appraisal tool derived from the JBI checklist.[24] Any discrepancies during the assessment were resolved through discussion between the two reviewers or by involving a third reviewer (UA). Each study was evaluated across 13 criteria. The assessment results were organized into a table, categorizing judgments as "Yes" for a low risk of bias, "No" for a high risk of bias, and "Unclear" for insufficient or unclear information reported. An overall score was calculated by giving a “1” score for each “Yes” answer and 0 to each “No” and “Unclear” answer. Values of all 13 criteria were added up. The total score was divided by the maximum possible score and multiplied by 100 to get the percentage.

Outcome assessment and effect measure

The primary outcome was the prevalence of Complementary and alternative medicine (CAM) use among type 2 diabetes mellitus patients in South Asia. Secondary outcomes include the types of CAM used by these patients and associated factors. The primary outcome was presented as a percentage, and the secondary outcomes were presented as categories and in table form.

Data synthesis

The data were synthesized using qualitative methods. Study-specific results were reported as percentage prevalence with exact 95% confidence intervals (95% CI).

Results and Discussion

Given an established paucity of data in scientific literature, this systematic review aimed to investigate the prevalence and the factors influencing the use of CAM practice among Type 2 diabetes mellitus patients in South Asia.

Study selection

A total of 799 records were identified from the electronic databases; all the records were imported into EndNote, and 43 duplicates were removed. After screening the title and abstract of the non-duplicate articles, 696 articles were excluded. The full text of 60 articles were

reviewed, and 14 eligible studies were selected. Figure 1 shows the article screening and selection process.

Study characteristics

This systematic review included fourteen (14) studies conducted in five South Asian countries, including India (n = 7), Pakistan (n = 3), Bangladesh (n = 1), Sri Lanka (n = 2), and Nepal (n = 1). No studies from Bhutan or the Maldives were included in this review. The included studies covered the period from 2014 to 2022, with participants primarily recruited from diabetes clinics and healthcare centers, as outlined in Table 1. All included studies exclusively focused on participants diagnosed with Type 2 diabetes mellitus and used a cross-sectional study design.

Table 1: Characteristics of studies included in this review

S/N	Author name, year of publication, and country	Study setting/ participants	Sampling method/Sample size	Data collection method	Prevalence of CAM use	Types of CAM used
1	Medagama *et al*. (2014)[41] Sri Lanka	Teaching hospital	A two-stage sampling N = 252 M = 85 F = 167	An interviewer-based questionnaire	76.1% N = 192 F = 139 M = 53	Herbal dietary supplements (bitter gourd (*Momordica charantia*) ivy gourd (*Coccinia grandis*) leaves, crepe ginger (*Costus speciosus*) leaves, *Salacia reticulata* and Fenugreek (BBP)
2	Devi *et al*. (2015)[22] India	Diabetes health campaign	Random Sampling N = 357 (252 Type 2 diabetes mellitus, 105 control)	An interviewer-based questionnaire	N = 162 64.2%	Biologically based practices: Herbs (Fenugreek, Cinnamon, Gymnena, Guduchi, Aloe vera, Black plum and seed) Special diet (Organic food, fiber rich diet/food, with saturated fats and a cholesterol-free diet) Nutrition supplements (Multiple vitamins, fish oil. Mind-body practices: Yoga, exercise, meditation/prayer,Music therapy, Whole medical systems: Acupuncture, Ayurveda, Homeopathy (WMS, BBP, MBP)
3	Medagama and Senadhira (2015)[35] Sri Lanks	Teaching hospital	A two-stage sampling N = 220 F = 173 M = 47	An interviewer-administered questionnaire	Only the prevalence of herbs N = 220 F = 173 M = 47	Ivy gourd (*Coccinia grandis*), crepe ginger (*Costus speciosus*) and bitter gourd (*Momordica charantia*) (BBP)
4	Sadiq *et al*. (2017)[28] India	Medical College, Hospital (OPD)	Not mentioned N=280	Pre-structured questionnaire	39.28% N = 110 F=62 M = 48	Ayurveda, Naturopathy, Yoga, Fenugreek seeds, Bittergourd (BBP, WMS, MBP)
5	Jawed *et al*. (2019)[26] Pakistan	Civil Hospital and National Institute of Diabetes	Not mentioned N = 400	A semi-structured pretested questionnaire	53.5%, N = 214, F = 152, M = 62	Herbal medicine, spiritual, Unani and Homeopathic medicines

						(BBP, MBP, WMS)
6	Raja *et al*. (2019)[25] Pakistan	Tertiary hospital	Convenient consecutive sampling technique N= 261	Questionnaire	57.8% N= 151	Herbs, specific die and cupping, nutritional supplements, spiritual healing, honeybee products, medical massage (BBP, WMS)
7	Shrilatha *et al*. (2019)[29] India	Department of General Medicine at SRM Medical College Hospital and Research Centre, SRM IST Kattankulathur, Kancheepuram district, Tamil Nadu	Not given N=169	Semi-constructed questionnaire	41.4% N = 70 M = 41 F= 29	Keezhanelli leaves, Fenugreek Leaves, Garlic, Ginger and accpuncture, Amla (BBP, WMS)
8	Mainali *et al*. (2020)[9] Nepal	OPD of Hospital, Biratnagar, Eastern Nepal	Not given N = 401, M = 243, F = 158	Questionnaire	(Exclusive use of CAM without any other medicine) 11% N = 44	Ayurvedic, Homeopathy, Herbs Garlic, Fenugreek, Bitter melon, Aloe vera (WMS, BBP)
9	Mishra *et al*. (2020)[24] India	Community-based	Random Sampling N = 470	Face-to-face interview using a validated questionnaire	72.3% N = 340 M =154 F = 186	Herbs, Guava leaves, Bitter gourd, Indian gooseberry, fenugreek and Mango leaves (BBP)
10	Rafi *et al*. (2020)[27] Bangladesh	Outpatient Department of Medical College Hospital	Purposive sampling N = 244, M = 100, F = 144	Face-to-face interview using a semi-structured questionnaire	35.2% N = 86 M = 38 F = 48	Herbal products: Leaf of Gynura procumbens, Fenugreek, Bitter gourd, Turmeric, Okra, Homeopathic medicine (BBP, WMS)
11	Dur-e-Sameen *et al*. (2022)[15] Pakistan	Medical Teaching Institute Lady Reading Hospital and Department of Medicine Medical Complex	Non-probability consecutive sampling N = 376, M = 257, F=119	Structured questionnaire	51.3% N= 193 M= 51, F= 142	Spiritual Healers, Dietary Supplements, Herbal Medicine, Homoeopathy (BBP, WMS)
12	Matpady *et al*. (2022)[23] India	Rural and suburban communities	Not given N = 148		68.9% N = 102	*Trigonella foenum-graecum* (Fenugreek) *Azadirachta indica* (Indian lilac or neem) *Momordica charantia* (bitter guard) , and *Aegle marmelos* (Bengal quince or bael (BBP)
13	Itrat and Akhlaq (2022)[30] India	Primary healthcare center	Systematic random sampling N = 484 M = 185 F = 299	Face-to-face interview using a semi-structured questionnaire	25.6% N = 124 M = 56 F = 68	Qurs Ziabetes,Zulal Ziabetes,Dolabi (WMS)

14	Vishnu *et al*. (2017)[11] India	Community-based	Cluster Sampling N = 400	Pre-tested questionnaire	Exclusive use of CAM (9%), Complementary (38.7%) N = 155 M = 82 F = 73	Ayurveda, Yoga, Homeopathy, Herbal medicine, Sugar therapy (WMS, MBT, BBP)

CSS: Cross-sectional survey/study CAM: complementary and alternative medicine, WMS: whole medical system, MBM: mind-body medicine, BBP: biologically based practices, MBP: manipulative and body-based practices. M: Male, F: Female, T2DM: Type 2 diabetes mellitus, SRM: Sri Ramaswamy Memorial, IST: Institute of Science and Technology

Quality assessment

The assessment results were organized into a table, categorizing judgments as "Yes" for a low risk of bias, "No" for a high risk of bias, and "Unclear" for insufficient or unclear information reported (Table 2). Overall, six studies (43%) were of good quality. Six studies (43%) had moderate quality, while two (14%) had low quality. There was a moderate risk of bias in the assessment of outcome. Six studies scored 100%, six had a total score of 92%, and one had 77% and 62%.

Table 2: Risk of bias assessment for the included studies based on Joanna Briggs Institute (JBI) Critical Appraisal Tool

S/N		Checklist													Score
	Articles	1	2	3	4	5	6	7	8	9	10	11	12	13	
1	Medagama *et al*.[41]	Y	Y	Y	N	Y	Y	Y	Y	Y	Y	Y	Y	Y	92
2	Devi *et al*.[22]	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	100
3	Medagama and Senadhira [35]	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	100
4	Sadiq *et al*. (2017) [28]	Y	Y	Y	N	Y	Y	Y	Y	Y	Y	Y	Y	Y	92
5	Jawed *et al*. (2019) [26]	Y	Y	Y	N	Y	Y	Y	Y	Y	Y	Y	Y	Y	92
6	Raja *et al*. (2019)[25]	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	100
7	Shrilatha *et al*. (2019) [29]	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	100
8	Mainali *et al*. (2020) [9]	Y	Y	Y	N	Y	Y	Y	Y	Y	Y	Y	Y	Y	92
9	Mishra et al. (2020) [24]	Y	Y	Y	N	Y	U	Y	U	U	Y	Y	Y	U	62
10	Rafi *et al*. (2020) [27]	Y	Y	Y	N	N	U	Y	N	Y	Y	Y	Y	Y	77
11	Dur-e-Sameen *et al*. (2022) [15]	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	100
12	Matpady *et al*. (2022)[23]	Y	Y	Y	N	Y	Y	Y	Y	Y	Y	Y	Y	Y	92
13	Itrat and Akhlaq (2022) [30]	Y	Y	Y	N	Y	Y	Y	Y	Y	Y	Y	Y	Y	92
14	Vishnu *et al*. (2017) [11]	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	100

Y: Yes, N: No, U: Unclear

The geospatial presentation of the prevalence of CAM use reported by the fourteen studies is indicated in Figure 2. Overall, the prevalence of CAM use among Type 2 diabetes mellitus patients in South Asia ranges from 9.0% to 76.1%. This compares with the prevalence of 9.0 - 88.4% reported in Mediterranean countries.[35] The highest prevalence of CAM use in the region was 76.1% in a study reported in Sri Lanka.[19] Other separate studies from India reported a high prevalence of 64.2%,[22] 72.3%,[18] and 68.9%.[23] The lowest extreme of the prevalence reflects the exclusive use of CAM. However, the same study reported a 38.7% prevalence of CAM use.[11] In Nepal, exclusive CAM practice was reported among 11% of Type 2 diabetes mellitus patients.[11,24] The prevalence of CAM use in Pakistan ranged from 51.3 to 57.8%.[15,25,26] One study from Bangladesh reported a prevalence of 35.2% for all CAM types.[27] Four studies from India revealed a prevalence of 25.6%, 38.7%, 39.2%, and 41.4%.[11,28-30]

Similarly, in the United Arab Emirates, Iran, Malaysia, and Morocco, the reported prevalence was 39.3%, 88.4%, 62.5%, and 34.8%, respectively.[9,31-33] Moreover, the prevalence in the United States and Japan was 26.2% and 38.2%, respectively.[13, 14] This study was also consistent with the global prevalence of CAM use among adult diabetic patients of 8 - 93%.[34] The high prevalence of complementary and alternative medicine (CAM) can be attributed to its lengthy history in various cultures and increased access to health information. The apparent variation in the prevalence was a function of many patient-centric sociodemographic factors that influence CAM utilization.[12] The study design and settings, sampling method, type of diabetes, specific type of CAM, and concomitant use with conventional medicine also affect the prevalence estimates.[5,12]

Based on the reported figures in Table 2, CAM usage among type 2 diabetic patients from five South Asian countries was above 50% in 7 studies.[15,18,23,25,26] and above 25% in 5 studies.[11,27-29] Cumulatively, 12 studies reported total CAM practice.

The prevalence of CAM use

The studies with higher CAM prevalence were those in which patients used CAM therapies to complement conventional medicines (most commonly oral hypoglycaemic agents and insulins). The studies that measure the exclusive use of CAM presented low prevalence.[24] One study measured only the use of herbal remedies and conventional medicines for type 2 diabetes.[35]

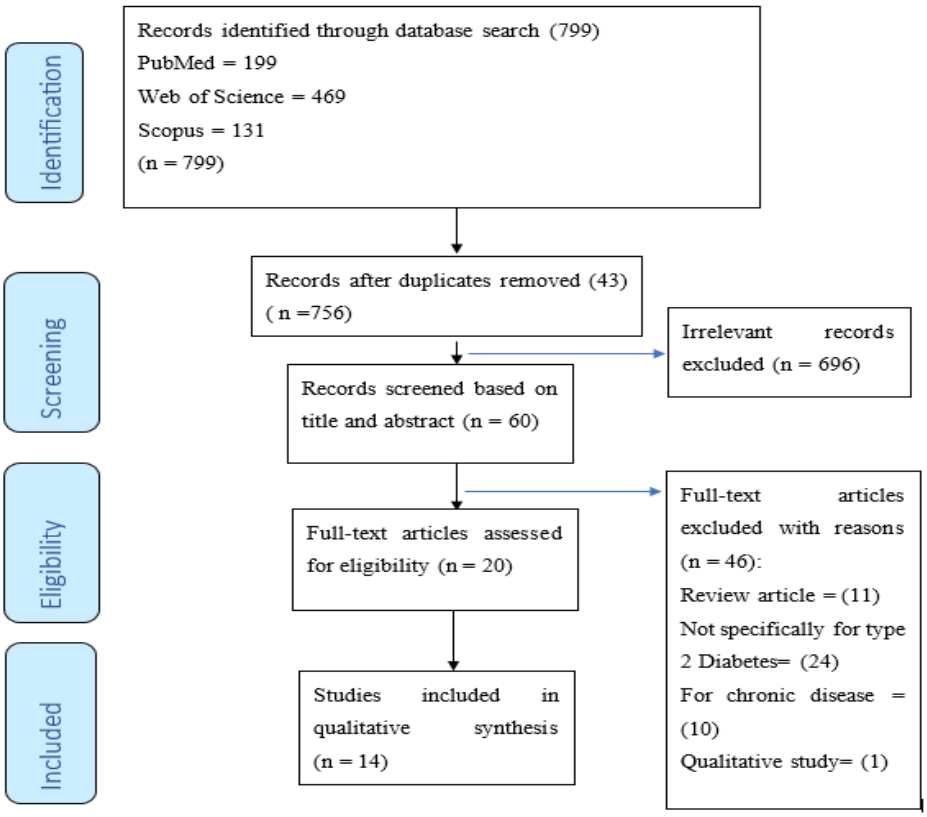

Figure 1: PRISMA flow diagram for the systematic literature review on the use of Complementary and Alternative Medicine for managing Type 2 diabetes mellitus in South Asia. PRISMA: Preferred Reporting Items for Systematic Reviews

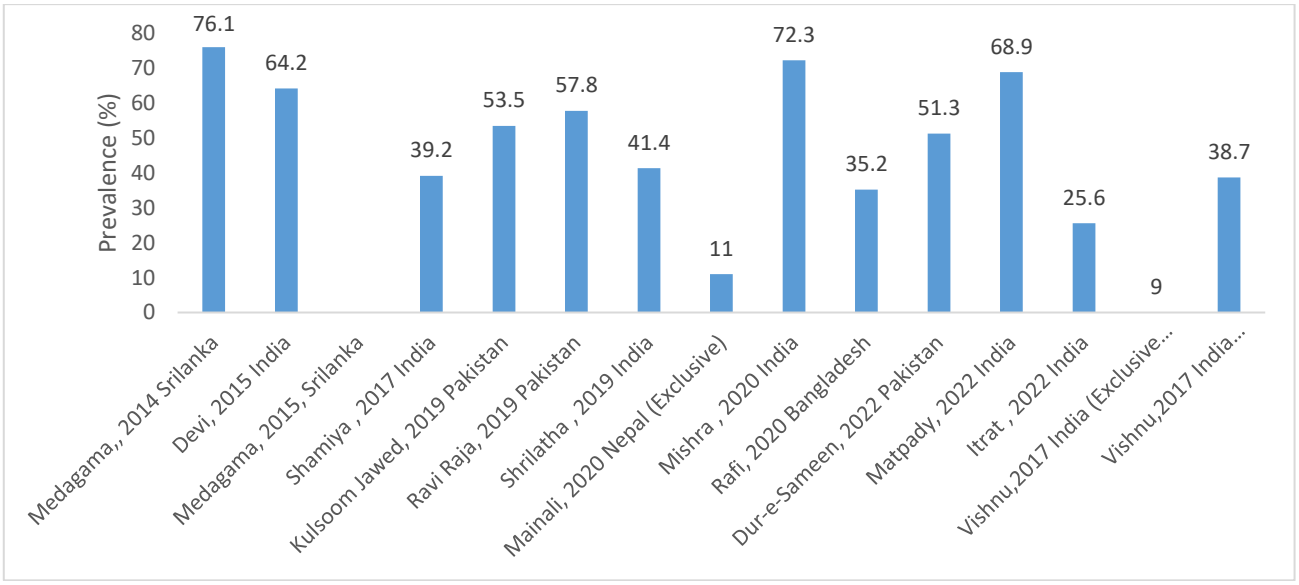

Figure 2: Prevalence of Complementary and Alternative medicine use among Type 2 diabetes mellitus patients in South Asia

Types of complementary and alternative medicines used for Type 2 diabetes mellitus

The selected studies included 59 different types of complementary and alternative medicine. Nine of the fourteen selected studies discussed various CAM, including ayurveda, homeopathy, herbal supplements, spiritual healing, acupuncture, cupping, naturopathy, and Unani medicines.[18,22,23,25,27-29] A study from India investigated only Unani medicine, focusing on Qurs Ziabetes, Zulal Ziabetes, and Dolabi as the most used Unani medicines by Type 2 diabetes mellitus patients.[31] The remaining four studies focused on herbal medicine use.[11,24,29,35]

This systematic review has further identified five heterogeneous sub-groups of CAM practices applied with divergent health outcomes in the management of Type 2 diabetes mellitus, of which biological-based practices accounted for the highest proportion, followed by whole

medical systems, manipulative and body-based practices, mind-body medicine, and energy-based medicine, respectively. The reported biological-based CAM practices involved myriads of herbs and other traditional formulae with hypoglycemic medicinal value, the ability to attenuate side effects, or prevent disease progression and complications. The frequency distribution of sub-types of CAM used for managing Type 2 diabetes mellitus in South Asia in the studies indicated that fenugreek and homoeopathy were the most widely reported. The studies that reported yoga equated to those of Indian gooseberry, garlic, bitter gourd, and aloe vera.

Type 2 diabetes mellitus is a chronic condition characterized by insulin resistance and impaired glucose metabolism. The herb-based Type 2 diabetes regimens were mainly non-proprietary insulin secretagogues or insulin mimetics used in single or multiple forms solely or concurrently with conventional oral hypoglycemic agents or insulins.[15] In most studies, the specific oral hypoglycemic agents (OHGA) and insulins were not indicated, although the blood glycemic indices associated with conventional, or CAM practices have been quite reported. Oral hypoglycemic agents such as biguanides (metformin), sulfonylureas (glipizide, gliclazide, glimepiride), thiazolidinediones (pioglitazone), and α-Glucosidase inhibitors (voglibose) have been reported in the patient-based survey to evaluate the prevalence of Unani medicines in Type 2 diabetes mellitus management in India.[30]

The prominence of biological-based practices, mainly the use of medicinal plants is evident from a significant proportion of the reviewed articles.[15,24,29] The types of herbal products were elaborated in four of the studies. However, in other studies, details of the herbs utilized were not explicated despite reporting a high prevalence of use. Thus, by virtue of their ability to increase insulin sensitivity, these medicinal plants have been used for centuries in traditional medicine to manage diabetes and related complications.[36] For instance, fenugreek (*Trigonella foenum-graecum*), the most widely reported herb, has been shown to contain 4-hydroxyisoleucine, which possesses insulinotropic biological activity in addition to its hypolipidemic potential.[37] The plant also contains soluble fibre, down-regulating carbohydrate absorption, leading to better glucose control.[37] Similarly, bitter melon, aloe vera, ginseng, garlic, and turmeric, as repetitively appeared in the studies, have been reported as essential biologically-based practices.[38] The extensive diversity of herbal medicines reported by the studies underscores the wide range of options available in South Asia. These herbs also augment insulin sensitivity and enhance cellular glucose uptake. Additionally, they tend to protect against diabetes-related complications owing to their antioxidant activity.[36,39] The result is similar to other studies in which patients use herbs for the treatment of type 2 diabetes mellitus.[40]

Despite the percentage of *Gynura procumbens* herb utilization being high (48.8%) in Bangladesh it was not mentioned by any other study.

The impact of other CAM modalities on the development of impaired glucose tolerance (IGT) in diabetes has been well corroborated and justified in some studies. For instance, in a 12-month, double-blind, placebo-controlled study, a 32% deceleration from IGT to type 2 diabetes was achieved using Tianqi (a Chinese-based herbal formula).[41] A systematic review and meta-analysis of observational studies on omega-3 fatty acids or fish intake showed a significant reduction in the risk of Type 2 DM.[42] In a separate study, Shenzhu Tiaopi granule, a traditional Chinese medicine, was found to significantly reduce the rate of transformation of IGT into type 2 diabetes from 15.28% to 8.52% with placebo in a randomized controlled trial. Additionally, a significantly higher percentage of IGT patients returned to normal blood glucose levels (42.15% vs. 32.87% for placebo).[43]

Likewise, spiritual healing was observed only in Pakistani diabetic patients. However, homoeopathy was used every day in India, Nepal, Pakistan, and Bangladesh. Unani medicines have been used in Pakistan and India. Herbs were utilized as proprietary and non-proprietary products. For instance, crepe ginger leaves and ivy gourd were used as salads, bitter gourd as curry, and Fenugreek seeds were used after maceration in water. Conversely, Qurs Ziabetes, Zulal Ziabetes, and dolabi of the Unani systems were utilized as formulated tablets.

Although the body-mind sub-type of CAM appeared in only 5% of all the reported CAM utilization, it constitutes a strongly useful CAM practice.

Table 3: Various forms of CAM therapies utilized by Type 2 diabetes mellitus patients

S/N	CAM Forms	Studies cited
1	Ayurveda	11, 22, 24, 28
2	Homeopathy	11, 15, 22, 24, 26, 27
3	Naturopathy	28
4	Unani Medicines	26
5	Cupping	25
6	Acupuncture	22, 29
7	Yoga	11, 22, 28
8	Spiritual Healing	15, 25
9	Massage	25
10	Religious methods	27
11	Music therapy	22
12	Meditation/Prayers	22
13	Nutritional Supplements	15, 22, 25, 27
14	Fenugreek (*Trigonella foenum graecum*)	18, 22, 24, 27-29
15	Bitter gourd (*Momordica charantia*)	18, 27, 35
16	Garlic (*Allium sativum*)	18, 24, 29
17	Ginger	28, 29
18	Bitter melon	24, 29
19	Aloe vera (*Aloe barbadensis*)	18, 22, 24
20	Mango leaves (*Mangifera indica*)	18, 23

21	Guava leaves (Psidium Guajava))	18
22	Indian Goose berry (*Phyllanthus charantia*)	18, 23, 29
23	Turmeric	27
24	Okra (*Abelmoschus esculentus*)	27
25	Cinnamon (*Cinnamomum verum*)	18, 22
26	Ginseng	24
27	Ivy gourd (*Coccinia grandis*)	18, 24, 35
28	Indian Lilac (*Azadirachta indica*)	23
29	Bengal quince (*Aegle marmelos L.)*	23
30	Mexican mint (*Plectranthus amboinicus*)	23
31	Cardamom (*Elettaria cardamomum*)	23
32	Crown flower (*Calotropis gigantea*)	23
33	Insulin leaves (*Costus igneus*)	23
34	Cucumber tree (*Averrhoa bilimbi*)	23
35	Crepe ginger (*Costus speciosus*)	35, 41
36	Finger millet	35, 41
37	Goat weed	41
38	Nutmeg (*Myristica fragrans)*	18
39	Hibiscus (*Hibiscus rosa-sinensis*)	18
40	Jamun seed (*Syzygium cumini*)	18
41	Gynura Procumbens (Diabetes tree)	27
42	Keezhanelli leaves	29
43	Sugar Therapy	11
44	Passion Fruit (*Passiflora edulis*)	18
45	Drumstick (*Moringa oleifera*)	18
46	Neem (*Azadirachta indica*)	18
47	Jack Fruit (*Artocarpus heterophyllus*)	18
48	Basil leaves (*Ocimum basilicum*)	18
49	Liquorice (*Glycyrrhiza glabra*)	18
50	Brahmi (*Water Hyssopo*)(*Bacopa monnieri*)	18
51	Oak Plant (Quercus)	18
52	Banyan tree bark (*Ficus benghalensis*)	18
53	Banana (*Musa paradisiaca*)	18
54	Senna (*Senna alexandrina*)	18
55	Papya(*Carica papaya*)	18
56	Onion (*Allium cepa*)	18
57	Chirata(Swertia Chiratta)(*Andrographis paniculate)*	18
58	Amla (*Phyllanthus emblica*)	29
59	Gymnema	24

Yoga constitutes CAM's most widely practiced body-mind sub-classification.[36] As a Hindu spiritual practice, Yoga means "union" or "connection" and comes in various forms, each with unique practices and approaches to help practitioners become more aware of themselves and the world around them. As a mental health-promoting tool, most yoga practices incorporate breathing exercises, meditation, and a series of physical postures for overall health, relaxation, and well-being.[44,45] A holistic practitioner's (chiropractor, naturopath, osteopath, shiatsu therapist) treatment plan for stress relief and physical strengthening frequently includes yoga or yoga therapy. It has been discovered that using yoga as a complementary and alternative medicine can effectively reduce blood pressure, cholesterol, and blood sugar levels. Thus, it could be considered a useful non-pharmacologic treatment modality in preventing and treating diabetes and associated comorbidities and complications. Yoga was reported to have beneficial effects on lowering HbA1c, postprandial glucose levels, and fasting blood glucose levels in a comprehensive review and meta-analysis.[46] A different systematic review and meta-analysis also observed improved lipid profile, blood pressure, and glycemic indices. The effectiveness of regular leisure-time physical activities on long-term glycemic control in people with type 2 diabetes has been studied in a systematic review and meta-analysis, which has demonstrated that practicing yoga three times

a week regularly is more helpful at lowering $HbA1_C$ levels than tai chi or walking.[44,47]

Factors associated with CAM utilization among Type 2 diabetes mellitus patients

The findings of this systematic review have underscored numerous critical multifactorial determinants associated with CAM utilization among Type 2 diabetes mellitus patients in South Asia. The factors are detailed in Table 4. The factors associated with CAM use were multidimensional and included availability and access to the practice, cultural and societal orientations, socioeconomic status, baseline biochemical and pathological markers, and personal beliefs and values of the patients.[18,25,29,30]

The need for non-invasive procedures, in addition to the perception of effectiveness, has been identified as critical determinants of CAM utilization that shape the prognosis of Type 2 diabetes mellitus and support chronic use.[18,29,30]

Anecdotal information, cultural beliefs, or personal experiences are important factors with a strong positive association with CAM utilization.[26,28,30,35] This includes a desire for greater control over their healthcare decisions, spirituality, and beliefs in holistic approaches to health. The age and gender of the patients have a significant impact on CAM use. In most of the studies, the female gender was more inclined towards CAM use than the male counterpart.[15,18,24,28,35]

A significant proportion of CAM users were influenced by recommendations from traditional healers, friends and family, co-CAM users, medical professionals, and the media (internet sources, TV, radio).[18,30] Dissatisfaction with modern medicine and confidence towards CAM was also cited as the primary motivation for the majority of users.[18,25,29] The presence or absence of comorbid conditions and complications also contributed to CAM utilization. Sufficient evidence correlates CAM practices with diabetes-related complications. For instance, a study showed that the absence of retinopathy and neuropathy was associated with higher utilisation of CAM.[15] The multimodal factors associated with the use of CAM were strongly correlated with a sociodemographic profile of the subjects, disease state, and prognosis, family history, poor response to conventional care, access to information and communication technology, educational status, and economic prosperity. In the majority of reviewed articles[18, 28, 41] females were found to be the more frequent users of CAM, because they are usually more involved in cooking, have good knowledge about the medicinal value of herbs and rely on easily available herbal remedies found in the kitchen.[48] Diabetes complications and comorbid determinants influencing the choice of CAM practices include nephropathy, neuropathy, retinopathy, ischemic heart diseases, hypertension, cerebrovascular accident, and diabetic foot ulcer sequel to macro and microvascular diabetes complications. The CAM used by patients with diabetes to improve their health status can be evaluated from the types of medicine selected, patterns of use, and the reasons for using CAM. CAM patterns include the first time of CAM (before/after diagnosis), the number and types of CAM, and the schedule of CAM use. Because of similar cultural and social beliefs, all the studies from selected regions utilized almost similar types of CAM therapies; however, they differed by patient-specific demographics.[24,26,41,49] Despite their celebrated significance in managing diseases, CAMs should be well-understood, carefully coordinated, and systematically integrated into evidenced-based standard Type 2 DM management plans to mitigate the risks of adverse drug reactions and side effects. The potential adverse effects associated with some Type 2 diabetes herbal regimens include hypoglycaemic episodes, glucose-6-phosphate deficiency, hypertension, amenorrhea, and interference with platelet activity.[15] Sufficient evidence has also attributed widespread CAM use to catastrophic expenditures or huge financial burden, and toxicity associate with orthodox complications leading to elevated mortality risk, worsened quality of life, and inability to complete standard treatment regimen. Given the paucity of systematic studies in the region, this study tends to bridge the considerable information gap by providing updated prevalence, various CAM modalities, and the determinants of practices in the South Asian region. Its broad view is to standardize the integrated approach to Type 2 diabetes management amid the growing disease burden in the resource-limited setting.

Table 4: Factors associated with using complementary and Alternative Medicines for managing Type 2 diabetes mellitus in South Asia

S/N	Reported factors		Reference
1	Female gender		41
2	Cost-effectiveness	Recommendations by other users	22
	Poor response to conventional treatment	Physicians and healthcare professionals	
	Body mass index	Satisfaction with previous CAM Older age and university education	
	Duration of diabetes	Family history of diabetes	
3	Female gender,		35
	Religion (Buddhist)		
	Low educational status		
	Unemployment		
	Lack of income		
4	Female gender		28
	Rural background		
	Educational qualification		
5	Household income> 10,000 rupees		26
	Education level		

6	Diabetes-related complications	Poor patient-doctor relationship	[25]
	Poor glycemic control	Affordability and accessibility	
	Lack of trust in pharmaceutical products	Safety Perception	
7	Age > 55 years		[29]
	Lower middle socioeconomic class		
	Non-satisfaction with conventional treatment		
8	Female gender,		[24]
	<10 years of the disease,		
	Family history		
	Literacy		
9	Age		[18]
	Female gender		
	Rural residency		
	Middle class, <At least 6 months of diabetes		
10	Age, female gender	Middle family income	[27]
	Religion (Muslim)	Urban residency, < 5years of diabetes	
	Marital status,	Presence of complications	
	Secondary education		
11	Age	Duration of diabetes (>10 years)	[15]
	Female gender	>7% Hb_{A1c}	
	Marriage	Presence of comorbidities	
	Rural residency	Absence of diabetic foot ulcer	
	Illiteracy	Retinopathy	
	Middle income	Nephropathy	
12	HbA1c levels		[23]
13	Age		[30]
	Male gender		
	Islamic religion		
	Upper-middle socioeconomic class		
	>10 years of the disease,		
	Presence of complications		
14	Age (55-65 years)	< 8 years of the disease.	[11]
	≥ secondary school education	Absence of comorbidity	
	Income ≥ 10 000 Rupees	Regular income earning	
	Adherence to a specific diet for glycemic control	Prior consultation with CAM practitioners	

Limitation

This review includes research on the prevalence, types, and factors associated with CAM use among type 2 diabetic patients in South Asia. This review is not a literature review of active compounds from herbs, the efficacy and safety of CAM, but only research on the behaviour of type 2 diabetic patients using CAM only in South Asian Countries. Some studies that show design bias, selection, and measurement were included because they provide valuable insights in terms of definitions and information about the prevalence and factors associated with CAM use.

Conclusion

The prevalence, types and contributing factors of complementary and alternative medicine (CAM) utilization among patients with Type 2 diabetes in South Asia were identified by this systematic review, which would help in influencing the region's clinical practice standards, patient-centered care strategies, and healthcare legislation. The prevalence of CAM use among T2DM patients in South Asia varies widely, ranging from 9.0 to 76.1%. This variability highlights the significant regional differences and the multifaceted nature of CAM utilization in managing diabetes. The review identified five main sub-groups of CAM practices: biological-based practices, whole medical systems, manipulative and body-based practices, mind-body medicine, and energy-based medicine. Among these, biological-based practices, primarily involving medicinal plants, were the most prevalent. Commonly used herbs included fenugreek, known for its potential to enhance insulin sensitivity and manage diabetes-related complications. The factors influencing CAM use among T2DM patients were diverse and included ease of access and availability, cultural and societal norms, socioeconomic status, initial health markers, and personal beliefs and values. Prospective directions for research and practice should further identify the gaps in the literature and suggest directions for further study on complementary and alternative medicine in treating

Type 2 diabetes. To discover more about patient experiences and outcomes connected to CAM use may entail carrying out completely randomized clinical trials, longitudinal studies, and qualitative research.

Conflict of Interest
The authors declare no conflict of interest.

Author's Declaration
The authors hereby declare that the work presented in this article is original and that any liability for claim relating to the content of this article will be borne by them.

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